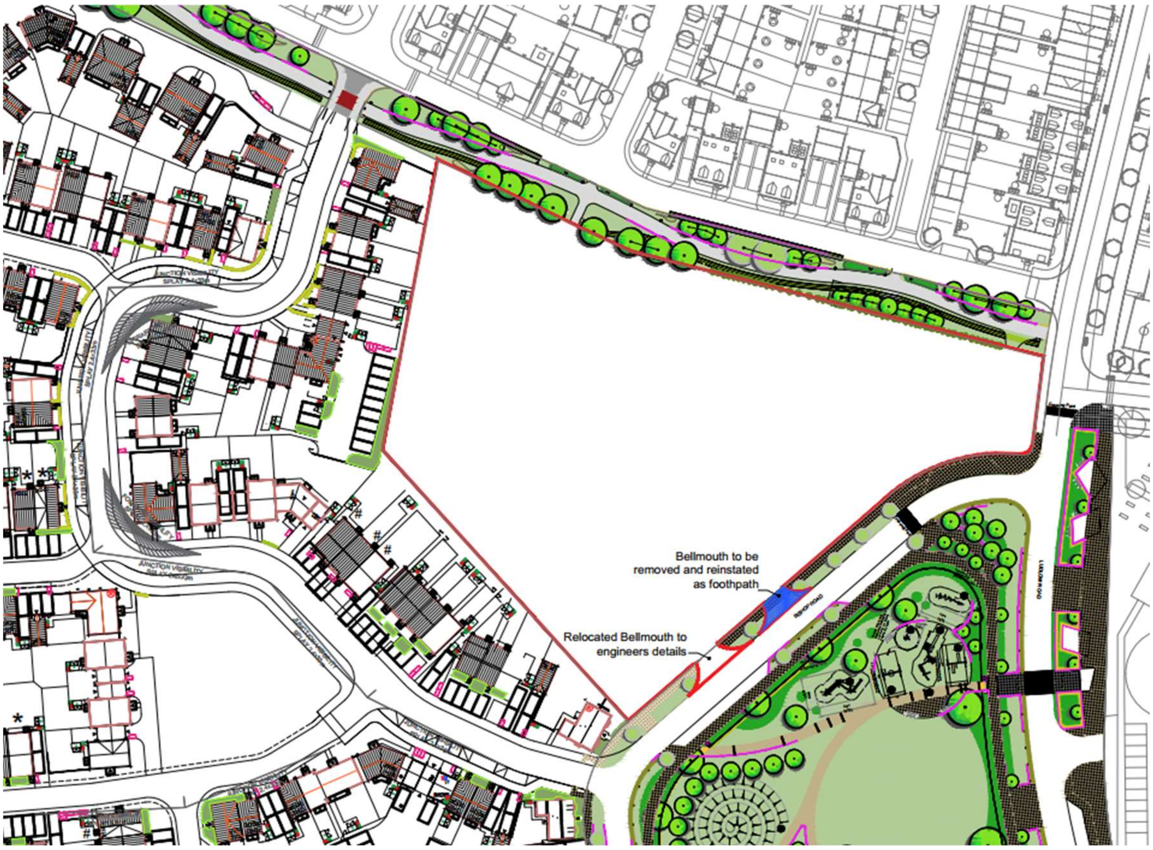

PROJECT	**PARCEL R DEVELOPMENT, KINGSMERE, BICESTER DRAINAGE STRATEGY**
PROJECT NUMBER	**23047**
CLIENT	**PREFERRED HOMES LTD AND COUNTRYSIDE (BICESTER) LTD**
REPORT DATE	**SEPT 2023**

PROJECT NAME	**PARCEL R DEVELOPMENT, KINGSMERE, BICESTER**
PROJECT NUMBER	**23047**
CLIENT	**PREFERRED HOMES LTD AND COUNTRYSIDE (BICESTER) LTD**

REVISION	DATE	WRITTEN BY	REVIEWED BY
Initial issue	11.09.2023	JE	AA/AR
P1	15.09.2023	JE	AA/AR
P2	24.10.2023	JE	AA/AR
P3	31.10.2023	JE	AA/AR
P4	03.11.2023	JE	AA/AR

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APPENDICIES

1 Introduction

1.1 Terms of Reference

ARC Engineers Ltd has been appointed by Preferred Homes Ltd and Countryside (Bicester) Ltd to provide a Drainage Strategy in support of a hybrid application comprising (i) in FULL, the construction of an 82 no. apartment affordable extra care home (class C2) with associated bistro, open space, landscaping, car/cycle parking, service infrastructure (drainage, highway, lighting), engineering operations, creation of new vehicular access and re-instatement of existing access to footpath, and (ii) in OUTLINE, the construction of a maximum of 14 market residential dwellings (class C3), on land known as Parcel R, Kingsmere, Bicester.

The part of the site containing the extra care development and the adopted road covers an area approximately 0.6089 Hectares. The C3 housing development site connecting into the adopted road covers an area of 0.318 Hectares.

1.2 Objectives

The objective of this drainage design strategy is to evaluate the following issues in regard to flood risk at the application site.

- To provide a suitable drainage design for the extra care development.
- To provide a suitable adopted drainage design to section 104 within the adopted road network .
- To ensure that the drainage strategy complies with the recommendations within the approved flood risk assessment under application 13/00847/OUT.

2 Details of the Site

2.1 Site Details

Table 2: Development Location

Site Name:	Parcel R, Kingsmere, Bicester
Purpose of Development:	C2 Extra Care nd up to 14 C3 dwellings
Existing Land Use:	Serviced prepared site
OS NGR:	SP565224
Country:	England
County:	Oxfordshire
Local Planning Authority:	Cherwell District Council
Lead Local Flood Authority	Oxfordshire County
Critical Drainage Area	No
Internal Drainage Board:	Not Applicable
Other Authority (e.g. British Waterways/ Harbour Authority)	Not Applicable

2.2 Location Plan:

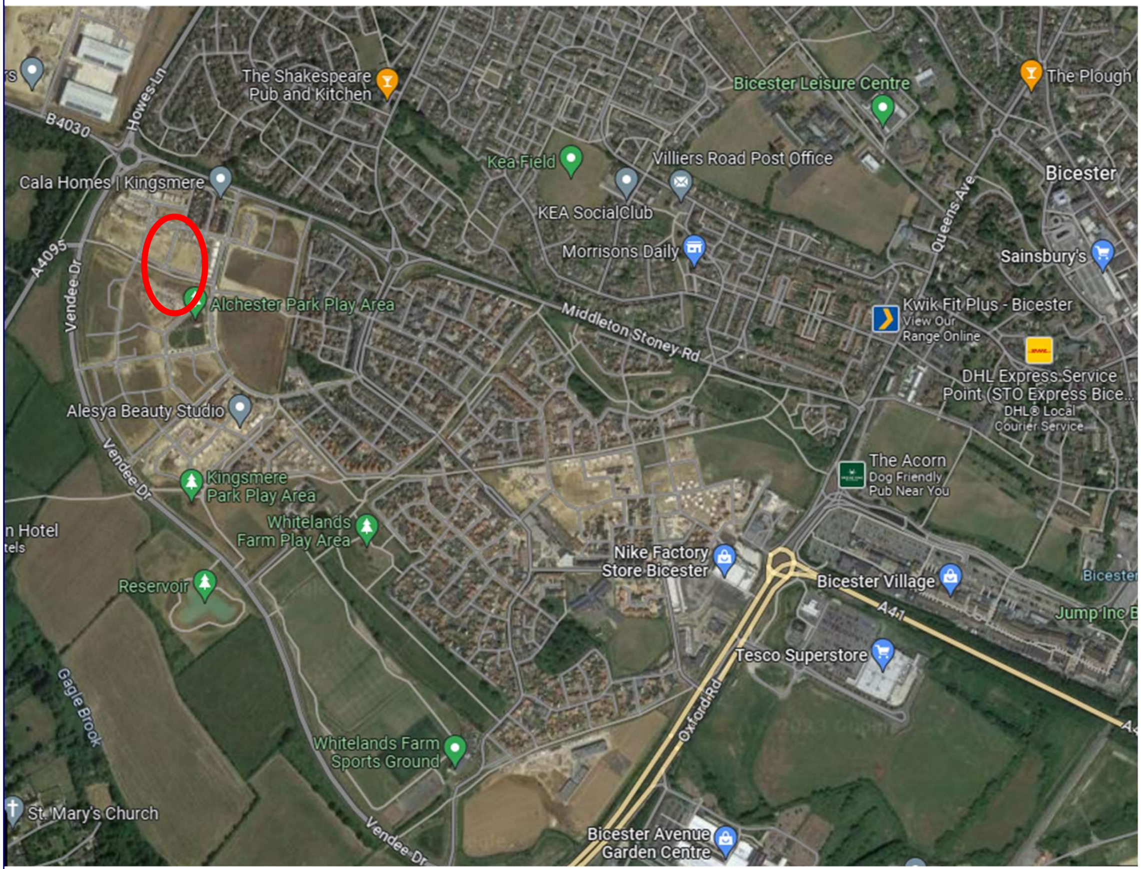


Image produced from the Google Maps.

2.3 Site Description

The application site is located south west of Bicester.

The application site is known as Parcel R and is part of the Kingsmere Phase 2 development. Road and drainage infrastructure has been planned in a comprehensive manner as part of the approved masterplan for the area.

A topographical survey is available for the development. This indicates the existing levels are as follows:

- Site access via junction with main site road network – 81.300mAOD
- North boundary = 82.200mAOD
- South-west corner = 81.300mAOD

The access road into the proposed site is to be adopted under a section 38 agreement with the local highways authority. As such the proposed drainage application within the access road will be to section 104 adoptable standards.

2.4 Proposed Development Details

Extra Care Development and C3 Dwellings.

Figure 3.2: Proposed Site Plan

Source: Corstophine & Wright

3 Existing drainage/Flood Risk Assessment

3.1 Flood Risk Assessment

The approved flood risk assessment for Kingsmere Phase 2 was prepared by WSP on behalf of Countryside (Bicester) Ltd. The details of this are as follows:

1. A residential led mixed use development together with the associated infrastructure is proposed at the Kingsmere Phase 2 site at south west Bicester.

2. The EA's Flood Map shows the development site to be wholly within Flood Zone 1 (Low Probability). All land uses are suitable for development within Flood Zone 1 according to the NPPF; hence the proposed development is in accordance with NPPF in terms of flood risk and the Sequential Test.

3. The drainage strategy for the development will continue to use the drainage principles set out in the Kingsmere Design Code, developed during Phase 1 and sets out the hierarchy of SuDS measures to be utilised on site. SuDS measures will be utilised within the housing parcels for rainfall events up to the 1 in 10. The surface water sewer system for the development will be used for events above the 1 in 10 year storm, and a proposed detention basin on the southern side of Vendee Drive will provide attenuation for events up to the 1 in 100 plus climate change (40%) while discharging at greenfield runoff rates to the upper reaches of Whitelands Farm Ditch.

4. The underling geology, predominantly Cornbrash, and the localised high groundwater table (estimated at 1.5m bgl adjacent Middleton Stoney Road) may preclude the use of soakaways in some areas of the site. Therefore, it will be necessary to establish the infiltration potential of each parcel before infiltration SuDS are used for surface water drainage. However, regardless of the infiltration capacity of the underlying geology, permeable paving can still be used for parcel SuDS for the 1 in 10 rainfall event.

5. Swales, walls and bunds along the boundary with Phase 1 will ensure that overland flows from the Phase 2 development site are conveyed to the detention basin south of Vendee Drive. The drainage strategy has been designed with input from the consultancy team, including planning and landscape consultants. The location of the detention basin on the south of Vendee Drive offers the potential to enhance the environment in that area.

6. The Environment Agency, Cherwell District Council (sports pitches) and Oxfordshire County Council as the Lead Local Flood Authority agreed to the principles of the drainage strategy during consultation and meetings.

7. The Phase 2 development maintains the main existing overland flow routes and is unlikely to increase surface water flood risk offsite.

8. Due to the location of the site and surrounding areas within Flood Zone 1, safe access and egress is available for the lifetime of the development.

9. The Phase 2 development proposals are robust in terms of flood risk and comply with the NPPF.

3.2 SUDS Hierarchy

Building Regulations Approved Document H, the Interim Code of Practice for SUDS and the NPPF, requires that a hierarchy is applied to development with regard to the disposal of surface water runoff from roof and paved areas and is listed below in order of preference:

- Infiltration to ground e.g. soakaway
- Discharge to watercourse e.g. Unnamed watercourse
- Discharge to sewer e.g. Located within Western Road.

As indicated in the flood risk assessment notes above, discharge via infiltration is considered to be ineffective due to the geology and the high water table. No water courses are available without crossing third party land for discharge.

3.3 Existing Drainage

A guideline drainage layout for the adopted road has been provided by Create Engineering as shown in appendix A below. This has been provided in accordance with the main infrastructure drainage and the FRA for the Kingsmere phase 2 development.

This drawing indicates that foul and surface water drainage connections have been provided into Parcel R. These are as follows:
Surface water = 375mm diameter SP1 Spur IL:78.420
Foul water = 150mm diameter FR1 Spur IL:79.220

3.4 Surface Water Restriction

As can be seen in Appendix A drawing, a surface water pipe for connection to the main infrastructure drainage network is provided for the Parcel R site. The proposed section 104 adopted surface water network is to discharge into this connection. The connection has a flow restriction noted as follows:

Parcel R surface water discharge:
3.5 l/s up to the 1 in 10 year storm event
Free discharge above the 1 in 10 year storm event up to the 1 in 100 year storm event including climate change.
Calculations and simulations have been provided to Create Engineering who have confimred the discharge rates are acceptable and are in accordance with their main infrastructure drainage.

In addition to the restriction above, a restriction has also been included on the extra care site to reduce the attenuation requirement within the adopted road. The connection restriction is as follows:

Extra Care development Connection:
2.0 l/s up to the 1 in 10 year storm event
Free discharge above the 1 in 10 year storm event up to the 1 in 100 year storm event including climate change.
This connection is to discharge into the proposed Section 104 adopted drainage layout as shown in appendix C

4 Proposed Drainage

4.1 Section 104 Adopted Drainage

A section 104 adoptable drainage layout has been included (see appendix D). Adopted foul and surface water drainage is to be included within the adopted road. Connections have been provided for both the proposed extra care development site and also the proposed C3 residential dwellings.

Section 104 Surface Water

- Attenuation in the form of large diameter pipes is to be provided in the adopted drainage system to allow the C3 residential dwellings to drain without restriction into the road network via the MHS23 stub connection (appendix C).
- Extra care development site is to connect via MHS19 stub into the adopted system. This connection will require a flow control and weir chamber to allow a flow restriction of 2.0 l/s for the 1 in 10 year storm event. The weir will be positioned at a level to allow free discharge above the 1 in 10 year storm event (appendix C).
- Outfall chamber MHS25 to contain Hydrobrake to restrict the Parcel R discharge to 3.5 l/s for the 1 in 10 year storm event. A Hydro International Hydrobrake is to be installed with a design head of 1.2m and a restriction of 3.5 l/S (ref: CTL-SHE-0086-3500-1200-3500). The 1 in 10 year storm water level is 79.527m. Weir wall to be installed within the chamber at a level of 79.650m to allow overflow above the 1 in 10 year storm event. Weir to be 450mm wide and 450mm deep (appendix C).

Section 104 Foul Water

- Proposed adopted foul water to discharge freely without restriction into main infrastructure network (appendix C).
- Proposed C3 residential dwellings to discharge freely without restriction into the adopted stub connections provided (MHFW13 and MHFW10, appendix C)
- Proposed extra care development to discharge freely without restriction into adopted connection provided MHFW9 (appendix C).

4.2 Private Surface Water Drainage

A proposed private surface water drainage network has been provided for the Extra Care Development (see appendix D). The summary of this network is as follows:

- Locations of RWP's are shown indicative and are to be confirmed by the Architect.
- Permeable paving is shown within the car parking spaces at the lowest point of the car park. This will require perforated pipes linking the permeable parking areas and connecting them to the drainage network. Location subject to confirmation of proposed levels by the Architect/Landscape Architect.
- Bioretention areas shown in patio area to allow for hard landscaping drainage/storage.
- Attenuation tank required due to site discharge restriction. Plastic crate type tank currently shown in appendix D. required volume = 182m³
- Outfall chamber MHS19 to contain Hydrobrake to restrict discharge to 2.0 l/s for the 1 in 10 year storm event. A Hydro International Hydrobrake is to be installed with a design head of 1.35m and a restriction of 2.0 l/S (ref: CTL-SHE-0063-2000-1350-2000). The 1 in 10 year storm water level is 80.551m. Weir wall to be installed within the chamber at a level of 80.600m to allow overflow above the 1 in 10 year storm event. Weir to be 450mm wide and 450mm deep (appendix D).
- Surface water drainage calculations provided in appendix E

The proposed drainage for the C3 dwellings is to be designed by others and has not been included in this report.

4.3 SUDS (Sustainable Urban Drainage Methods)

An assessment of SUDS for the Extra Care development has been undertaken and is provided below:

Permeable Paving:

Recommended for inclusion within the access road and car parking area to provide shallow conveyance, attenuation volume and pollution control. Impermeable membrane to be used beneath the construction and perforated pipes to be run across the lowest area to allow for water collection and connected to the drainage network.

Green Roof:

No green roofs have been specified for this project. However, large areas of flat roofs have been indicated which may be suitable for use as green roofs.

Swales:

Swales could be used in the green space to the north east of the site if required. This will reduce the drainage depth and also provide attenuation in this area.

Bioretention areas:

Inclusion of bioretention areas has been indicated on the patio area to the east of the site. This is to allow for drainage of the hard landscaped area. Additional bioretention areas may be able to be located in the green spaces to the north east of the site if required.

4.4 Private Foul Water Drainage

Private foul water to drain via MHFW9 by gravity into proposed section 104 adopted stub connection shown in appendix C and D. foul water drainage calcualtions are also provided in appendix F.

Estimation of flows:

- 82-bedrooms, 20 staff in a 24 hour period, 60 visitors (TBC) over a 24 hour period
- Flows & Loads – residential care homes – 350l/person/day
- Total Flow = (350 x 169) / 86400 = 0.66 l/s

Figure 6.8: Example Block Permeable Paving

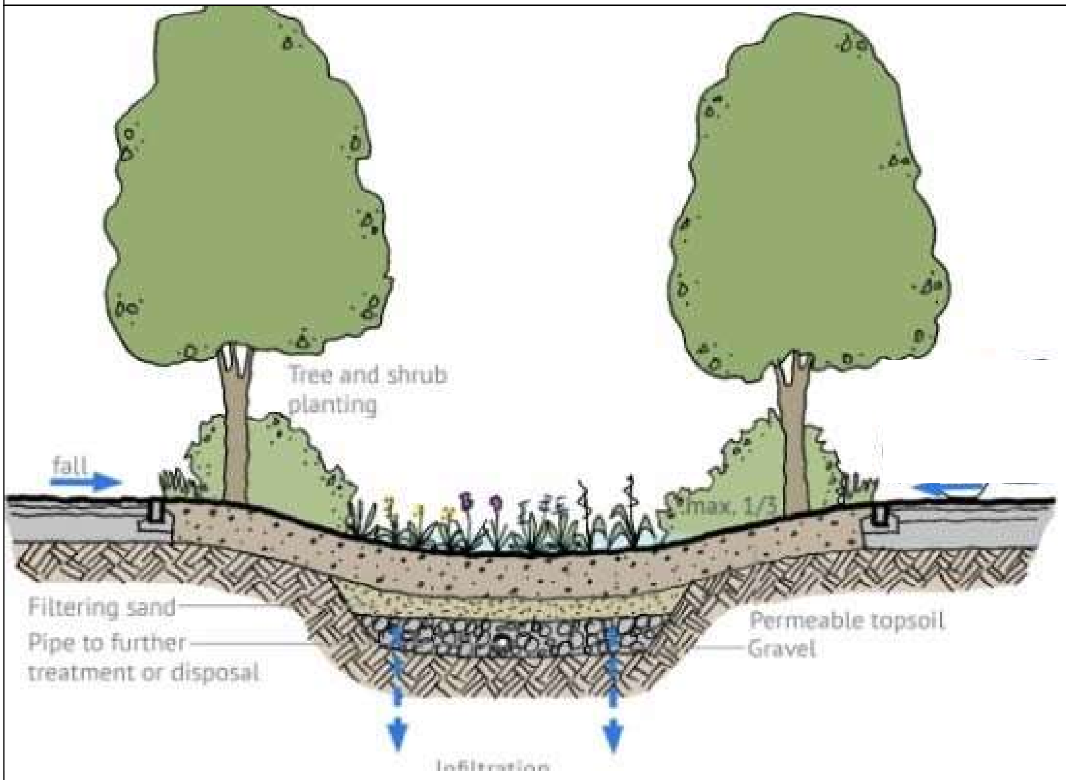
Source: https://www.kilsaraninternational.co.uk/blog/manage-water-and-flooding-with-permeable-paving/

Figure 6.9: Example Crate type Attenuation Storage

Source: https://www.polypipe.com/civils-and-infrastructure/permavoid-geocellular-system

Bioretention areas are shown in the soft landscaping areas of the patio area to allow for surface water storage. Additonal bioretention areas may be implimented in the private garden area to the North of the site to manage surface water runoff from roof areas.

Figure 6.10: Typical Bioretention Area



Source: https://www.susdrain.org

If required, swales may be a solution for roof drainage along the perimeter of the building in the private gardens to the north. This can provide shallow access roof water and provide additional attenuation. As the swales would be located close to the building, partial infiltration at the channel base should be avoided and an impermeable liner is recommended.

An example of shallow swales is illustrated within Figure 6.11 overleaf.

Outflow from the site to the surface water sewer is restricted to 3.5 l/s (QBAR) for the 1 in 10 year storm with free discharge flow rate above that level to the 1 in 100 year storm event including climate change in accordance with the flood risk assessment.

Foul flows will be discharged freely by gravity connection to the public foul/combined sewer located within Western Road.

Figure 6.11: Example of Grassed Swales

Source: https://www.susdrain.org

4.5 Assessment of Water Quality Hazard

An assessment of the water quality hazard arising from the Extra Care Development using the simple index approach outlined within Chapter 26 of CIRIA C753 The SUDS Manual has been requested by the LLFA.

Figure 6.12: Water Quality Assessment Methods

TABLE 26.1 Approaches to water quality risk management

Design method	Hazard characterisation	Risk reduction	
		For surface water	For groundwater
Simple index approach	Simple pollution hazard indices based on land use (eg Table 26.2 or equivalent)	Simple SuDS hazard mitigation indices (eg Table 26.3 or equivalent)	Simple SuDS hazard mitigation indices (eg Table 26.4 or equivalent)
Risk screening[1]	Factors characterising traffic density and extent of infiltration likely to occur (eg Table 26.5 or equivalent)	N/A	Factors characterising unsaturated soil depth and type, and predominant flow type through the soils (eg Table 26.5 or equivalent)
Detailed risk assessment	Site specific information used to define likely pollutants and their significance	More detailed, component specific performance information used to demonstrate that the proposed SuDS components reduce the hazard to acceptable levels	
Process-based treatment modelling	Time series rainfall used with generic pollution characteristics to determine statistical distributions of likely concentrations and loadings in the runoff	Models that represent the treatment processes in the proposed SuDS components give estimates of reductions in event mean discharge concentrations and total annual load reductions delivered by the system	

Source: CIRIA C753 The SUDS Manual

For the Extra Care Development site:

- Pollution Hazard Level = Low – medium
- Total Suspended Solids (TSS) = 0.3 + 0.7 = 1.0
- Metals = 0.2 + 0.6 = 0.8
- Hydrocarbons = 0.05 + 0.7 = 0.75

Total SuDS mitigation index = mitigation index1 + 0.5 (mitigation index2)

Where:

mitigation Index n = mitigation index for component n

A factor of 0.5 is used to account for the reduced performance of secondary or tertiary components associated with already reduced inflow concentrations.

Proposed SUDS within the drainage strategy incorporate permeable pavement and a detention basin. The combined SUDS mitigation indices associated with these features for discharge to surface waters is:

- TSS = 0.5 + 0.7 = 1.2
- Metals = 0.6 + 0.6 = 1.2
- Hydrocarbons = 0.6 + 0.7 = 1.3

The proposed SUDS features are therefore considered to appropriately mitigate against any potential sources of pollution generated by the development.

Figure 6.13: Pollution Hazard Indices

TABLE 26.2 Pollution hazard indices for different land use classifications

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways[1]	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways[1]	High	0.8[2]	0.8[2]	0.9[2]

Source: CIRIA C753 The SUDS Manual

Figure 6.14: Pollution Hazard Indices

TABLE 26.3 Indicative SuDS mitigation indices for discharges to surface waters

	Mitigation indices[1]		
Type of SuDS component	**TSS**	**Metals**	**Hydrocarbons**
Filter strip	0.4	0.4	0.5
Filter drain	0.4[2]	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6
Pond[4]	0.7[3]	0.7	0.5
Wetland	0.8[3]	0.8	0.8
Proprietary treatment systems[5,6]	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.		

Source: CIRIA C753 The SUDS Manual

5 Conclusions and Recommendations

ARC Engineers have been commissioned to undertake a Drainage Strategy for Parcel R in accordance the approved flood risk assessment under application 13/00847/OUT to support a planning application for an Extra Care Development and the associated Section 104 adopted drainage network.

The approved flood risk assessment states that runoff generated by the development is to be connected to the drainage network as soakaway is considered unachievable due to ground water and geotechnical conditions and no water courses are able to be connected to in the vicinity.

Drainage connection is to be made via existing foul and surface water connection stubs provided in the adopted road network.

Discharge rates must be restricted according the approved flood risk assessment, which states a flow restriction of 3.5 l/s for the for Parcel R up to the 1 in 10 year storm. Any flows above the 1 in 10 year storm up to the 1 in 100 year storm event plus climate change is to have free discharge.

Additional flow restriction has been placed on the Section 104 adopted connection stub for the Extra Care development. This has a restriction of 2.0 l/s up to the 1 in 10 year storm with a free discharge above the 1 in 10 years storm up to the 1 in 100 year storm event including climate change. Surface water attenuation is required for the Extra Care Development.

Drainage connections for both foul and surface water for the C3 dwellings have been provided in the section 104 adopted drainage network. The surface water from the C3 dwellings is to connect without a restriction. The oversized pipes within the section 104 network are to provide attenuation for this area.

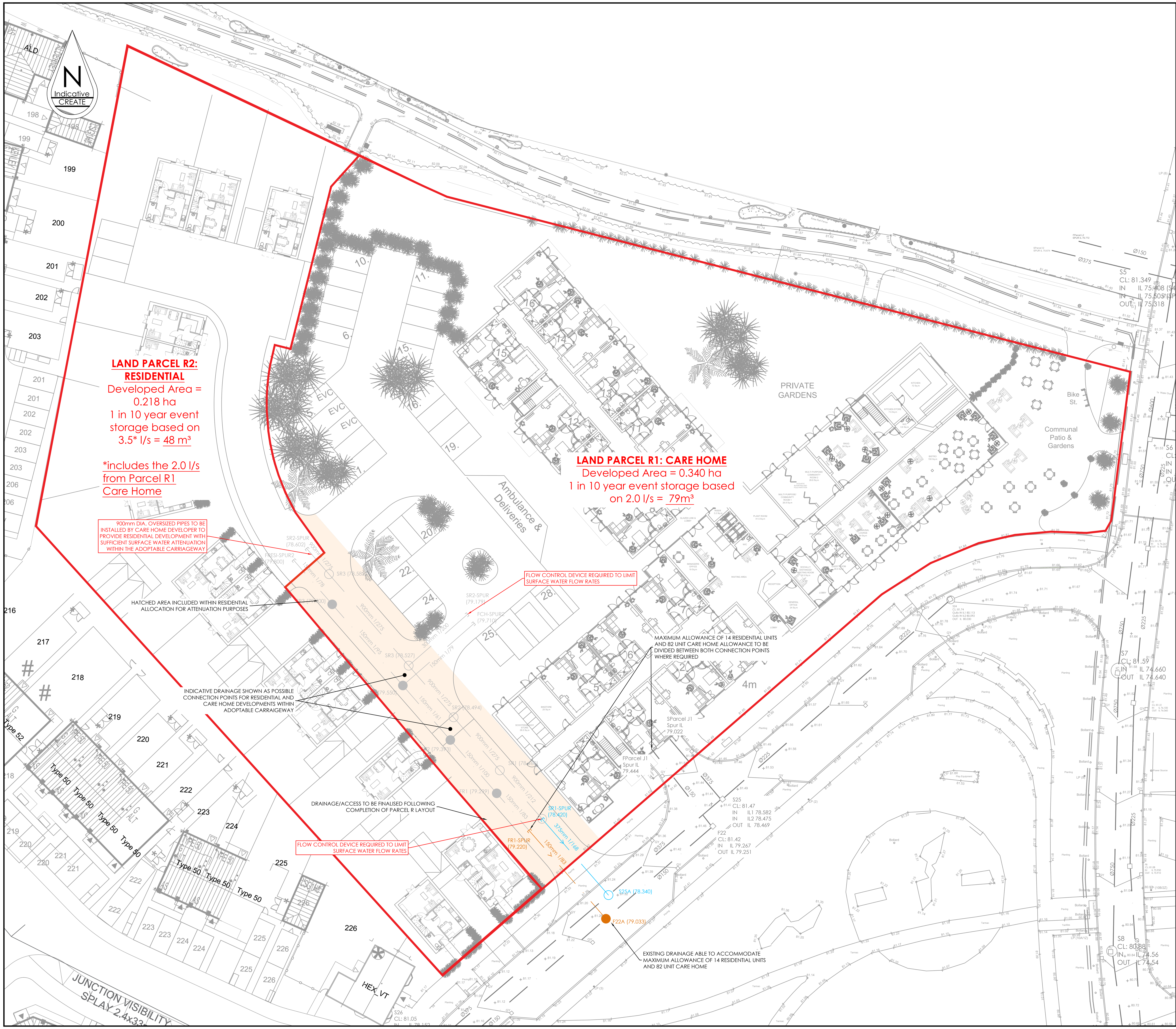
A number of SUDS features such as permeable paving and bioretention have been utilised to provide infiltration, shallow conveyance and attenuation prior to discharge from the site.

Undertaking a simple assessment of the likely water hazard arising from the development, it is indicated that the SUDS features proposed provide suitable mitigation against possible TSS, metals and Hydrocarbon pollution.

Following development, the responsibility for maintenance of the Extra Care drainage system, including the SUDS features will be retained with the Extra Care operator. Adopted drainage within the road will become the responsibility of Thames Water under section 104 agreement.

APPENDICES

Appendix A:-
Create Engineering Design/existing drainage



GENERAL NOTES:

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER CONSULTANTS DRAWINGS AS APPROPRIATE.
2. ALL SETTING OUT COORDINATES AND LEVELS ARE BASED ON THE LOCAL GRID GPS DATUM AS INDICATED.
3. ALL SETTING OUT DETAILS SHALL BE VERIFIED ON SITE WITH THE ENGINEER. THE ENGINEER MAY REQUIRE MINOR AMENDMENT TO THE SETTING OUT AND/OR LEVEL DETAILS TO ENSURE PROPER TIE IN TO THE EXISTING CARRIAGEWAY AND/OR FOOTWAYS.
4. NO PRIVATE SURFACE WATER RUN OFF SHALL DISCHARGE ONTO THE PUBLIC HIGHWAY.
5. PRIVATE DRAINAGE AND EXTERNAL WORKS SHALL COMPLY WITH PART H OF THE BUILDING REGULATIONS AND ALL ASSOCIATED BRITISH STANDARDS (BSEN WHERE APPLICABLE) AND NHBC GUIDELINES.
6. ALL WORK WITHIN THE PUBLIC HIGHWAY WILL BE CARRIED OUT IN ACCORDANCE WITH THE REQUIREMENTS AND SPECIFICATION OF OXFORDSHIRE COUNTY COUNCIL. NO WORK SHALL BE UNDERTAKEN WITHIN THE PUBLIC HIGHWAY UNTIL A LICENSE HAS BEEN ISSUED BY OXFORDSHIRE COUNTY COUNCIL.
7. ALL PROPOSED ADOPTABLE SEWERS (EXCLUDING HIGHWAY DRAINS) AND ALL WORKS TO THE EXISTING PUBLIC SEWERS SHALL BE CARRIED OUT STRICTLY IN ACCORDANCE WITH THE WATER AUTHORITIES ASSOCIATION SPECIFICATION "SEWERS FOR ADOPTION 7TH EDITION" AND THE REQUIREMENTS OF THE WATER AUTHORITY .
8. ALL GULLIES, GULLY CONNECTIONS AND HIGHWAY DRAINS TO BE CONSTRUCTED IN ACCORDANCE WITH THE REQUIREMENTS OF OXFORDSHIRE COUNTY COUNCIL HIGHWAY AUTHORITY.
9. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING THE LOCATIONS OF ANY EXISTING STATUTORY UTILITIES, ALONG WITH ANY ADOPTABLE AND PRIVATE DRAINAGE THAT MAY BE AFFECTED BY THE PROPOSED WORKS. IDENTIFICATION SHOULD BE CARRIED OUT BY MEANS OF EITHER A CAT SCAN OR HAND DUG TRIAL HOLES. ANY DAMAGE TO EXISTING PLANT OR EQUIPMENT SHALL BE REPAIRED AT THE CONTRACTORS EXPENSE.
10. SITE CLEARANCE. EXISTING TREES, BUSHES AND SHRUBS SHALL ONLY BE REMOVED, INCLUDING GRUBBING UP OF ALL ROOTS, WITH THE PRIOR AGREEMENT OF THE ENGINEER. TRIMMING AND LOPPING OF EXISTING TREES SHALL ONLY BE CARRIED OUT BY AN EXPERIENCED TREE SURGEON AND APPROVED BY THE ENGINEER.
11. PRIOR TO COMMENCEMENT OF WORKS PLEASE REFER TO THE PRE-TENDER & CONSTRUCTION PHASE HEALTH AND SAFETY PLANS FOR FURTHER INFORMATION.

KEY:

150mm 1/100 (blue)	PROPOSED SURFACE WATER PIPE TO CONNECTION POINT SR1-SPUR (COUNTRYSIDE PROPERTIES LTD)
(blue circle)	PROPOSED SURFACE WATER MANHOLE (COUNTRYSIDE PROPERTIES LTD)
150mm 1/100 (orange)	PROPOSED FOUL WATER PIPE TO CONNECTION POINT FR1-SPUR (COUNTRYSIDE PROPERTIES LTD)
(orange circle)	PROPOSED FOUL WATER MANHOLE (COUNTRYSIDE PROPERTIES LTD)
150mm 1/100 (grey)	PROPOSED SURFACE WATER PIPE (CARE HOME DEVELOPER)
(grey circle)	PROPOSED SURFACE WATER MANHOLE (CARE HOME DEVELOPER)
150mm 1/100 (grey)	PROPOSED FOUL WATER PIPE (CARE HOME DEVELOPER)
(grey filled circle)	PROPOSED FOUL WATER MANHOLE (CARE HOME DEVELOPER)
Ø375	AS BUILT SURFACE WATER SEWER
Ø150	AS BUILT FOUL WATER SEWER
(red line)	LAND PARCEL R BOUNDARY

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REV	DATE	AMENDMENT DETAILS	DRAWN	APPROVED
E	02.06.23	KEY REVISED TO CLIENT COMMENTS	SW	LJM
D	19.05.23	CARE UNIT INCREASED TO 82 UNITS	SW	LJM
C	10.05.23	BOUNDARY AND PARCEL R REVISED	SW	BWA
B	11.10.22	BOUNDARY AND PARCEL R REVISED	SW	LJM
A	20.05.22	REVISED TO LATEST LAYOUT	SW	BWA

PROJECT: BICESTER PHASE 2	DATE: 17.02.22	DRAWING STATUS: INFORMATION	
DRAWING TITLE: LAND PARCEL R - DRAINAGE LAYOUT	SCALE(S): 1:250	DESIGNED: SW	DRAWN: SW
		CHECKED: LJM	APPROVED: LJM
	JOB No: 874		
CLIENT: COUNTRYSIDE PROPERTIES LTD (BICESTER)	DRAWING No: 02/801	REVISION: E	

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ORIGINAL SHEET SIZE - A1 Landscape

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Appendix B:-
Impermeable Areas Plan

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FOR THE AVOIDANCE OF DOUBT, NO APPROVALS, REVIEWS, COMMENTS OR INDICATION OF SATISFACTION GIVEN BY ARC ENGINEERS IN TERMS OF SUBCONTRACT DRAWINGS, PRODUCTS OR PROPOSED MATERIALS SHALL REDUCE OR EXTINGUISH THE OBLIGATION OF THE SUB-CONTRACTOR OR SUPPLIER TO ADHERE TO THE SPECIFICATION, GENERAL ARRANGEMENT DRAWINGS, STATUTORY REQUIREMENTS AND GOOD WORKING PRACTICE. ARC ENGINEER'S ACCEPT NO LIABILITY FOR THE SELECTION OF MATERIALS OR WORKMANSHIP IN THE EXECUTION OF THE WORKS.

GENERAL NOTES

1. THESE NOTES ARE INTENDED TO AUGMENT DRAWINGS AND SPECIFICATIONS. WHERE CONFLICT OF REQUIREMENTS EXISTS THE ORDER OF PRECEDENCE SHALL BE AS SHOWN IN THE SPECIFICATIONS. OTHERWISE THE STRICTEST PROVISION SHALL GOVERN.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEERS AND ARCHITECTS DRAWINGS,
3. DRAWINGS NOT TO BE SCALED.
4. ALL DIMENSIONS TO BE CHECKED ON SITE BY THE CONTRACTOR. ANY DISCREPANCIES TO BE NOTIFIED TO THE ENGINEER/ARCHITECT AND FURTHER INSTRUCTIONS OBTAINED BEFORE WORK IS COMMENCED.
5. THE STRUCTURE IS DESIGNED TO BE SELF-SUPPORTING AND STABLE AFTER THE BUILDING IS FULLY COMPLETE. IT IS THE CONTRACTORS SOLE RESPONSIBILITY TO DETERMINE THE ERECTION PROCEDURE AND SEQUENCE AND ENSURE THAT THE BUILDING AND ITS COMPONENTS ARE SAFE DURING ERECTION. THIS INCLUDES THE ADDITION OF WHATEVER TEMPORARY BRACING, GUYS OR TIE-DOWNS WHICH MAY BE NECESSARY, SUCH MATERIAL REMAINING THE PROPERTY OF THE CONTRACTOR UPON COMPLETION.
6. ALL WORK TO COMPLY TO CURRENT BUILDING REGULATIONS AND TO BE IN ACCORDANCE WITH THE RELEVANT BRITISH STANDARDS AND APPROPRIATE CODES OF PRACTICE.
7. FOR FURTHER NOTES REFER TO PROJECT SPECIFICATIONS.

SAFETY, HEALTH & ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following risks and information.

Risks listed here are not exhaustive. Refer to Risk Assessment Register: 23047

Construction:

⚠	ADD PROJECT NOTES HERE

Demolition
No Unusual hazards/risks

For information relating to Use, Cleaning and Maintenance see Health & Safety File

It is assumed that all works will be carried out by a competent contractor working, where appropriate, to an approved method statement

●	INDICATES A RESIDUAL RISK REQUIRING A COMPULSORY ACTION
ⓘ	INDICATES A RESIDUAL RISK FOR INFORMATION
⊘	INDICATES A RESIDUAL RISK REQUIRING PROHIBITIVE ACTION
⚠	INDICATES A RESIDUAL RISK AS A WARNING

REV	DETAIL	BY	CHK	APP	DATE
P4	AREAS ALTERED TO SUIT CURRENT SITE PLAN AND DRAINAGE LAYOUT	JE	AA	AA	24.10.23
P3	SITE PLAN UPDATED TO CURRENT	JE	AA	AA	15.09.23
P2	DRAWING NUMBER CHANGED	JE	AA	AA	11.09.23
P1	INITIAL ISSUE	JE	AA	AA	07.09.23

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PROPOSED EXTRA CARE DEVELOPMENT
KINGSMERE, BICESTER

TITLE:
IMPERMEABLE AREAS PLAN

DRAWING STATUS:
PRELIMINARY

DRAWN:	DATE:	CHECKED:	DATE:	APPROVED:	DATE:
JE	SEPT 23	AA	SEPT 23	AA	SEPT 23

CONTRACT No.: 23047
SCALE @ A1: 1:250

PROJECT No.	ORIGINATOR	ZONE	LEVEL	TYPE	DISCIPLINE	NUMBER	REVISION
23047	ARC	XX	XX	DR	C	5500	P4

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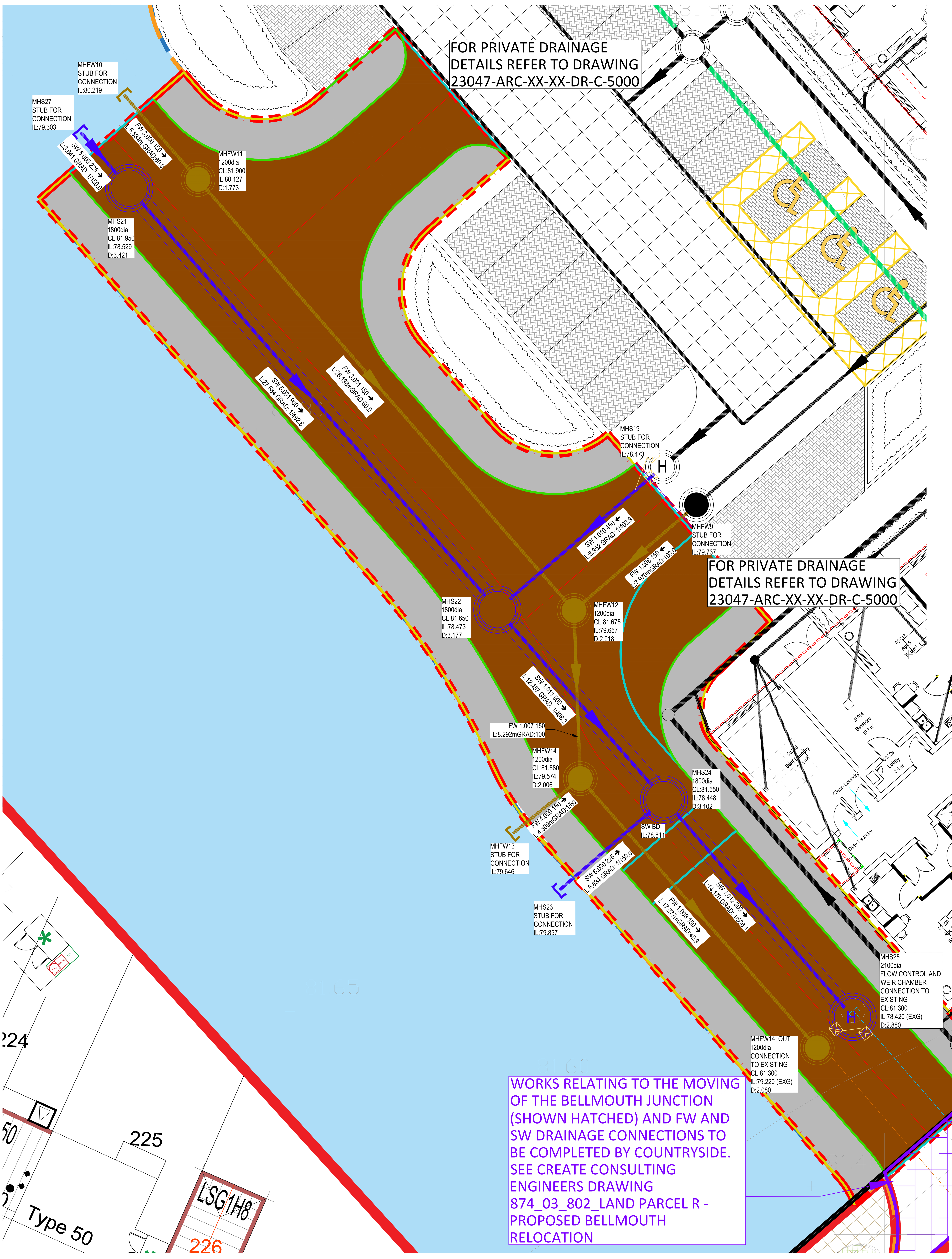
Appendix C:-
Section 104 Adopted Drainage Layout



DO NOT SCALE

FOR THE AVOIDANCE OF DOUBT, NO APPROVALS, REVIEWS, COMMENTS OR INDICATION OF SATISFACTION GIVEN BY ARC ENGINEERS IN TERMS OF SUBCONTRACT DRAWINGS, PRODUCTS OR PROPOSED MATERIALS SHALL REDUCE OR EXTINGUISH THE OBLIGATION OF THE SUB-CONTRACTOR OR SUPPLIER TO ADHERE TO THE SPECIFICATION, GENERAL ARRANGEMENT DRAWINGS, STATUTORY REQUIREMENTS AND GOOD WORKING PRACTICE. ARC ENGINEER'S ACCEPT NO LIABILITY FOR THE SELECTION OF MATERIALS OR WORKMANSHIP IN THE EXECUTION OF THE WORKS.

GENERAL NOTES

1. THESE NOTES ARE INTENDED TO AUGMENT DRAWINGS AND SPECIFICATIONS. WHERE CONFLICT OF REQUIREMENTS EXISTS THE ORDER OF PRECEDENCE SHALL BE AS SHOWN IN THE SPECIFICATIONS. OTHERWISE THE STRICTEST PROVISION SHALL GOVERN.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEERS AND ARCHITECTS DRAWINGS,
3. DRAWINGS NOT TO BE SCALED.
4. ALL DIMENSIONS TO BE CHECKED ON SITE BY THE CONTRACTOR. ANY DISCREPANCIES TO BE NOTIFIED TO THE ENGINEER/ARCHITECT AND FURTHER INSTRUCTIONS OBTAINED BEFORE WORK IS COMMENCED.
5. THE STRUCTURE IS DESIGNED TO BE SELF-SUPPORTING AND STABLE AFTER THE BUILDING IS FULLY COMPLETE. IT IS THE CONTRACTORS SOLE RESPONSIBILITY TO DETERMINE THE ERECTION PROCEDURE AND SEQUENCE AND ENSURE THAT THE BUILDING AND ITS COMPONENTS ARE SAFE DURING ERECTION. THIS INCLUDES THE ADDITION OF WHATEVER TEMPORARY BRACING, GUYS OR TIE-DOWNS WHICH MAY BE NECESSARY, SUCH MATERIAL REMAINING THE PROPERTY OF THE CONTRACTOR UPON COMPLETION.
6. ALL WORK TO COMPLY TO CURRENT BUILDING REGULATIONS AND TO BE IN ACCORDANCE WITH THE RELEVANT BRITISH STANDARDS AND APPROPRIATE CODES OF PRACTICE.
7. FOR FURTHER NOTES REFER TO PROJECT SPECIFICATIONS.

SAFETY, HEALTH & ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following risks and information.

Risks listed here are not exhaustive. Refer to Risk Assessment Register: XXXXXXX

Construction:

ADD PROJECT NOTES HERE

Demolition
No Unusual hazards/risks

For information relating to Use, Cleaning and Maintenance see Health & Safety File

It is assumed that all works will be carried out by a competent contractor working, where appropriate, to an approved method statement

- INDICATES A RESIDUAL RISK REQUIRING A COMPULSORY ACTION
- INDICATES A RESIDUAL RISK FOR INFORMATION
- INDICATES A RESIDUAL RISK REQUIRING PROHIBITIVE ACTION
- INDICATES A RESIDUAL RISK AS A WARNING

SECTION 104 ADOPTED DRAINAGE KEY:

- PROPOSED FOUL WATER PIPE (150mmØ U.N.O. OUTLET AND CONNECTION BY OTHERS) (1.000 150Ø at 1:60)
- PROPOSED SURFACE WATER PIPE (1.000 150Ø at 1:60)
- ADOPTABLE SURFACE WATER CHAMBER (SW01 CL = TBC IL = TBC)
- ADOPTABLE HYDROBRAKE (FW01 CL = TBC IL = TBC)
- ADOPTABLE FOUL WATER CHAMBER
- PROPOSED PRIVATE SURFACE WATER DRAINAGE
- PROPOSED PRIVATE FOUL WATER DRAINAGE
- ROAD GULLY
- ADOPTABLE ROAD BOUNDARY
- WHOLE SITE BOUNDARY

FLOW CONTROL CHAMBER DETAILS

MHS25
2100dia PCC
FLOW CONTROL:
HYDROBRAKE CTL-SHE-0086-3500-1200-3500
DESIGN HEAD = 1.20m
DESIGN FLOW = 3.5 l/s
DESIGN FLOW UP TO 1 IN 10 YEAR STORM EVENT
WATER LEVEL = 79.527m
WEIR:
DESIGN WIDTH = 0.45m
DESIGN DEPTH = 0.45m
LEVEL = 79.650m
FOR FLOWS ABOVE 1 IN 10 YEAR STORM EVENT UP TO 1 IN 100 YEAR STORM + CLIMATE CHANGE.
CL:81.300
IL:78.420
D:2.880

DRAINAGE NOTES

1. All drainage works shall be carried out in accordance with the Sewer Sector Guidance, Appendix C - Design and Construction Guidance requirements/addendums to the Mechanical & Electrical Specification kite marked.
2. Position size & depth of all existing sewers & services shall be established prior to commencement on site.
3. The Contractor shall allow for the protection, temporary & permanent support, & temporary & permanent diversion works, as necessary to all existing services.
4. The Contractor shall allow for all traffic management in connection with road & sewer works.
5. The Contractor shall allow for keeping sewer trenches & excavations as dry as practicable by pumping from temporary sumps & de-watering as appropriate. The point & method of discharge to be agreed with the drainage authority.
6. Concrete pipes to be Class S unless noted otherwise. The min crushing strength for concrete pipes should be Class 120 to EN1916/BS5911-1:2002.
7. Vitrified clay pipes & fittings shall comply with the relevant provisions of BS EN295 & BS 65 respectively & be kitemarked. All pipes shall be extra strength to BS 65 or equivalent BS EN295 pipe crushing strength. The min crushing strength for clay pipes should be as follows:100mm dia 40kN/m, 150mm dia 40kN/m, 225mm dia 45kN/m & 300mm dia 72kN/m.
8. Manhole covers & frames shall comply with the relevant provisions of BS EN124, have minimum 600 x 600 clear openings with 150 deep frames unless otherwise specified. Manhole covers & frames to be of a non-rocking design without cushion inserts & be kitemarked. Load class D400 in vehicular trafficked areas & load class B125 in footways & pedestrian areas.
9. Gully grates & frames shall comply with the relevant provisions of BS EN124 & be of a non-rocking design with captive hinge access & be kitemarked. Load Class D400 for roads regularly carrying fast moving heavy vehicles. Class C250 to be used in lesser trafficked areas eg. Estate roads, cul-de-sacs, residential car parking areas etc.
10. Cover slabs shall be provided where cover to the pipe barrel is less than 1.2m in vehicular trafficked areas & 0.9m elsewhere, to all road gully connections & within areas of deep rooting vegetation.
11. Selected backfill material shall consist of uniform material free from stones larger than 40mm, clay lumps larger than 75mm, tree roots, organic matter & frozen soil. Selected backfill material shall be placed in layers not exceeding 225mm, each layer compacted to form a stable trench backfill.
12. General backfill material to be free from stones larger than 40mm. General backfill material is to be placed in layers not exceeding 150mm thickness & each layer compacted by hand. No mechanical compaction of fill material shall be permitted within 300mm above the crown/barrel of the pipe.
13. Backfilling & reinstatement to trenches in public highways shall be in accordance with the requirements & specifications of the adopting authority, or, in the absence of such, in accordance with the requirements of "The Street Works Regulations 1992" & relevant provisions of H.A.U.C. "Specification for the Reinstatement of Openings in Highways" June 1992, both under section 71 of the New Roads & Street works Act 1991.
14. Filled ground must be filled & consolidated under the supervision & satisfaction of Building Control/Local Authority before any sewer works are carried out.
15. Contractor to take measures to protect his operatives with respect to the presence of gas in sewer trenches & manholes through the use of gas monitoring equipment & breathing apparatus as required.
16. Contractor to apply for sewer permits & road opening permits as necessary from the appropriate authorities, prior to commencing works.
17. Statutory Undertaker / Utilities Provider is not obligated to accept filter drain/land drainage run-off into the public sewer network or adoptable drainage system(directly or in-directly). An alternative method of disposal of land drainage run-off will therefore be required & you will have to liaise with the local authority, land drainage section with regards to the disposal of filter drain/land drainage run off.
18. Cover slabs must carry BSI Kitemark or will be rejected by Statutory Undertaker / Utilities Provider inspector. Where the clear opening of the kitemarked product is different to that of the cover & frame a load bearing slab should be fitted above the cover slab to bring down the size to 600mm x 600mm for Statutory Undertaker / Utilities Provider specified cover size. Please refer to Concrete Pipeline Systems Association (CPSA), Technical Bulletin for kitemarked cover slab opening sizes.
19. Sulphate resistant cement (C20-DC2) & precast concrete products must be used or a laboratory report provided providing that such precautions are not necessary.
20. The adopted sewers should be a minimum of 1m & manholes 0.5m from kerb faces & service margins.
21. Sewers must have 5m clearance from trees & hedges (please also refer to figure B5.1.10 in the 'Sewer Sector Guidance, Appendix C - Design and Construction Guidance planting adjacent to sewers).
22. The chamber size of manholes with more than one connection in them may need to be increased an increment to accommodate the connections & bends.
23. Sewers to be laid in Class "S" bedding (150mm granular bed & surround). Where depth of cover to top of sewer is less than 1.2m in highways & verges (or less 900mm in private vehicle areas or 750mm in landscaping areas) then a concrete slab should be provided above the granular surround. Bedding & backfill material to conform to the requirements of Water Industry Specification 4-08-02 (Table A2).

REV	DETAIL	BY	CHK	APP	DATE
P4	MHFW10 AND 11 ALTERED TO INCREASE GRADIENT FOLLOWING COMMENTS.	JE	AA	AA	24.10.23
P3	DRAINAGE UPDATED TO SUIT CURRENT SITE PLAN AND COUNTRYSIDE COMMENTS	JE	AA	AA	24.10.23
P2	SITE PLAN UPDATED TO SUIT CURRENT. BELLMOUTH NOTES ADDED	JE	AA	AA	15.09.23
P1	INITIAL ISSUE	JE	AA	AA	11.09.23

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Phone: 0113 253 3904
www.arc-engineers.co.uk

CLIENT: PREFERRED HOMES

PROJECT: PROPOSED EXTRA CARE DEVELOPMENT, KINGSMERE, BICESTER

TITLE: SECTION 104 ADOPTED DRAINAGE GA

DRAWING STATUS: PRELIMINARY

DRAWN:	DATE:	CHECKED:	DATE:	APPROVED:	DATE:
JE	SEPT 23	AA	SEPT 23	AA	SEPT 23

CONTRACT No. 23047 | SCALE @ A1: 1:100

PROJECT No. / ORIGINATOR / ZONE / LEVEL / TYPE / DISCIPLINE / NUMBER / REVISION
23047- ARC - XX - XX - DR - C - 5200 - P4

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Appendix D:-
Proposed Drainage General Arrangement

PRIVATE DRAINAGE KEY:

- 1.000 150Ø at 1:60 — PROPOSED PRIVATE FOUL WATER PIPE (150mmØ U.N.O. OUTLET AND CONNECTION BY OTHERS)
- 1.000 150Ø at 1:60 — PROPOSED PRIVATE SURFACE WATER PIPE
- SW01 CL = TBC IL = TBC — SURFACE WATER CHAMBER
- H — HYDROBRAKE
- FW01 CL = TBC IL = TBC — FOUL WATER CHAMBER
- EXISTING FW SEWER
- EXISTING SW SEWER
- PPIC PPIC — POLYPROPYLENE INSPECTION CHAMBER
- RG — ROAD GULLY
- RE — RODDING EYE
- G — GULLY
- FG — FOUL WATER GULLY
- RWP — RAINWATER PIPE
- ST — SILT TRAP
- SURFACE WATER ATTENUATION POLYSTORM-R OR SIMILAR APPROVED PRODUCT
- PROPOSED PERMEABLE PAVING AREA
- PROPOSED BIORETENTION AREA
- SITE BOUNDARY

GREASE TRAPS

NOTE: GREASE TRAPS TO BE CONSIDERED FOR ALL KITCHEN AREAS. THESE MAY BE INTERNAL AND PART OF THE KITCHEN SUPPLIERS WORKS, OR EXTERNAL WITH SIZE AND LOCATION TO BE ADVISED BY SPECIALIST SUPPLIER FOR INDICATIVE INCLUSION ON ENGINEERS DRAWINGS.

NOTE: ALL COVER LEVELS TO BE CONFIRMED FOLLOWING DEVELOPMENT OF EXISTING WORKS

FLOW CONTROL CHAMBER DETAILS

MHS19
1500dia PCC
FLOW CONTROL:
HYDROBRAKE CTL-SHE-0063-2000-1350-2000
DESIGN HEAD = 1.35m
DESIGN FLOW = 2.0 l/s
DESIGN FLOW UP TO 1 IN 10 YEAR STORM EVENT
WATER LEVEL = 80.551m
WEIR:
DESIGN WIDTH = 0.45m
DESIGN DEPTH = 0.45m
LEVEL = 80.600m
FOR FLOWS ABOVE 1 IN 10 YEAR STORM EVENT UP TO 1 IN 100 YEAR STORM + CLIMATE CHANGE.
CL:81.869
IL:79.382
D:2.487

DRAINAGE NOTES

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SAFETY, HEALTH & ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following risks and information.

Risks listed here are not exhaustive. Refer to Risk Assessment Register: 23047

Construction:

ADD PROJECT NOTES HERE

Demolition
No Unusual hazards/risks

For information relating to Use, Cleaning and Maintenance see Health & Safety File

It is assumed that all works will be carried out by a competent contractor working, where appropriate, to an approved method statement

INDICATES A RESIDUAL RISK REQUIRING A COMPULSORY ACTION

INDICATES A RESIDUAL RISK FOR INFORMATION

INDICATES A RESIDUAL RISK REQUIRING PROHIBITIVE ACTION

INDICATES A RESIDUAL RISK AS A WARNING

REV	DETAIL	BY	CHK	APP	DATE
P5	SECTION 38 BOUNDARY ALTERED TO INCLUDE FOOTWAY	JE	AA	AA	31.10.23
P4	DRAINAGE UPDATED TO SUIT CURRENT SITE PLAN AND S104 DRAINAGE. ALTERED TO SUIT COMMENTS	JE	AA	AA	24.10.23
P3	SITE PLAN UPDATED TO CURRENT	JE	AA	AA	15.09.23
P2	BIORETENTION AREAS ADDED TO CAFE PATIO AREA. ADOPTABLE DRAINAGE REMOVED	JE	AA	AA	11.09.23
P1	INITIAL ISSUE	JE	AA	AA	08.09.23

ArcEngineers

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CLIENT:
PREFERRED HOMES

PROJECT:
PROPOSED EXTRA CARE DEVELOPMENT
KINGSMERE, BICESTER

TITLE:
PROPOSED PRIVATE DRAINAGE
GENERAL ARRANGEMENT

DRAWING STATUS:
PRELIMINARY

DRAWN:	DATE:	CHECKED:	DATE:	APPROVED:	DATE:
JE	SEPT 23	AA	SEPT 23	AA	SEPT 23

CONTRACT No. 23047 — SCALE @ A1: 1:200

PROJECT No. / ORIGINATOR / ZONE / LEVEL / TYPE / DISCIPLINE / NUMBER / REVISION
23047- ARC - XX - XX - DR - C - 5000 - P5

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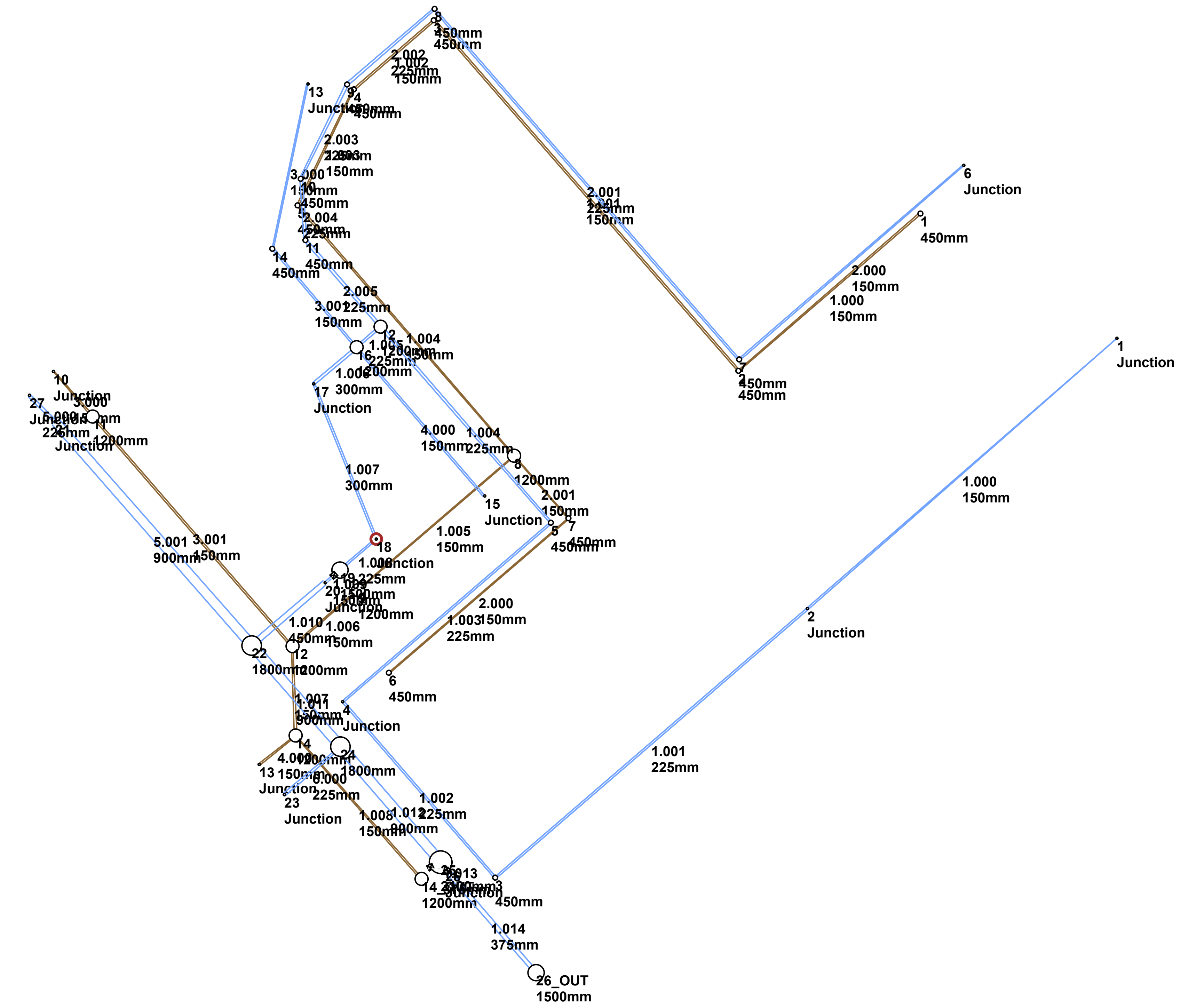
Appendix E:-
Surface Water Design Calculations

CAUSEWAY	ARC Engineers Ltd	File: 23047-ARC-XX-XX-M3-C- ADOPTED ROAD CALCS.pfd Network: SW N1 Jim Emmerson 24/10/2023	Page 1



Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	40	Minimum Backdrop Height (m)	0.200
CV	0.750	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	x
Maximum Rainfall (mm/hr)	50.0		

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.012	14.170	506.1	900	Circular	81.550	78.448	2.202	81.300	78.420	1.980
1.011	12.457	498.3	900	Circular	81.650	78.473	2.277	81.550	78.448	2.202
6.000	6.834	150.0	225	Circular	81.650	79.857	1.568	81.550	79.811	1.514
1.010	8.952	406.9	450	Circular	81.869	79.064	2.355	81.650	79.042	2.158
5.001	27.584	492.6	900	Circular	81.950	78.529	2.521	81.650	78.473	2.277
1.009	1.802	100.1	150	Circular	81.869	79.382	2.337	81.869	79.364	2.355
1.008	4.420	250.0	225	Circular	81.650	79.400	2.025	81.869	79.382	2.262
1.007	15.514	250.0	300	Circular	81.575	79.638	1.637	81.650	79.576	1.774
1.006	5.223	250.0	300	Circular	81.550	79.659	1.591	81.575	79.638	1.637
4.000	18.182	150.0	150	Circular	81.550	80.950	0.450	81.550	80.829	0.571
1.005	2.918	250.0	225	Circular	81.650	79.746	1.679	81.550	79.734	1.591
3.001	12.007	150.0	150	Circular	81.550	80.846	0.554	81.550	80.766	0.634
3.000	15.644	150.0	150	Circular	81.550	80.950	0.450	81.550	80.846	0.554
1.004	24.050	150.0	225	Circular	81.650	79.981	1.444	81.650	79.821	1.604
1.003	25.418	150.0	225	Circular	81.650	80.150	1.275	81.650	79.981	1.444
1.002	21.563	150.0	225	Circular	81.550	80.294	1.031	81.650	80.150	1.275
1.001	38.146	150.0	225	Circular	81.700	80.548	0.927	81.550	80.294	1.031
1.000	38.043	150.0	150	Circular	81.700	80.800	0.750	81.700	80.546	1.004
2.005	10.619	150.0	225	Circular	81.650	80.156	1.269	81.650	80.085	1.340
2.004	5.710	150.0	225	Circular	81.650	80.194	1.231	81.650	80.156	1.269

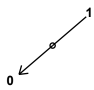
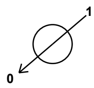
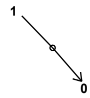
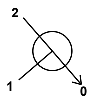
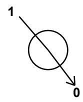
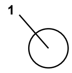
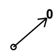
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.012	24	1800	Manhole	Adoptable	25	2100	Manhole	Adoptable
1.011	22	1800	Manhole	Adoptable	24	1800	Manhole	Adoptable
6.000	23		Junction		24	1800	Manhole	Adoptable
1.010	20	1350	Junction		22	1800	Manhole	Adoptable
5.001	21	1800	Junction		22	1800	Manhole	Adoptable
1.009	19	1500	Manhole	Adoptable	20	1350	Junction	
1.008	18		Junction		19	1500	Manhole	Adoptable
1.007	17	1200	Junction		18		Junction	
1.006	16	1200	Manhole	Adoptable	17	1200	Junction	
4.000	15	1200	Junction		16	1200	Manhole	Adoptable
1.005	12	1200	Manhole	Adoptable	16	1200	Manhole	Adoptable
3.001	14	450	Manhole	Adoptable	16	1200	Manhole	Adoptable
3.000	13	450	Junction		14	450	Manhole	Adoptable
1.004	5	450	Manhole	Adoptable	12	1200	Manhole	Adoptable
1.003	4	450	Junction		5	450	Manhole	Adoptable
1.002	3	450	Manhole	Adoptable	4	450	Junction	
1.001	2	450	Junction		3	450	Manhole	Adoptable
1.000	1	450	Junction		2	450	Junction	
2.005	11	450	Manhole	Adoptable	12	1200	Manhole	Adoptable
2.004	10	450	Manhole	Adoptable	11	450	Manhole	Adoptable

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
2.003	9.738	150.0	225	Circular	81.700	80.259	1.216	81.650	80.194	1.231
2.002	10.705	150.0	225	Circular	81.700	80.330	1.145	81.700	80.259	1.216
2.001	43.014	150.0	225	Circular	81.700	80.617	0.858	81.700	80.330	1.145
2.000	27.478	150.0	150	Circular	81.700	80.800	0.750	81.700	80.617	0.933
1.014	12.798	250.0	375	Circular	81.300	78.413	2.512	81.300	78.362	2.563
1.013	1.000	142.9	375	Circular	81.300	78.420	2.505	81.300	78.413	2.512
5.000	3.416	150.0	225	Circular	82.000	79.303	2.472	81.950	79.280	2.445

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
2.003	9	450	Manhole	Adoptable	10	450	Manhole	Adoptable
2.002	8	450	Manhole	Adoptable	9	450	Manhole	Adoptable
2.001	7	450	Manhole	Adoptable	8	450	Manhole	Adoptable
2.000	6	1200	Junction		7	450	Manhole	Adoptable
1.014	26		Junction		26_OUT	1500	Manhole	Adoptable
1.013	25	2100	Manhole	Adoptable	26		Junction	
5.000	27		Junction		21	1800	Junction	

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
20	456487.784	222437.000	81.869	2.805	1350		1	1.009	79.364	150
							0	1.010	79.064	450
19	456489.152	222438.173	81.869	2.487	1500		1	1.008	79.382	225
							0	1.009	79.382	150
21	456462.831	222451.936	81.950	3.421	1800		1	5.000	79.280	225
							0	5.001	78.529	900
24	456489.190	222421.795	81.550	3.102	1800		1	6.000	79.811	225
							2	1.011	78.448	900
							0	1.012	78.448	900
25	456498.455	222411.074	81.300	2.880	2100		1	1.012	78.420	900
							0	1.013	78.420	375
26_OUT	456507.275	222400.826	81.300	2.938	1500		1	1.014	78.362	375
23	456484.009	222417.338	81.650	1.793			0	6.000	79.857	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
18	456492.507	222441.050	81.650	2.250		1	1.007	79.576	300
						0	1.008	79.400	225
26	456498.892	222410.496	81.300	2.887		1	1.013	78.413	375
						0	1.014	78.413	375
22	456480.989	222431.172	81.650	3.177	1800	1	5.001	78.473	900
						2	1.010	79.042	450
						0	1.011	78.473	900
17	456486.727	222455.447	81.575	1.937	1200	1	1.006	79.638	300
						0	1.007	79.638	300
16	456490.689	222458.851	81.550	1.891	1200	1	4.000	80.829	150
						2	3.001	80.766	150
						3	1.005	79.734	225
						0	1.006	79.659	300
14	456482.893	222467.983	81.550	0.704	450	1	3.000	80.846	150
						0	3.001	80.846	150
13	456486.200	222483.273	81.550	0.600	450				
						0	3.000	80.950	150
12	456492.902	222460.753	81.650	1.904	1200	1	2.005	80.085	225
						2	1.004	79.821	225
						0	1.005	79.746	225
5	456508.639	222442.567	81.650	1.669	450	1	1.003	79.981	225
						0	1.004	79.981	225
4	456489.399	222425.957	81.650	1.500	450	1	1.002	80.150	225
						0	1.003	80.150	225
3	456503.496	222409.640	81.550	1.256	450	1	1.001	80.294	225
						0	1.002	80.294	225
2	456532.344	222434.598	81.700	1.154	450	1	1.000	80.546	150
						0	1.001	80.548	225
1	456560.956	222459.671	81.700	0.900	450				
						0	1.000	80.800	150

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Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
15	456502.524	222445.048	81.550	0.600	1200	0	4.000	80.950	150
11	456485.954	222468.783	81.650	1.494	450	1	2.004	80.156	225
						0	2.005	80.156	225
10	456485.523	222474.477	81.650	1.456	450	1	2.003	80.194	225
						0	2.004	80.194	225
6	456546.803	222475.719	81.700	0.900	1200	0	2.000	80.800	150
7	456526.045	222457.715	81.700	1.083	450	1	2.000	80.617	150
						0	2.001	80.617	225
8	456497.893	222490.237	81.700	1.370	450	1	2.001	80.330	225
						0	2.002	80.330	225
9	456489.806	222483.223	81.700	1.441	450	1	2.002	80.259	225
						0	2.003	80.259	225
27	456460.454	222454.390	82.000	2.697		0	5.000	79.303	225

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m^3/ha)	20.0
Summer CV	0.750	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	0.840	Drain Down Time (mins)	240	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
10	0	0	0
30	20	0	0
100	40	0	0

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Node 19 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	79.382	Product Number	CTL-SHE-0063-2000-1350-2000
Design Depth (m)	1.350	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	2.0	Min Node Diameter (mm)	1200

Node 25 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	78.420	Product Number	CTL-SHE-0086-3500-1200-3500
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	3.5	Min Node Diameter (mm)	1200

Node 25 Offline Weir Control

Flap Valve	x	Design Depth (m)	0.450	Discharge Coefficient	0.590
Loop to Node	26	Design Flow (l/s)			
Invert Level (m)	79.650	Width (m)	0.450		

Node 19 Offline Weir Control

Flap Valve	x	Design Depth (m)	0.450	Discharge Coefficient	0.590
Loop to Node	20	Design Flow (l/s)			
Invert Level (m)	80.600	Width (m)	0.450		

Node 18 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	79.400
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	190.0	0.0	1.000	190.0	0.0	1.001	0.0	0.0

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Results for 2 year Critical Storm Duration. Lowest mass balance: 93.89%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	20	49	79.097	0.033	1.7	0.0000	0.0000	OK
720 minute winter	19	690	79.988	0.606	1.7	1.0716	0.0000	SURCHARGED
240 minute winter	21	184	78.958	0.429	4.4	0.0776	0.0000	OK
240 minute winter	24	184	78.958	0.510	6.0	1.3656	0.0000	OK
240 minute winter	25	184	78.958	0.538	4.5	1.8621	0.0000	SURCHARGED
120 minute summer	26_OUT	146	78.403	0.041	3.5	0.0000	0.0000	OK
15 minute winter	23	10	79.926	0.069	8.1	0.0466	0.0000	OK
720 minute winter	18	690	79.989	0.589	9.2	107.9985	0.0000	SURCHARGED
180 minute summer	26	104	78.456	0.043	3.5	0.0000	0.0000	OK
240 minute winter	22	184	78.958	0.485	5.6	1.3093	0.0000	OK
720 minute winter	17	690	79.989	0.351	4.7	0.0000	0.0000	SURCHARGED
720 minute winter	16	690	79.989	0.330	4.7	0.3727	0.0000	SURCHARGED
15 minute winter	14	12	80.916	0.070	5.9	0.0644	0.0000	OK
15 minute winter	13	11	80.995	0.045	2.9	0.0392	0.0000	OK
720 minute winter	12	690	79.989	0.243	3.0	0.2998	0.0000	SURCHARGED
15 minute winter	5	12	80.075	0.094	15.0	0.0479	0.0000	OK
15 minute winter	4	11	80.230	0.080	11.6	0.0224	0.0000	OK
15 minute winter	3	11	80.365	0.071	9.1	0.0113	0.0000	OK
15 minute winter	2	11	80.619	0.073	9.1	0.0429	0.0000	OK
15 minute winter	1	10	80.858	0.058	4.8	0.0466	0.0000	OK
15 minute winter	15	11	81.026	0.076	7.3	0.1650	0.0000	OK
15 minute winter	11	12	80.236	0.080	10.4	0.0128	0.0000	OK
15 minute winter	10	11	80.278	0.084	10.5	0.0214	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute winter	20	1.010	22	1.7	0.384	0.010	0.0390	
720 minute winter	19	1.009	20	1.7	0.611	0.093	0.0049	
720 minute winter	19	Weir	20	0.0				0.0
240 minute winter	21	5.001	22	3.1	0.218	0.004	8.9037	
240 minute winter	24	1.012	25	4.5	0.215	0.005	5.4217	
240 minute winter	25	Hydro-Brake®	26	3.5				
240 minute winter	25	Weir	26	0.0				0.0
15 minute winter	23	6.000	24	8.0	0.808	0.189	0.0678	
720 minute winter	18	1.008	19	1.7	0.167	0.053	0.1758	
180 minute summer	26	1.014	26_OUT	3.5	0.519	0.028	0.0864	69.1
240 minute winter	22	1.011	24	3.6	0.185	0.004	4.4728	
720 minute winter	17	1.007	18	4.5	0.552	0.065	1.0925	
720 minute winter	16	1.006	17	4.7	0.555	0.067	0.3678	
15 minute winter	14	3.001	16	5.9	0.757	0.405	0.0928	
15 minute winter	13	3.000	14	2.9	0.465	0.199	0.0971	
720 minute winter	12	1.005	16	3.0	0.511	0.092	0.1161	
15 minute winter	5	1.004	12	14.7	0.957	0.348	0.3704	
15 minute winter	4	1.003	5	11.4	0.804	0.270	0.3615	
15 minute winter	3	1.002	4	9.0	0.770	0.212	0.2516	
15 minute winter	2	1.001	3	9.1	0.852	0.214	0.4075	
15 minute winter	1	1.000	2	4.6	0.632	0.322	0.2804	
15 minute winter	15	4.000	16	7.2	0.814	0.497	0.1607	
15 minute winter	11	2.005	12	10.5	0.858	0.247	0.1296	
15 minute winter	10	2.004	11	10.4	0.799	0.246	0.0746	

Results for 2 year Critical Storm Duration. Lowest mass balance: 93.89%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	6	10	80.857	0.057	4.5	0.0429	0.0000	OK
15 minute winter	7	10	80.688	0.071	9.3	0.0600	0.0000	OK
15 minute winter	8	11	80.406	0.076	9.2	0.0120	0.0000	OK
15 minute winter	9	11	80.338	0.079	9.7	0.0180	0.0000	OK
15 minute winter	27	10	79.395	0.092	15.1	0.0775	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	6	2.000	7	4.4	0.617	0.306	0.1969	
15 minute winter	7	2.001	8	9.2	0.825	0.217	0.4832	
15 minute winter	8	2.002	9	9.1	0.757	0.215	0.1289	
15 minute winter	9	2.003	10	9.6	0.745	0.228	0.1260	
15 minute winter	27	5.000	21	15.0	0.991	0.355	0.0518	

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Results for 10 year Critical Storm Duration. Lowest mass balance: 93.89%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	20	172	79.619	0.555	4.9	0.0000	0.0000	SURCHARGED
600 minute winter	19	585	80.456	1.074	1.8	1.8983	0.0000	SURCHARGED
180 minute winter	21	140	79.617	1.088	22.2	0.1969	0.0000	SURCHARGED
180 minute winter	24	140	79.614	1.166	38.8	3.1250	0.0000	SURCHARGED
180 minute winter	25	144	79.638	1.218	48.5	4.2182	0.0000	SURCHARGED
180 minute winter	26_OUT	144	78.408	0.046	4.4	0.0000	0.0000	OK
15 minute winter	23	10	79.958	0.101	16.3	0.0686	0.0000	OK
600 minute winter	18	585	80.456	1.056	16.6	183.7730	0.0000	SURCHARGED
180 minute winter	26	144	78.461	0.048	4.4	0.0000	0.0000	OK
180 minute winter	22	144	79.758	1.285	72.8	3.4709	0.0000	SURCHARGED
600 minute winter	17	585	80.456	0.818	8.1	0.0000	0.0000	SURCHARGED
600 minute winter	16	585	80.456	0.797	8.2	0.9018	0.0000	SURCHARGED
15 minute winter	14	12	80.957	0.111	12.0	0.1029	0.0000	OK
15 minute winter	13	11	81.016	0.066	5.9	0.0574	0.0000	OK
600 minute winter	12	585	80.456	0.710	5.4	0.8780	0.0000	SURCHARGED
600 minute winter	5	585	80.456	0.475	3.0	0.2410	0.0000	SURCHARGED
600 minute winter	4	585	80.456	0.306	2.3	0.0858	0.0000	SURCHARGED
600 minute winter	3	585	80.457	0.163	1.8	0.0259	0.0000	OK
15 minute winter	2	10	80.652	0.106	18.5	0.0622	0.0000	OK
15 minute winter	1	10	80.888	0.088	9.6	0.0700	0.0000	OK
15 minute winter	15	12	81.077	0.127	14.8	0.2757	0.0000	OK
600 minute winter	11	585	80.457	0.301	2.1	0.0478	0.0000	SURCHARGED
600 minute winter	10	585	80.457	0.263	2.1	0.0670	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
240 minute winter	20	1.010	22	17.7	0.384	0.111	1.4184	
600 minute winter	19	1.009	20	1.8	0.624	0.100	0.0307	
600 minute winter	19	Weir	20	0.0				0.0
180 minute winter	21	5.001	22	29.8	0.258	0.033	17.4820	
180 minute winter	24	1.012	25	48.5	0.258	0.055	8.9806	
180 minute winter	25	Hydro-Brake®	26	3.5				
180 minute winter	25	Weir	26	1.0				0.2
15 minute winter	23	6.000	24	16.2	0.973	0.382	0.1135	
600 minute winter	18	1.008	19	1.8	0.135	0.056	0.1758	
180 minute winter	26	1.014	26_OUT	4.4	0.534	0.035	0.1050	75.0
180 minute winter	22	1.011	24	33.7	0.205	0.038	7.8949	
600 minute winter	17	1.007	18	8.0	0.583	0.114	1.0925	
600 minute winter	16	1.006	17	8.1	0.592	0.116	0.3678	
15 minute winter	14	3.001	16	11.8	0.890	0.820	0.1597	
15 minute winter	13	3.000	14	5.9	0.541	0.405	0.1679	
600 minute winter	12	1.005	16	5.1	0.574	0.155	0.1161	
600 minute winter	5	1.004	12	3.0	0.608	0.071	0.9565	
600 minute winter	4	1.003	5	2.3	0.523	0.054	1.0109	
600 minute winter	3	1.002	4	1.8	0.490	0.043	0.7610	
15 minute winter	2	1.001	3	18.2	1.015	0.431	0.6887	
15 minute winter	1	1.000	2	9.4	0.783	0.649	0.4552	
15 minute winter	15	4.000	16	14.5	0.964	1.003	0.2729	
600 minute winter	11	2.005	12	2.1	0.551	0.050	0.4223	
600 minute winter	10	2.004	11	2.1	0.531	0.050	0.2271	

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Results for 10 year Critical Storm Duration. Lowest mass balance: 93.89%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	6	10	80.885	0.085	9.1	0.0642	0.0000	OK
15 minute winter	7	10	80.722	0.105	18.8	0.0888	0.0000	OK
600 minute winter	8	585	80.457	0.127	1.8	0.0202	0.0000	OK
600 minute winter	9	585	80.457	0.198	1.9	0.0452	0.0000	OK
180 minute winter	27	144	79.629	0.326	11.4	0.2757	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	6	2.000	7	8.9	0.759	0.619	0.3231	
15 minute winter	7	2.001	8	18.5	0.968	0.437	0.8313	
600 minute winter	8	2.002	9	1.8	0.508	0.043	0.3222	
600 minute winter	9	2.003	10	1.9	0.499	0.045	0.3740	
180 minute winter	27	5.000	21	-10.2	0.805	-0.240	0.1359	

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 93.89%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	20	120	79.798	0.734	36.4	0.0000	0.0000	SURCHARGED
180 minute winter	19	120	80.720	1.338	36.4	2.3650	0.0000	SURCHARGED
180 minute winter	21	120	79.796	1.267	14.0	0.2293	0.0000	SURCHARGED
180 minute winter	24	120	79.795	1.347	50.5	3.6108	0.0000	SURCHARGED
180 minute winter	25	120	79.796	1.376	49.6	4.7651	0.0000	SURCHARGED
180 minute winter	26_OUT	120	78.523	0.161	49.6	0.0000	0.0000	OK
15 minute winter	23	10	79.990	0.133	25.9	0.0907	0.0000	OK
180 minute winter	18	120	80.754	1.354	61.7	184.6698	0.0000	SURCHARGED
180 minute winter	26	120	78.582	0.169	49.7	0.0000	0.0000	OK
240 minute summer	22	208	79.847	1.374	25.3	3.7117	0.0000	SURCHARGED
180 minute winter	17	120	80.756	1.118	29.2	0.0000	0.0000	SURCHARGED
180 minute winter	16	120	80.761	1.102	29.6	1.2469	0.0000	SURCHARGED
15 minute winter	14	12	81.048	0.202	18.5	0.1869	0.0000	SURCHARGED
15 minute winter	13	12	81.092	0.142	9.4	0.1229	0.0000	OK
180 minute winter	12	120	80.765	1.019	19.1	1.2595	0.0000	SURCHARGED
180 minute winter	5	120	80.768	0.787	11.6	0.3992	0.0000	SURCHARGED
180 minute winter	4	120	80.771	0.621	8.8	0.1738	0.0000	SURCHARGED
180 minute winter	3	120	80.772	0.478	6.9	0.0760	0.0000	SURCHARGED
180 minute winter	2	120	80.775	0.229	7.9	0.1351	0.0000	SURCHARGED
15 minute winter	1	10	80.925	0.125	15.3	0.1002	0.0000	OK
15 minute winter	15	12	81.274	0.324	23.5	0.7027	0.0000	FLOOD RISK
180 minute winter	11	120	80.766	0.609	8.1	0.0969	0.0000	SURCHARGED
180 minute winter	10	120	80.766	0.572	8.1	0.1460	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
180 minute winter	20	1.010	22	36.2	0.386	0.227	1.4184	
180 minute winter	19	1.009	20	2.7	0.627	0.150	0.0317	
180 minute winter	19	Weir	20	34.7				65.0
180 minute winter	21	5.001	22	13.1	0.286	0.015	17.4820	
180 minute winter	24	1.012	25	49.6	0.237	0.056	8.9806	
180 minute winter	25	Hydro-Brake®	26	3.5				
180 minute winter	25	Weir	26	46.2				103.1
15 minute winter	23	6.000	24	25.7	1.091	0.607	0.1610	
180 minute winter	18	1.008	19	36.4	0.916	1.115	0.1758	
180 minute winter	26	1.014	26_OUT	49.6	1.063	0.394	0.5979	180.3
240 minute summer	22	1.011	24	26.7	0.233	0.030	7.8949	
180 minute winter	17	1.007	18	28.9	0.831	0.413	1.0925	
180 minute winter	16	1.006	17	29.2	0.821	0.417	0.3678	
15 minute winter	14	3.001	16	18.4	1.058	1.275	0.1998	
15 minute winter	13	3.000	14	9.1	0.570	0.629	0.2725	
180 minute winter	12	1.005	16	18.2	0.808	0.556	0.1161	
180 minute winter	5	1.004	12	10.8	0.841	0.255	0.9565	
180 minute winter	4	1.003	5	8.8	0.750	0.208	1.0109	
180 minute winter	3	1.002	4	-6.9	0.717	-0.163	0.8576	
180 minute winter	2	1.001	3	6.8	0.784	0.161	1.5169	
15 minute winter	1	1.000	2	14.8	0.904	1.026	0.6245	
15 minute winter	15	4.000	16	22.6	1.284	1.563	0.3117	
180 minute winter	11	2.005	12	8.1	0.801	0.191	0.4223	
180 minute winter	10	2.004	11	8.1	0.775	0.191	0.2271	

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 93.89%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	6	10	80.921	0.121	14.5	0.0915	0.0000	OK
180 minute winter	7	120	80.770	0.153	6.9	0.1286	0.0000	OK
180 minute winter	8	120	80.768	0.438	6.9	0.0696	0.0000	SURCHARGED
180 minute winter	9	120	80.767	0.508	7.4	0.1158	0.0000	SURCHARGED
180 minute winter	27	120	79.797	0.494	11.0	0.4171	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	6	2.000	7	14.1	0.867	0.975	0.4453	
180 minute winter	7	2.001	8	6.9	0.759	0.163	1.4725	
180 minute winter	8	2.002	9	6.9	0.718	0.163	0.4257	
180 minute winter	9	2.003	10	7.4	0.704	0.175	0.3873	
180 minute winter	27	5.000	21	11.0	0.910	0.260	0.1359	

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Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 93.89%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	20	40	80.024	0.960	123.8	0.0000	0.0000	SURCHARGED
60 minute winter	19	41	80.878	1.496	123.7	2.6438	0.0000	SURCHARGED
60 minute winter	21	40	80.003	1.474	46.9	0.2668	0.0000	SURCHARGED
60 minute winter	24	40	80.001	1.553	174.4	4.1618	0.0000	SURCHARGED
60 minute winter	25	40	79.998	1.578	174.2	5.4657	0.0000	SURCHARGED
60 minute winter	26_OUT	40	78.668	0.306	173.9	0.0000	0.0000	OK
15 minute winter	23	10	80.037	0.180	38.9	0.1223	0.0000	OK
60 minute winter	18	41	81.264	1.863	195.2	186.2050	0.0000	SURCHARGED
60 minute winter	26	40	78.813	0.400	174.1	0.0000	0.0000	SURCHARGED
60 minute winter	22	40	80.003	1.530	157.2	4.1348	0.0000	SURCHARGED
60 minute winter	17	41	81.312	1.674	86.9	0.0000	0.0000	FLOOD RISK
60 minute winter	16	41	81.338	1.679	88.1	1.8990	0.0000	FLOOD RISK
60 minute winter	14	41	81.396	0.550	16.8	0.5097	0.0000	FLOOD RISK
60 minute winter	13	41	81.413	0.463	8.3	0.4013	0.0000	FLOOD RISK
60 minute winter	12	41	81.374	1.628	56.1	2.0119	0.0000	FLOOD RISK
60 minute winter	5	42	81.424	1.443	33.0	0.7316	0.0000	FLOOD RISK
60 minute winter	4	42	81.453	1.303	27.6	0.3648	0.0000	FLOOD RISK
60 minute winter	3	42	81.468	1.174	22.7	0.1866	0.0000	FLOOD RISK
60 minute winter	2	42	81.491	0.945	22.7	0.5567	0.0000	FLOOD RISK
15 minute winter	1	11	81.700	0.900	22.9	0.8497	0.0000	FLOOD RISK
15 minute summer	15	12	81.550	0.600	31.8	1.3285	0.0000	FLOOD RISK
60 minute winter	11	42	81.387	1.231	28.3	0.1958	0.0000	FLOOD RISK
60 minute winter	10	42	81.396	1.202	25.8	0.3065	0.0000	FLOOD RISK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute winter	20	1.010	22	123.9	0.782	0.778	1.4184	
60 minute winter	19	1.009	20	-7.7	0.627	-0.434	0.0317	
60 minute winter	19	Weir	20	122.0				112.9
60 minute winter	21	5.001	22	46.8	0.422	0.052	17.4820	
60 minute winter	24	1.012	25	174.2	0.453	0.198	8.9806	
60 minute winter	25	Hydro-Brake®	26	3.5				
60 minute winter	25	Weir	26	170.6				175.8
15 minute winter	23	6.000	24	38.6	1.183	0.911	0.2227	
60 minute winter	18	1.008	19	123.7	3.110	3.783	0.1758	
60 minute winter	26	1.014	26_OUT	173.9	1.616	1.380	1.3216	230.5
60 minute winter	22	1.011	24	157.0	0.329	0.177	7.8949	
60 minute winter	17	1.007	18	85.8	1.219	1.227	1.0925	
60 minute winter	16	1.006	17	86.9	1.235	1.243	0.3678	
60 minute winter	14	3.001	16	16.7	0.968	1.156	0.2114	
60 minute winter	13	3.000	14	8.2	0.553	0.568	0.2754	
60 minute winter	12	1.005	16	52.6	1.323	1.609	0.1161	
60 minute winter	5	1.004	12	31.9	0.979	0.753	0.9565	
60 minute winter	4	1.003	5	24.6	0.945	0.582	1.0109	
60 minute winter	3	1.002	4	21.2	0.924	0.501	0.8576	
60 minute winter	2	1.001	3	22.7	1.052	0.535	1.5171	
15 minute winter	1	1.000	2	17.9	1.019	1.241	0.6697	
15 minute summer	15	4.000	16	30.6	1.739	2.118	0.3169	
60 minute winter	11	2.005	12	-28.3	1.025	-0.669	0.4223	
60 minute winter	10	2.004	11	24.6	0.944	0.581	0.2271	

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Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 93.89%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	6	42	81.478	0.678	17.9	0.5124	0.0000	FLOOD RISK
60 minute winter	7	42	81.443	0.826	23.0	0.6957	0.0000	FLOOD RISK
60 minute winter	8	42	81.416	1.086	23.1	0.1726	0.0000	FLOOD RISK
60 minute winter	9	42	81.406	1.147	24.0	0.2616	0.0000	FLOOD RISK
60 minute winter	27	40	80.010	0.707	37.0	0.5978	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute winter	6	2.000	7	11.0	0.811	0.761	0.4837	
60 minute winter	7	2.001	8	23.1	0.997	0.545	1.7107	
60 minute winter	8	2.002	9	22.4	0.888	0.530	0.4257	
60 minute winter	9	2.003	10	23.5	0.871	0.555	0.3873	
60 minute winter	27	5.000	21	36.8	1.212	0.870	0.1359	

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Appendix F:-
Foul Water Design Calculations

Design Settings

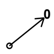
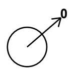
Frequency of use (kDU)	0.70	Minimum Velocity (m/s)	1.00
Flow per dwelling per day (l/day)	4000	Connection Type	Level Soffits
Domestic Flow (l/s/ha)	0.6	Minimum Backdrop Height (m)	0.200
Industrial Flow (l/s/ha)	0.7	Preferred Cover Depth (m)	1.200
Additional Flow (%)	0	Include Intermediate Ground	✓

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.008	17.677	49.9	150	Circular	81.580	79.574	1.856	81.300	79.220	1.930
4.000	4.309	60.0	150	Circular	81.750	79.646	1.954	81.580	79.574	1.856
1.007	8.292	100.0	150	Circular	81.675	79.657	1.868	81.580	79.574	1.856
1.006	7.970	100.0	150	Circular	81.869	79.737	1.982	81.675	79.657	1.868
3.001	28.198	60.0	150	Circular	81.900	80.127	1.623	81.675	79.657	1.868
3.000	5.534	60.0	150	Circular	82.000	80.219	1.631	81.900	80.127	1.623
1.005	19.073	99.9	150	Circular	81.650	79.928	1.572	81.869	79.737	1.982
1.004	30.657	99.9	150	Circular	81.650	80.235	1.265	81.650	79.928	1.572
2.001	7.676	99.7	150	Circular	81.650	80.005	1.495	81.650	79.928	1.572
2.000	21.927	100.1	150	Circular	81.700	80.224	1.326	81.650	80.005	1.495
1.003	11.955	99.6	150	Circular	81.700	80.355	1.195	81.650	80.235	1.265
1.002	9.777	99.8	150	Circular	81.700	80.453	1.097	81.700	80.355	1.195
1.001	43.014	113.2	150	Circular	81.700	80.833	0.717	81.700	80.453	1.097
1.000	22.270	99.9	150	Circular	81.700	81.106	0.444	81.700	80.883	0.667

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.008	14	1200	Manhole	Adoptable	14_OUT	1200	Manhole	Adoptable
4.000	13		Junction		14	1200	Manhole	Adoptable
1.007	12	1200	Manhole	Adoptable	14	1200	Manhole	Adoptable
1.006	9	1200	Manhole	Adoptable	12	1200	Manhole	Adoptable
3.001	11	1200	Manhole	Adoptable	12	1200	Manhole	Adoptable
3.000	10		Junction		11	1200	Manhole	Adoptable
1.005	8	1200	Manhole	Adoptable	9	1200	Manhole	Adoptable
1.004	5	450	Manhole	Adoptable	8	1200	Manhole	Adoptable
2.001	7	450	Manhole	Adoptable	8	1200	Manhole	Adoptable
2.000	6	450	Manhole	Adoptable	7	450	Manhole	Adoptable
1.003	4	450	Manhole	Adoptable	5	450	Manhole	Adoptable
1.002	3	450	Manhole	Adoptable	4	450	Manhole	Adoptable
1.001	2	450	Manhole	Adoptable	3	450	Manhole	Adoptable
1.000	1	450	Manhole	Adoptable	2	450	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
13	456481.683	222420.142	81.750	2.104			0	4.000	79.646	150
6	456493.667	222428.650	81.700	1.476	450		0	2.000	80.224	150

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
7	456510.264	222442.980	81.650	1.645	450	1	2.000	80.005	150
						0	2.001	80.005	150
1	456542.794	222471.249	81.700	0.594	450	0	1.000	81.106	150
2	456525.970	222456.657	81.700	0.867	450	1	1.000	80.883	150
						0	1.001	80.833	150
3	456497.817	222489.178	81.700	1.247	450	1	1.001	80.453	150
						0	1.002	80.453	150
4	456490.431	222482.772	81.700	1.345	450	1	1.002	80.355	150
						0	1.003	80.355	150
5	456485.229	222472.008	81.650	1.415	450	1	1.003	80.235	150
						0	1.004	80.235	150
8	456505.242	222448.785	81.650	1.722	1200	1	2.001	79.928	150
						2	1.004	79.928	150
						0	1.005	79.928	150
9	456490.819	222436.305	81.869	2.132	1200	1	1.005	79.737	150
						0	1.006	79.737	150
10	456462.665	222456.596	82.000	1.781		0	3.000	80.219	150
11	456466.294	222452.418	81.900	1.773	1200	1	3.000	80.127	150
						0	3.001	80.127	150
12	456484.769	222431.116	81.675	2.018	1200	1	3.001	79.657	150
						2	1.006	79.657	150
						0	1.007	79.657	150
14	456485.051	222422.829	81.580	2.006	1200	1	4.000	79.574	150
						2	1.007	79.574	150
						0	1.008	79.574	150
14_OUT	456496.691	222409.525	81.300	2.080	1200	1	1.008	79.220	150

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