



**Balmoral Avenue, Banbury (Phase 2)  
Condition 10 Response  
Our Ref: 27526-FLD-0101  
September 2023**

Mewies Engineering Consultants Ltd (M-EC) has been commissioned by Orbit Homes (hereafter referred to as 'the Client'), to undertake flood risk and drainage work to support the discharge of Condition 10 associated with a proposed residential development at the above site (hereafter referred to as 'the Site').

This covering response provides a response to points A to I of the planning condition.

**a. Discharge Rates;**

The discharge rate from the proposed attenuation basin has been set at 5l/s which is consistent with the BWB Sustainable Drainage Statement included as part of the outline planning application. Reference should be made to the following attached information:

- Drawings 27526\_02\_040\_02, 27526\_02\_020\_06 and 27056\_02\_070\_03a
- Sewer calculations (27526\_CALC\_0201)

**b. Discharge Volumes;**

The total impermeable area with 10% urban creep is 9820m<sup>2</sup>. Reference should be made to the following attached information:

- Drawing 27526\_02\_070\_01
- Sewer calculations (27526\_CALC\_0201)

**c. SUDS (Permeable Paving, Soakaway Tanks);**

The only SUDS feature is the attenuation pond to the south which is consistent with the information submitted as part of the outline planning application. The submitted BWB Sustainable Drainage Statement for this scheme includes options for a second stage treatment as per the below paragraph:

*"The basin will provide one level of treatment to surface water prior to discharge. A second level of surface water treatment should be provided to trafficked areas, for example by a forebay within the detention basin, permeable paving or silt traps".*

On that basis we have included a forebay within the basin as per the attached designs

**d. Maintenance and management of SUDS features (to include provision of a SUDS Management and Maintenance Plan);**

A SuDS Management strategy can be found attached ([report 27056-CIVL-0202](#)).

**e. Infiltration in accordance with BRE365;**

Infiltration rates obtained as part of the BWB Phase 1 and 2 Geo-Environmental Assessment confirms variable soakage rates across the site. This report was submitted as part of the planning application and the drainage strategy which includes an off site attenuation basin with a positive outfall was approved.

**f. Detailed drainage layout with pipe numbers;**

Refer to drawing 27526\_02\_020\_06 attached.

**g. Network drainage calculations;**

Refer to sewer calculations (27526\_CALC\_020)

**h. Phasing;**

This is not applicable.

**i. Flood Flow Routing in exceedance conditions (To include provision of a flood exceedance route plan).**

Refer to drawing 27526\_02\_020\_06 attached.



## REGISTRATION OF AMENDMENTS

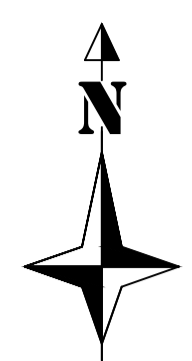
Date	Rev	Comment	Prepared By
September 2023	-	First issue	<b>Alexander Bennett</b> BSc(Hons) MCIHT MTPS Managing Director

## Appendices

- A. Drawings:
  - 27526\_02\_040\_02
  - 27526\_02\_020\_06
  - 27056\_02\_070\_03a
  - 27526\_02\_070\_01
- B. Sewer calculations (27526\_CALC\_0201)
- C. SuDS Management Strategy (27056-CIVL-0202)

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KEY	
	TRAPPED YARD GULLY (USE OF EXTRA CHANNEL DRAINAGE SYSTEM AT DISCRETION OF CLIENT)
	ACO GULLY DRAIN (USE OF EXTRA CHANNEL DRAINAGE SYSTEM AT DISCRETION OF CLIENT)
	ADOPTABLE FOUL SEWER (SECTION 104 WATER INDUSTRY ACT)
	ADOPTABLE SURFACE WATER SEWER (SECTION 104 WATER INDUSTRY ACT)
	SURFACE WATER DRAIN (INVERT LEVEL SHOWN)
	SEALED RODDING EYE WITH INVERT LEVEL
	450mm DIA. PRIVATE SURFACE WATER MANHOLE (UP TO 3.0m DEEP)
	FOUL WATER DRAIN (INVERT LEVEL SHOWN)
	450mm DIA. FOUL UNIVERSAL INSPECTION CHAMBER (UP TO 3.0m DEEP)
	300mm DIA. SHALLOW FOUL INSPECTION CHAMBER.

- NOTES**
1. THE CONTRACTOR SHALL CHECK ALL TIE-INS FOR LINE AND LEVEL WITH EXISTING BEFORE COMMENCING ANY WORKS. THE ENGINEER SHALL BE NOTIFIED IMMEDIATELY, IN WRITING, SHOULD ANY ERRORS BE FOUND.
  2. ANY DISCREPANCIES, OF WHATEVER NATURE, MUST BE REPORTED TO THE ENGINEER PRIOR TO THE COMMENCEMENT OR CONTINUANCE OF ANY FURTHER WORKS.
  3. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO EXECUTE THE WORKS AT ALL TIMES IN STRICT ACCORDANCE WITH THE REQUIREMENTS OF THE HEALTH AND SAFETY AT WORK ACT 1974, AND CDM REGULATIONS 2015. THE CONTRACTOR WILL BE DEEMED TO HAVE ALLOWED FOR FULL COMPLIANCE, INCLUDING FULL LIAISON WITHIN THEIR RATES.
  4. ALL PRIVATE DRAINAGE WORKS TO BE IN ACCORDANCE WITH THE REQUIREMENTS OF BUILDING REGULATIONS 2000, PART H, "DRAINAGE AND WASTE DISPOSAL". PIPES WITH LESS THAN 600MM COVER TO BE PROTECTED IN ACCORDANCE WITH PART H, DIAGRAM 11.
  5. ALL PIPES TO BE 100 OR 110MM DIA. AND LAID AT 1 IN 80 UNLESS STATED OTHERWISE.
  6. ALL PIPES, CHAMBERS AND FITTINGS TO BE INSTALLED, BEDDED AND BACKFILLED IN ACCORDANCE WITH THE MANUFACTURERS INSTRUCTIONS.
  7. PIPES WHICH RUN ADJACENT TO BUILDINGS SHALL BE INSTALLED IN STRICT ACCORDANCE WITH PART H, CLAUSES 2.23 TO 2.25.
  8. ALL MANHOLES AND INSPECTION CHAMBERS SITUATED IN AREAS SUBJECT TO VEHICULAR LOADING TO HAVE CLASS B125 COVERS AND FRAMES TO BS EN124 AND THOSE NOT SUBJECT TO VEHICULAR LOADING TO HAVE CLASS A15 COVERS AND FRAMES.
  9. ALL DRAINS IN THE VICINITY OF EXISTING OR PROPOSED TREES TO BE CONSTRUCTED IN ACCORDANCE WITH THE REQUIREMENTS OF NHBC PRACTICE NOTE 3.
  10. PRIVATE DRAINAGE FRAMES MUST BE TIED TO MANHOLE RISERS BY USE OF MANUFACTURERS TIES (EG. POLYPIPE REF FRK500 FIXING KIT AND FRK501 BLACK TIES). THE GROUND WORKS CONTRACTOR WILL BE HELD FULLY RESPONSIBLE FOR ANY ACCIDENTS DUE TO INCORRECT FITTING OR FAILURE TO USE THE CORRECT MANUFACTURERS FIXING EQUIPMENT.
  11. ALL EXISTING LAND DRAINS ENCOUNTERED ON SITE DURING CONSTRUCTION TO BE RE-CONNECTED.
  12. SHOULD ANY DEPARTURE FROM THE SLAB LEVEL BE CONSIDERED, AGREEMENT SHALL BE SOUGHT FROM THE ENGINEER IMMEDIATELY AND PRIOR TO COMMENCEMENT OR CONTINUANCE OF ANY WORKS, AND SHOULD TAKE FULL ACCOUNT OF ALL RESTRICTIONS TO THE SLAB LEVEL.
  13. ALL DIMENSIONS IN METRES UNLESS STATED OTHERWISE.

CONNECTIONS TO PLOTS 1, 2 & 27 SHOWN INDICATIVELY. AWAITING HOUSETYPES FROM ARCHITECT.

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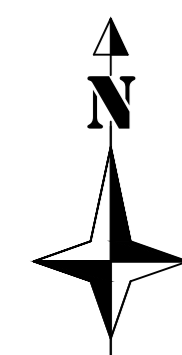
REV:	FIRST ISSUE	JW	NB	EM	07.08.23
AMENDMENTS:		DRN	CHK	APP	DATE:
PROJECT:	BALMORAL AVENUE BANBURY (PHASE 2)				
DRAWING TITLE:	PRIVATE DRAINAGE				
CLIENT:	ORBIT HOMES (2020) LIMITED				
DRAWING NUMBER:	27526_02_040_01				
REVISION:		SHEET SIZE:	A1		
		SCALE:	1:250		
STATUS:	FOR INFORMATION / APPROVAL				

**M-EC**  
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File Location: T:\M-EC Job Books\27526\dwg\p02 series - infrastructure\27526\_02\_040\_02 private drainage.dwg  
Printed on 08/08/2023



**KEY**

- SITE BOUNDARY
- ADAPTABLE SURFACE WATER SEWER (SECTION 104 WATER INDUSTRY ACT) (COVER AND INVERT LEVELS SHOWN)
- ADAPTABLE FOUL SEWER (SECTION 104 WATER INDUSTRY ACT) (COVER AND INVERT LEVELS SHOWN)
- PRIVATE LATERAL CONNECTION TO ADAPTABLE SEWER (CONNECT SOFFIT TO SOFFIT UNLESS NOTED OTHERWISE)
- 450mm DIA X 900mm DEEP TRAPPED ROAD GULLY GRATING AND 150mm GULLY CONNECTION (SEE DRG NO. 27526\_02\_000\_01)
- PHASE 1 SURFACE WATER SEWER (COVER AND INVERT LEVELS SHOWN)
- PHASE 1 FOUL SEWER (COVER AND INVERT LEVELS SHOWN)

**OVERLAND FLOW ROUTE NOTES:**

- FLOW ROUTES ARE REQUIRED TO FACILITATE THE POTENTIAL ROUTE OF SURFACE WATER FLOW FLOWS FOR ALL EVENTS EXCEEDING THE STORM SEWER DESIGN CRITERIA.
- FLOW ROUTES ILLUSTRATED ON THE DRAWINGS SHALL BE KEPT CLEAR OF PERMANENT PHYSICAL OBSTRUCTIONS WHICH MAY IMPED THE FLOW OF SURFACE WATER (E. WALLS, RETAINING WALLS) FAILURE TO DO THIS WILL INCREASE THE RISK OF FLOODING TO PROPERTIES.
- HOUSE SLAB LEVELS, EXTERNAL WORKS, DRIVE AND GARDEN GRADIENTS SHALL BE DESIGNED IN SUCH A WAY AS TO MINIMIZE THE RISK OF FLOODING TO PROPERTIES IMMEDIATELY ADJACENT TO FLOW ROUTES.
- SURFACE WATER REGULATION & ATTENUATION FACILITIES SHALL BE CONSTRUCTED TO THEIR ENTIRETY PRIOR TO THE CONNECTION OF ANY IMPERMEABLE AREAS FROM THE SURFACE WATER SYSTEM. THIS WILL LIMIT FLOOD RISK TO DOWN STREAM PROPERTIES DURING CONSTRUCTION.

- NOTES:**
- DO NOT SCALE THIS DRAWING.
  - THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEERS, ARCHITECTS AND SPECIALIST DESIGN DRAWINGS AND DETAILS.
  - ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE. ALL LEVELS ARE IN METRES UNLESS NOTED OTHERWISE.
  - ANY DISCREPANCIES NOTED ON SITE ARE TO BE REPORTED TO THE ENGINEER IMMEDIATELY.
  - SEWERS SHALL BE CONSTRUCTED TO THE SATISFACTION OF THAMES AND IN ACCORDANCE WITH DESIGN AND CONSTRUCTION GUIDANCE FOR FOUL AND SURFACE WATER SEWERS OFFERED FOR ADOPTION UNDER THE CODE FOR ADOPTION AGREEMENTS FOR WATER AND SEWERAGE COMPANIES OPERATING WHOLLY OR MAINLY IN ENGLAND ("THE CODE") APPROVED VERSION 2.2 JUNE 2022.
  - THE CONTRACTOR SHALL CHECK ALL THE-INS FOR LINE AND LEVEL WITH EXISTING BEFORE COMMENCING ANY WORKS. THE ENGINEER SHALL BE NOTIFIED IMMEDIATELY IN WRITING, SHOULD ANY ERRORS BE FOUND.
  - IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO LOCATE ANY SERVICE APPARATUS IN THE VICINITY OF THE WORKS. THE CLIENT WILL ACCEPT NO CLAIMS WHATSOEVER IN RESPECT OF ANY LOSSES OR DAMAGE CAUSED IN RESPECT OF SUCH APPARATUS, HOWEVER CAUSED.
  - IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO EXECUTE THE WORKS AT ALL TIMES IN STRICT ACCORDANCE WITH THE REQUIREMENTS OF THE HEALTH AND SAFETY AT WORK ACT 1974, AND THE C.D.M. REGULATIONS 2015. THE CONTRACTOR WILL BE DEEMED TO HAVE ALLOWED FOR FULL COMPLIANCE WITH THESE REGULATIONS.
  - THE CONTRACTOR IS RESPONSIBLE FOR ENSURING THAT ALL WORKS ARE TO THE SATISFACTION OF THE ENGINEER AND SHALL BE DEEMED TO HAVE INCLUDED WITHIN THEIR RATES FOR ANY NECESSARY TESTING.
  - THE CONTRACTOR WILL BE RESPONSIBLE FOR PROVIDING ALL NECESSARY DE-WATERING AND TRENCH SUPPORT TO EXECUTE THE WORKS IN A SATISFACTORY MANNER, AND SHALL BE DEEMED TO HAVE ALLOWED FOR THE SAME WITHIN THEIR RATES.
  - ALL BURIED CONCRETE PRODUCTS AND MORTAR SHALL BE MADE USING SULPHATE RESISTING CEMENT.
  - ALL PRECAST CONCRETE PRODUCTS FOR USE IN THE CONTRACT MUST BE BS ITEMARKED.
  - ALL LIFTING EYES IN PRECAST CONCRETE PRODUCTS SHALL BE POINTED SMOOTH AFTER FIXING.
  - FOR HIGHWAY & DRAINAGE LONGITUDINAL SECTIONS REFER TO DRG NOS. 27526\_02\_110\_01.1-01.2
  - FINISHED FLOOR LEVELS AND DRAINAGE LATERALS SUBJECT TO CHANGE UPON COMPLETION OF EXTERNAL WORKS & PRIVATE DRAINAGE DESIGN.
  - THE FIRST MANHOLE UPSTREAM FROM CONNECTION TO THE EXISTING PUBLIC SEWER SHALL, WHEN CONSTRUCTED BE FITTED WITH A SCREEN IN ORDER TO PREVENT DEBRIS ENTERING THE PUBLIC SEWER. THE SCREEN SHALL NOT BE REMOVED UNTIL IMMEDIATELY PRIOR TO THE OCCUPATION OF PREMISES TO BE SERVED BY THE SEWER.
  - EASEMENTS AT ANY CHANGE IN WIDTH WILL BE 2.5m EITHER SIDE OF THE PIPE FOR PIPE SIZES UP TO 300mm, AND 5m EITHER SIDE OF THE PIPE FOR PIPES GREATER THAN 300mm.
  - PROTECTIVE COVER SLABS REQUIRED WHERE DEPTH OF COVER TO SEWERS IS LESS THAN: 0.9m (NON-TRAFFICKED AREAS) 1.2m (TRAFFICKED AREAS)
  - ALL MANHOLE COVERS TO BE 675 x 675mm COVER AND FRAME TO MAINTAIN CLEAR 600 x 600mm CLEAR OPENING, UNLESS OTHERWISE STATED IN ACCORDANCE WITH BS EN 124 CLASS D400 AND EMBOSSED FW OR SW AS APPROPRIATE.
  - PRECAST CONCRETE RINGS SHALL NOT BE CUT UNDER ANY CIRCUMSTANCES. MANHOLES TO BE BUILT UP WITH CONCRETE OR BRICK WORK TO THE REQUIRED LEVEL.
  - PIPES OF DIFFERENT DIAMETERS ENTERING MANHOLES SHOULD BE INSTALLED WITH SOFFITS AT THE SAME LEVEL UNLESS STATED OTHERWISE.

ALL HIGHWAY WORKS TO BE CARRIED OUT IN ACCORDANCE WITH NATIONAL HIGHWAYS MOH/SHW SPECIFICATION

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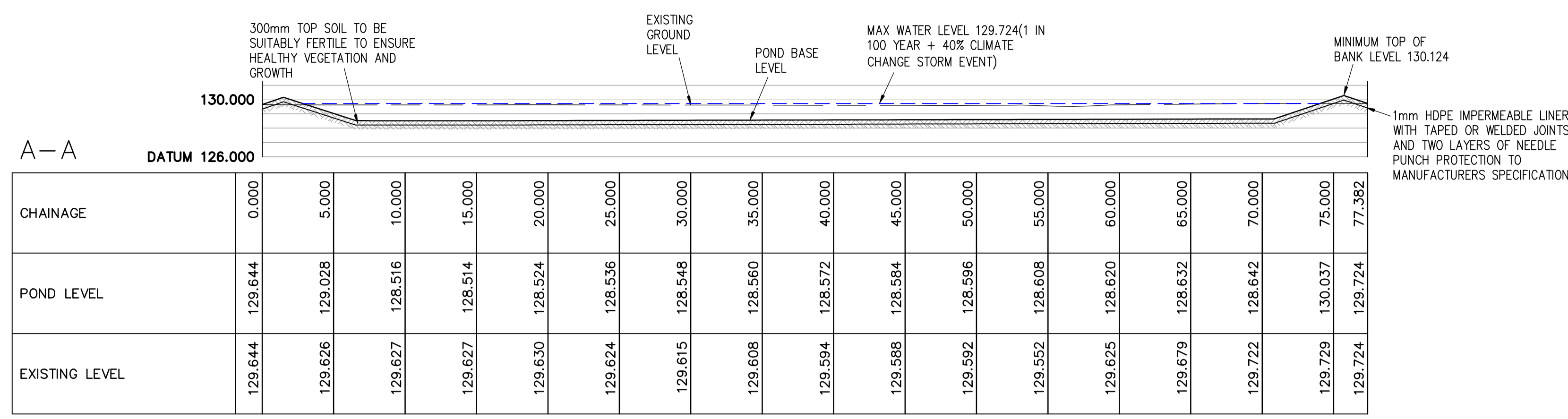
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1	FIRST ISSUE					
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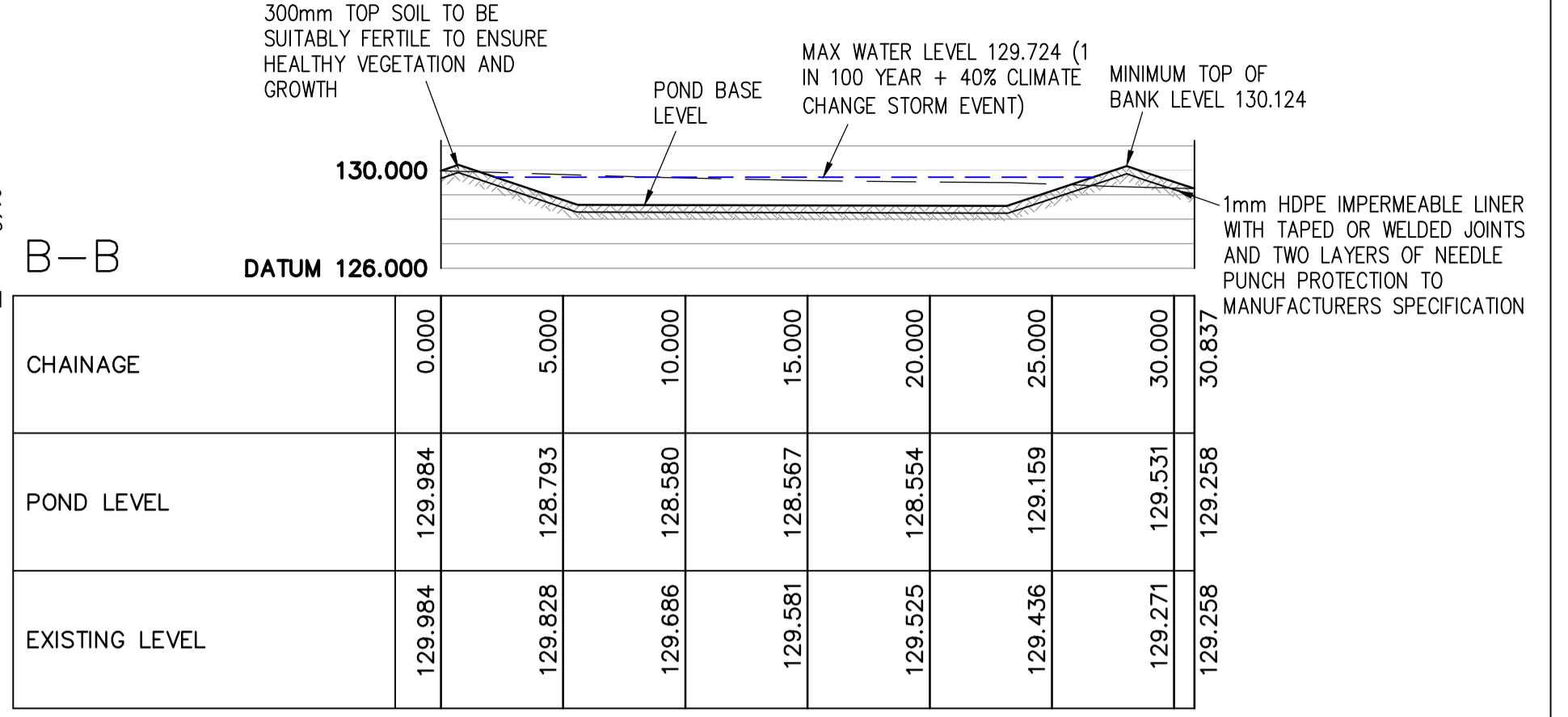
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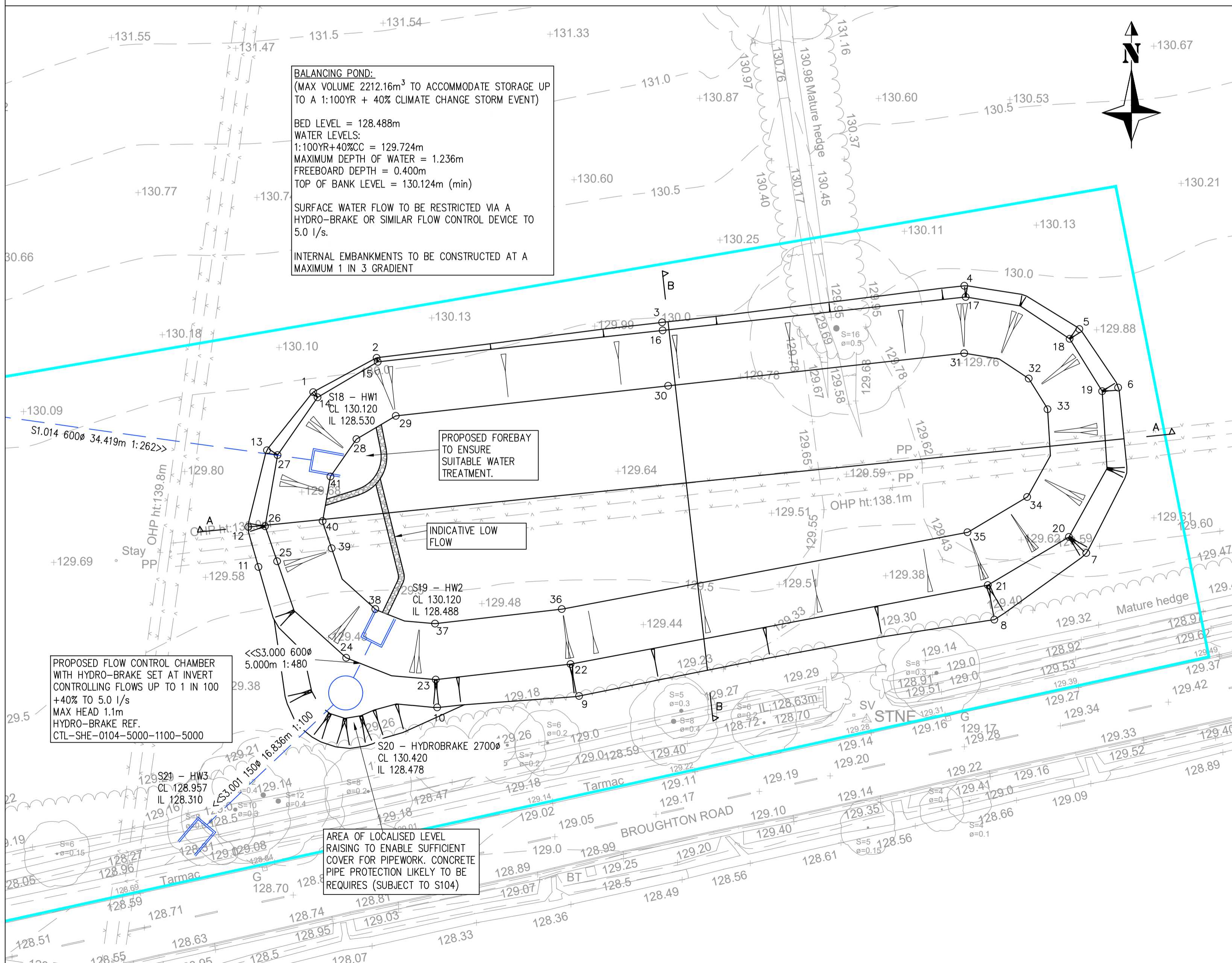


SECTION VIEW  
SCALE H1:100 V1:100



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SCALE H1:100 V1:100

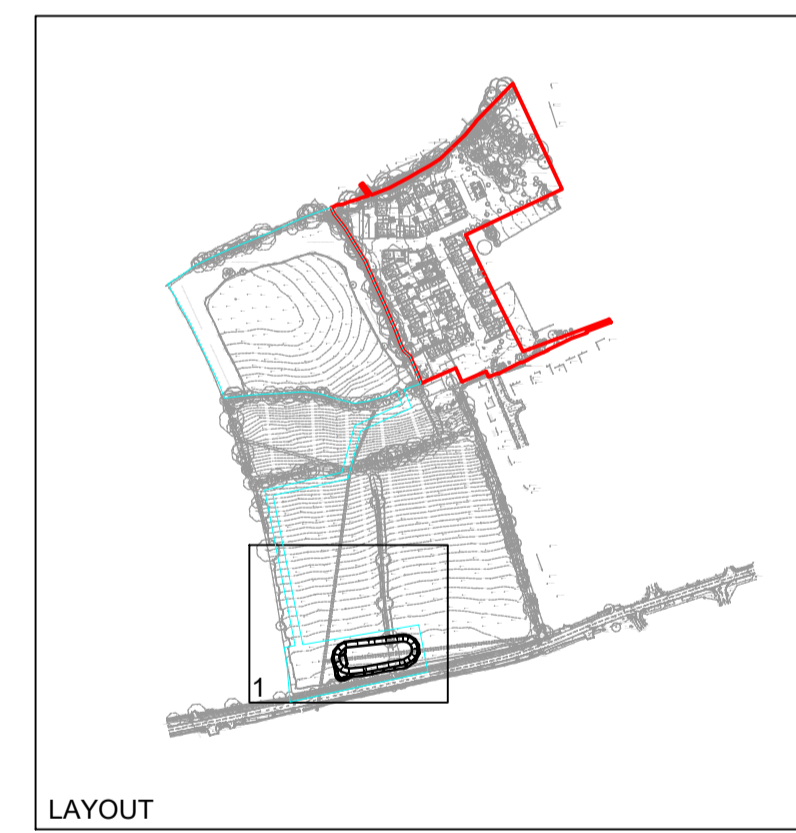
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**KEY**

- S2 1200# CL 150.00 IL 150.80: ADOPTABLE SURFACE WATER SEWER (SECTION 104 WATER INDUSTRY ACT) (COVER AND INVERT LEVELS SHOWN)
- [Symbol]: ADOPTABLE SURFACE WATER HEADWALL
- [Red Line]: PHASE 1 SITE BOUNDARY
- [Cyan Line]: PHASE 2 SITE BOUNDARY
- [Symbol]: PROPOSED BALANCING POND

	EASTINGS	NORTHINGS	LEVELS
1	443728.927	239680.953	129.960
2	443734.505	239683.975	130.037
3	443759.610	239687.093	129.982
4	443786.183	239690.312	129.957
5	443796.291	239686.502	129.873
6	443799.703	239681.362	129.794
7	443796.894	239666.815	129.567
8	443788.816	239660.962	129.211
9	443752.302	239654.249	129.185
10	443739.831	239653.245	129.301
11	443724.114	239665.589	129.572
12	443723.225	239669.102	129.644
13	443724.861	239675.842	129.813
14	443729.311	239680.501	130.166
15	443734.605	239683.621	130.166
16	443759.648	239686.387	130.227
17	443786.294	239689.328	130.291
18	443795.433	239685.642	130.291
19	443798.300	239681.044	130.291
20	443795.372	239668.231	130.266
21	443788.243	239663.992	130.243
22	443751.556	239657.047	130.152
23	443739.702	239655.687	130.124
24	443731.827	239657.601	130.124
25	443725.758	239666.087	130.148
26	443724.700	239669.169	130.156
27	443725.796	239675.419	130.166
28	443732.729	239676.832	128.530
29	443736.187	239678.870	128.530
30	443760.139	239681.515	128.590
31	443786.162	239684.388	128.655
32	443791.838	239682.155	128.655
33	443793.491	239679.459	128.655
34	443791.699	239671.743	128.630
35	443786.458	239668.637	128.607
36	443750.777	239661.886	128.516
37	443739.635	239660.608	128.488
38	443734.389	239661.884	128.488
39	443730.543	239667.228	128.511
40	443729.571	239669.628	128.520
41	443730.444	239673.539	128.530



PROJECT: **BALMORAL AVENUE BANBURY**

DRAWING TITLE: **POND SECTIONS & SETTING OUT PLAN**

CLIENT: **ORBIT HOMES (2020) LIMITED**

DRAWING NUMBER: **27056\_02\_070\_03**

REVISION: **A** SHEET SIZE: **A1** SCALE: **AS SHOWN**

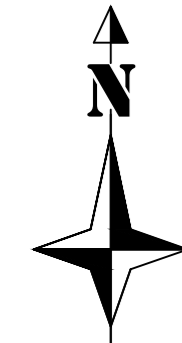
STATUS: **FOR INFORMATION / APPROVAL**

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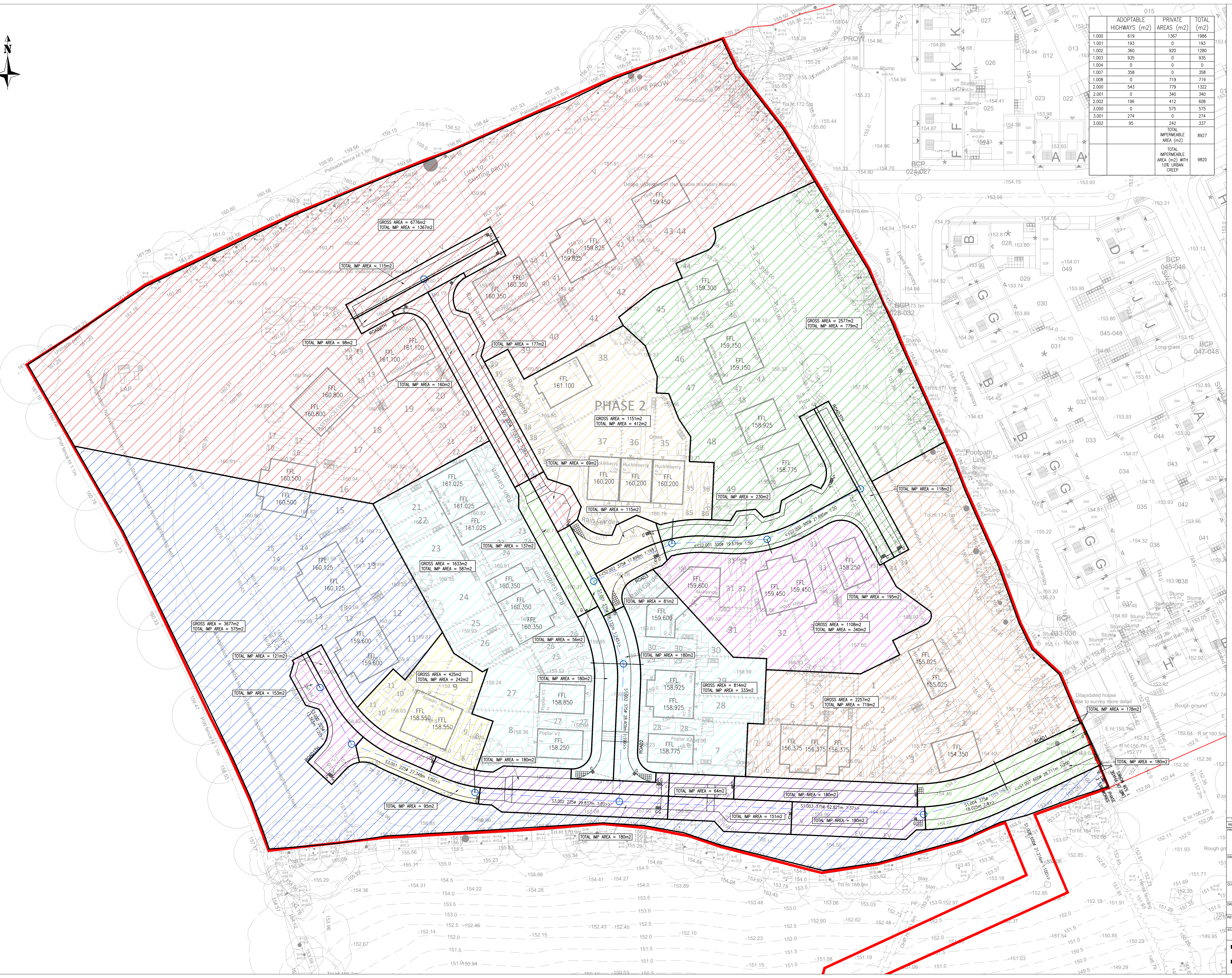
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File Location: I:\M-EC Job\27056\Drawings\27056\_02\_070\_03.psd sections & setting out.dwg



ADOPTABLE HIGHWAYS (m <sup>2</sup> )	PRIVATE AREAS (m <sup>2</sup> )	TOTAL (m <sup>2</sup> )
1.000	619	1367
1.001	193	0
1.002	360	920
1.003	935	0
1.004	0	0
1.007	358	0
1.008	0	719
2.000	543	779
2.001	0	340
2.002	196	412
3.000	0	575
3.001	274	0
3.002	95	242
		8927
	TOTAL IMPERMEABLE AREA (m <sup>2</sup> )	
	TOTAL IMPERMEABLE AREA (m <sup>2</sup> ) WITH 10% URBAN CREEP	9820

- NOTES:**
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REV	AMENDMENTS	DRAWN	CHECKED	APP	DATE
1	FIRST ISSUE				
PROJECT: <b>BALMORAL AVENUE BANBURY (PHASE 2)</b>					
DRAWING TITLE: <b>IMPERMEABLE AREAS PLAN</b>					
CLIENT: <b>ORBIT HOMES (2020) LIMITED</b>					
DRAWING NUMBER: <b>27526_02_01_01</b>					
REVISION	SHEET SIZE	SCALE			
	A1	1:250			
STATUS: <b>FOR INFORMATION / APPROVAL</b>					

**M-EC** Consulting Development Engineers

Telephone: 01203 264 703  
 Email: group@mec.co.uk  
 Website: www.mec.co.uk

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<b>Doc. Ref.</b>	27526-CALC-0201
<b>Sheet</b>	1 of 13
<b>Engineer</b>	Jack Wills
<b>Date</b>	01.08.23
<b>Revision</b>	-

## DESIGN CALCULATIONS FRONT SHEET

<b>SCHEME</b>	BALMORAL AVENUE, BANBURY (PHASE 2)
<b>CLIENT</b>	ORBIT HOMES (2020) LIMITED
<b>ASPECTS OF SCHEME TO BE DESIGNED</b>	<ol style="list-style-type: none"> <li>1. Surface Water Sewer design</li> <li>2. 1 in 2, 1 in 30 year + 35% climate change and 1 in 100 year + 40% climate change design simulations</li> <li>3. Foul Water Sewer design</li> </ol>
<b>CODES OF PRACTICE, DESIGN SPECIFICATIONS &amp; BRITISH STANDARDS</b>	<ol style="list-style-type: none"> <li>1. Wallingford Procedure.</li> <li>2. Code for Adoption Agreements, OFWAT V5.0 October 2022.</li> <li>3. Sewerage Sector Guidance Appendix C, V2.2, June 2022</li> </ol>
<b>NOTES</b>	<p>Calculations carried out using Causeway Flow design software.          Refer to design drawing 27526_02_020_06 for sewer layout details.</p> <p>Max surface water discharge set to 5 l/s for 1 in 100 year + 40% climate change storm event.</p>

## INDEX

<b>Pages</b>	<b>Calculations</b>	<b>Checked by</b>	<b>Date</b>
2-8	Surface water Sewer design details and 1 in 2, 1 in 30 year + 35% climate change and 1 in 100 year + 40% climate change design simulation results	NB	01.08.2023
9-13	Foul Water Sewer design details	NB	01.08.2023

**Design Settings**

Rainfall Methodology	FEH-13	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	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	✓
Maximum Rainfall (mm/hr)	50.0		

**Nodes**

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.199	5.00	160.452	1200	443660.677	240016.510	1.500
7	0.132	5.00	158.387	1200	443750.727	239973.214	1.500
8	0.037	5.00	159.272	1200	443731.471	239962.792	3.480
9	0.058	5.00	159.820	1350	443711.811	239961.938	4.497
2	0.000	5.00	159.884	1350	443695.697	239954.149	4.667
3	0.086	5.00	159.008	1350	443701.823	239937.083	3.865
10	0.058	5.00	159.291	1200	443639.231	239932.184	1.425
11	0.023	5.00	158.614	1200	443645.733	239920.509	1.425
12	0.079	5.00	158.263	1200	443671.202	239910.547	1.621
4	0.065	5.00	157.857	1350	443700.981	239908.686	2.857
5	0.000	5.00	154.886	1350	443763.745	239906.002	1.575
6	0.075		153.964	1500	443781.042	239911.072	5.105

**Links**

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	2	71.521	0.600	158.952	155.292	3.660	19.5	300	5.33	50.0
2.000	7	8	21.895	0.600	156.887	155.792	1.095	20.0	300	5.10	50.0
2.001	8	9	19.679	0.600	155.792	155.398	0.394	50.0	300	5.25	50.0
2.002	9	2	17.898	0.600	155.323	155.217	0.106	169.0	375	5.47	50.0
1.001	2	3	18.132	0.600	155.217	155.143	0.074	245.0	375	5.73	50.0
1.002	3	4	28.409	0.600	155.143	155.000	0.143	198.7	375	6.10	50.0
3.000	10	11	13.363	0.600	157.866	157.189	0.677	19.7	225	5.08	50.0
3.001	11	12	27.348	0.600	157.189	156.642	0.547	50.0	225	5.32	50.0
3.002	12	4	29.837	0.600	156.642	155.150	1.492	20.0	225	5.49	50.0
1.003	4	5	62.821	0.600	155.000	153.311	1.689	37.2	375	6.45	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	3.572	252.5	27.0	1.200	4.292	0.199	0.0	66	2.360
2.000	3.531	249.6	17.9	1.200	3.180	0.132	0.0	54	2.069
2.001	2.228	157.5	22.9	3.180	4.122	0.169	0.0	77	1.606
2.002	1.391	153.6	30.8	4.122	4.292	0.227	0.0	113	1.094
1.001	1.153	127.3	57.7	4.292	3.490	0.426	0.0	177	1.125
1.002	1.282	141.5	69.4	3.490	2.482	0.512	0.0	186	1.276
3.000	2.958	117.6	7.9	1.200	1.200	0.058	0.0	39	1.695
3.001	1.854	73.7	11.0	1.200	1.396	0.081	0.0	58	1.340
3.002	2.939	116.8	21.7	1.396	2.482	0.160	0.0	65	2.262
1.003	2.979	329.0	99.9	2.482	1.200	0.737	0.0	141	2.623



### Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.004	5	6	18.025	0.600	153.311	148.859	4.452	4.0	375	6.48	50.0



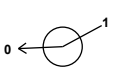
Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.004	9.055	1000.1	99.9	1.200	4.730	0.737	0.0	79	5.883

### Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	71.521	19.5	300	Circular_Default Sewer Type	160.452	158.952	1.200	159.884	155.292	4.292
2.000	21.895	20.0	300	Circular_Default Sewer Type	158.387	156.887	1.200	159.272	155.792	3.180
2.001	19.679	50.0	300	Circular_Default Sewer Type	159.272	155.792	3.180	159.820	155.398	4.122
2.002	17.898	169.0	375	Circular_Default Sewer Type	159.820	155.323	4.122	159.884	155.217	4.292
1.001	18.132	245.0	375	Circular_Default Sewer Type	159.884	155.217	4.292	159.008	155.143	3.490
1.002	28.409	198.7	375	Circular_Default Sewer Type	159.008	155.143	3.490	157.857	155.000	2.482
3.000	13.363	19.7	225	Circular_Default Sewer Type	159.291	157.866	1.200	158.614	157.189	1.200
3.001	27.348	50.0	225	Circular_Default Sewer Type	158.614	157.189	1.200	158.263	156.642	1.396
3.002	29.837	20.0	225	Circular_Default Sewer Type	158.263	156.642	1.396	157.857	155.150	2.482
1.003	62.821	37.2	375	Circular_Default Sewer Type	157.857	155.000	2.482	154.886	153.311	1.200
1.004	18.025	4.0	375	Circular_Default Sewer Type	154.886	153.311	1.200	153.964	148.859	4.730

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	1200	Manhole	Adoptable	2	1350	Manhole	Adoptable
2.000	7	1200	Manhole	Adoptable	8	1200	Manhole	Adoptable
2.001	8	1200	Manhole	Adoptable	9	1350	Manhole	Adoptable
2.002	9	1350	Manhole	Adoptable	2	1350	Manhole	Adoptable
1.001	2	1350	Manhole	Adoptable	3	1350	Manhole	Adoptable
1.002	3	1350	Manhole	Adoptable	4	1350	Manhole	Adoptable
3.000	10	1200	Manhole	Adoptable	11	1200	Manhole	Adoptable
3.001	11	1200	Manhole	Adoptable	12	1200	Manhole	Adoptable
3.002	12	1200	Manhole	Adoptable	4	1350	Manhole	Adoptable
1.003	4	1350	Manhole	Adoptable	5	1350	Manhole	Adoptable
1.004	5	1350	Manhole	Adoptable	6	1500	Manhole	Adoptable

### Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
1	443660.677	240016.510	160.452	1.500	1200		0	1.000	158.952	300
7	443750.727	239973.214	158.387	1.500	1200		0	2.000	156.887	300
8	443731.471	239962.792	159.272	3.480	1200		1	2.000	155.792	300
							0	2.001	155.792	300

**Manhole Schedule**

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
9	443711.811	239961.938	159.820	4.497	1350		1	2.001	155.398	300
							0	2.002	155.323	375
2	443695.697	239954.149	159.884	4.667	1350		1	2.002	155.217	375
							2	1.000	155.292	300
							0	1.001	155.217	375
3	443701.823	239937.083	159.008	3.865	1350		1	1.001	155.143	375
							0	1.002	155.143	375
10	443639.231	239932.184	159.291	1.425	1200		0	3.000	157.866	225
11	443645.733	239920.509	158.614	1.425	1200		1	3.000	157.189	225
							0	3.001	157.189	225
12	443671.202	239910.547	158.263	1.621	1200		1	3.001	156.642	225
							0	3.002	156.642	225
4	443700.981	239908.686	157.857	2.857	1350		1	3.002	155.150	225
							2	1.002	155.000	375
							0	1.003	155.000	375
5	443763.745	239906.002	154.886	1.575	1350		1	1.003	153.311	375
							0	1.004	153.311	375
6	443781.042	239911.072	153.964	5.105	1500		1	1.004	148.859	375

**Simulation Settings**

Rainfall Methodology	FEH-13	Skip Steady State	✓	100 year (l/s)	0.0
Summer CV	0.750	Drain Down Time (mins)	240	Check Discharge Volume	✓
Winter CV	0.840	Additional Storage (m <sup>3</sup> /ha)	0.0	100 year 360 minute (m <sup>3</sup> )	
Analysis Speed	Normal	Check Discharge Rate(s)	✓		

**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
30	35	0	0
100	40	0	0

**Pre-development Discharge Rate**

Site Makeup	Greenfield	Growth Factor 30 year	1.95
Greenfield Method	IH124	Growth Factor 100 year	2.48
Positively Drained Area (ha)		Betterment (%)	0
SAAR (mm)		QBar	
Soil Index	1	Q 1 year (l/s)	
SPR	0.10	Q 30 year (l/s)	
Region	1	Q 100 year (l/s)	
Growth Factor 1 year	0.85		

**Pre-development Discharge Volume**

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)		Storm Duration (mins)	360
Soil Index	1	Betterment (%)	0
SPR	0.10	PR	
CWI		Runoff Volume (m <sup>3</sup> )	

**Results for 2 year Critical Storm Duration. Lowest mass balance: 98.90%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
15 minute winter	1	11	159.021	0.069	29.7	0.0777	0.0000	OK
15 minute winter	7	10	156.944	0.057	19.7	0.0639	0.0000	OK
15 minute winter	8	11	155.876	0.084	25.1	0.0953	0.0000	OK
15 minute winter	9	11	155.447	0.124	33.5	0.1776	0.0000	OK
15 minute winter	2	11	155.422	0.205	62.7	0.2931	0.0000	OK
15 minute winter	3	11	155.343	0.200	74.4	0.2863	0.0000	OK
15 minute winter	10	10	157.907	0.041	8.7	0.0466	0.0000	OK
15 minute winter	11	11	157.250	0.061	12.0	0.0692	0.0000	OK
15 minute winter	12	11	156.712	0.070	23.7	0.0794	0.0000	OK
15 minute winter	4	11	155.163	0.163	106.3	0.2329	0.0000	OK
15 minute winter	5	12	153.397	0.086	103.9	0.1231	0.0000	OK
15 minute winter	6	12	148.939	0.080	113.8	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
15 minute winter	1	1.000	2	29.5	1.950	0.117	1.4786	
15 minute winter	7	2.000	8	19.6	1.566	0.079	0.2775	
15 minute winter	8	2.001	9	24.9	1.596	0.158	0.3075	
15 minute winter	9	2.002	2	33.3	0.716	0.217	0.8354	
15 minute winter	2	1.001	3	61.7	1.028	0.485	1.0999	
15 minute winter	3	1.002	4	73.2	1.407	0.517	1.5001	
15 minute winter	10	3.000	11	8.6	1.281	0.074	0.0913	
15 minute winter	11	3.001	12	12.0	1.246	0.163	0.2635	
15 minute winter	12	3.002	4	23.5	2.272	0.201	0.3086	
15 minute winter	4	1.003	5	103.9	3.283	0.316	2.0330	
15 minute winter	5	1.004	6	104.3	5.750	0.104	0.3272	50.6

**Results for 30 year +35% CC Critical Storm Duration. Lowest mass balance: 98.90%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
15 minute winter	1	10	159.083	0.131	101.5	0.1478	0.0000	OK
15 minute winter	7	10	156.993	0.105	67.3	0.1193	0.0000	OK
15 minute winter	8	12	156.521	0.729	86.1	0.8242	0.0000	SURCHARGED
15 minute winter	9	12	156.407	1.084	101.6	1.5515	0.0000	SURCHARGED
15 minute winter	2	12	156.346	1.129	195.7	1.6157	0.0000	SURCHARGED
15 minute winter	3	12	156.129	0.986	217.4	1.4111	0.0000	SURCHARGED
15 minute winter	10	10	157.943	0.077	29.6	0.0865	0.0000	OK
15 minute winter	11	10	157.313	0.124	41.2	0.1398	0.0000	OK
15 minute winter	12	11	156.779	0.137	81.0	0.1550	0.0000	OK
15 minute winter	4	12	155.695	0.695	322.0	0.9946	0.0000	SURCHARGED
15 minute winter	5	12	153.470	0.159	308.8	0.2276	0.0000	OK
15 minute winter	6	12	148.999	0.140	340.7	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
15 minute winter	1	1.000	2	100.8	1.952	0.399	3.5717	
15 minute winter	7	2.000	8	67.2	2.061	0.269	1.0128	
15 minute winter	8	2.001	9	73.6	1.796	0.467	1.3858	
15 minute winter	9	2.002	2	97.2	0.882	0.633	1.9741	
15 minute winter	2	1.001	3	179.1	1.624	1.406	1.9999	
15 minute winter	3	1.002	4	215.3	1.952	1.521	3.1334	
15 minute winter	10	3.000	11	29.5	1.731	0.251	0.2287	
15 minute winter	11	3.001	12	40.8	1.716	0.553	0.6495	
15 minute winter	12	3.002	4	80.5	2.841	0.689	0.9709	
15 minute winter	4	1.003	5	308.8	3.824	0.939	4.8612	
15 minute winter	5	1.004	6	308.2	7.526	0.308	0.7386	173.3

**Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 98.90%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
15 minute winter	1	11	159.118	0.166	135.6	0.1877	0.0000	OK
15 minute winter	7	12	157.921	1.034	89.9	1.1691	0.0000	SURCHARGED
15 minute winter	8	12	157.809	2.017	105.1	2.2810	0.0000	SURCHARGED
15 minute winter	9	12	157.640	2.317	131.1	3.3150	0.0000	SURCHARGED
15 minute winter	2	12	157.548	2.331	248.2	3.3358	0.0000	SURCHARGED
15 minute winter	3	12	157.224	2.081	267.0	2.9776	0.0000	SURCHARGED
15 minute winter	10	10	157.955	0.089	39.5	0.1010	0.0000	OK
15 minute winter	11	12	157.758	0.569	55.1	0.6437	0.0000	SURCHARGED
15 minute winter	12	12	157.530	0.888	104.0	1.0038	0.0000	SURCHARGED
15 minute winter	4	12	156.577	1.576	387.5	2.2559	0.0000	SURCHARGED
15 minute winter	5	13	153.490	0.179	372.2	0.2562	0.0000	OK
15 minute winter	6	13	149.014	0.155	411.2	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
15 minute winter	1	1.000	2	131.8	2.151	0.522	3.9481	
15 minute winter	7	2.000	8	81.5	2.034	0.326	1.5418	
15 minute winter	8	2.001	9	93.9	1.786	0.596	1.3858	
15 minute winter	9	2.002	2	121.8	1.105	0.793	1.9741	
15 minute winter	2	1.001	3	219.5	1.991	1.724	1.9999	
15 minute winter	3	1.002	4	263.4	2.388	1.861	3.1334	
15 minute winter	10	3.000	11	39.4	1.818	0.335	0.3597	
15 minute winter	11	3.001	12	50.2	1.714	0.681	1.0877	
15 minute winter	12	3.002	4	94.6	2.816	0.810	1.1866	
15 minute winter	4	1.003	5	372.2	3.989	1.131	5.0946	
15 minute winter	5	1.004	6	372.7	7.851	0.373	0.8559	233.5

**Design Settings**

Frequency of use (kDU)	0.00	Minimum Velocity (m/s)	0.75
Flow per dwelling per day (l/day)	4000	Connection Type	Level Soffits
Domestic Flow (l/s/ha)	0.0	Minimum Backdrop Height (m)	0.200
Industrial Flow (l/s/ha)	0.0	Preferred Cover Depth (m)	1.200
Additional Flow (%)	0	Include Intermediate Ground	✓

**Nodes**

Name	Dwellings	Cover Level (m)	Manhole Type	Easting (m)	Northing (m)	Depth (m)
1	11	160.525	Adoptable	443659.773	240014.013	1.350
8	5	158.404	Adoptable	443748.086	239973.892	1.350
9	4	159.217	Adoptable	443732.546	239964.743	2.404
10	4	159.798	Adoptable	443713.195	239964.229	3.227
2		160.098	Adoptable	443692.012	239956.336	3.810
3	9	159.136	Adoptable	443699.388	239939.110	2.973
11	5	159.264	Adoptable	443641.417	239932.830	1.350
12		158.694	Adoptable	443647.543	239922.514	1.350
13	4	158.288	Adoptable	443669.623	239912.935	1.350
4		157.882	Adoptable	443698.582	239911.925	2.319
5		154.668	Adoptable	443768.177	239909.008	1.350
6	7	153.853	Adoptable	443783.035	239914.628	1.350
7		153.176	Adoptable	443807.824	239927.312	1.350

**Links**

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
1.000	1	2	66.076	1.500	159.175	156.288	2.887	22.9	150
2.000	8	9	18.033	1.500	157.054	156.813	0.241	74.8	150
2.001	9	10	19.358	1.500	156.813	156.571	0.242	80.0	150
2.002	10	2	22.606	1.500	156.571	156.288	0.283	79.9	150
1.001	2	3	18.739	1.500	156.288	156.163	0.125	149.9	150
1.002	3	4	27.197	1.500	156.163	155.563	0.600	45.3	150
3.000	11	12	11.998	1.500	157.914	157.344	0.570	21.0	150
3.001	12	13	24.068	1.500	157.344	156.938	0.406	59.3	150
3.002	13	4	28.977	1.500	156.938	155.563	1.375	21.1	150
1.003	4	5	69.656	1.500	155.563	153.318	2.245	31.0	150
1.004	5	6	15.885	1.500	153.318	152.503	0.815	19.5	150

Name	Pro Vel @ 1/3 Q (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Dwellings (ha)	Σ Units (ha)	Σ Add Inflow (ha)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	0.448	1.836	32.4	0.5	1.200	3.660	0.000	11	0.0	0.0	13	0.647
2.000	0.231	1.013	17.9	0.2	1.200	2.254	0.000	5	0.0	0.0	12	0.333
2.001	0.275	0.980	17.3	0.4	2.254	3.077	0.000	9	0.0	0.0	16	0.395
2.002	0.311	0.980	17.3	0.6	3.077	3.660	0.000	13	0.0	0.0	20	0.452
1.001	0.309	0.714	12.6	1.1	3.660	2.823	0.000	24	0.0	0.0	30	0.434
1.002	0.514	1.303	23.0	1.5	2.823	2.169	0.000	33	0.0	0.0	27	0.735
3.000	0.358	1.915	33.8	0.2	1.200	1.200	0.000	5	0.0	0.0	9	0.517
3.001	0.261	1.139	20.1	0.2	1.200	1.200	0.000	5	0.0	0.0	11	0.362
3.002	0.441	1.914	33.8	0.4	1.200	2.169	0.000	9	0.0	0.0	12	0.632
1.003	0.638	1.576	27.9	1.9	2.169	1.200	0.000	42	0.0	0.0	27	0.902
1.004	0.745	1.990	35.2	1.9	1.200	1.200	0.000	42	0.0	0.0	24	1.059

**Links**

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
1.005	6	7	27.846	1.500	152.503	151.826	0.677	41.1	150

Name	Pro Vel @ 1/3 Q (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Dwellings (ha)	Σ Units (ha)	Σ Add Inflow (ha)	Pro Depth (mm)	Pro Velocity (m/s)
1.005	0.607	1.368	24.2	2.3	1.200	1.200	0.000	49	0.0	0.0	31	0.854

**Pipeline Schedule**

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	66.076	22.9	150	Circular_Default Sewer Type	160.525	159.175	1.200	160.098	156.288	3.660
2.000	18.033	74.8	150	Circular_Default Sewer Type	158.404	157.054	1.200	159.217	156.813	2.254
2.001	19.358	80.0	150	Circular_Default Sewer Type	159.217	156.813	2.254	159.798	156.571	3.077
2.002	22.606	79.9	150	Circular_Default Sewer Type	159.798	156.571	3.077	160.098	156.288	3.660
1.001	18.739	149.9	150	Circular_Default Sewer Type	160.098	156.288	3.660	159.136	156.163	2.823
1.002	27.197	45.3	150	Circular_Default Sewer Type	159.136	156.163	2.823	157.882	155.563	2.169
3.000	11.998	21.0	150	Circular_Default Sewer Type	159.264	157.914	1.200	158.694	157.344	1.200
3.001	24.068	59.3	150	Circular_Default Sewer Type	158.694	157.344	1.200	158.288	156.938	1.200
3.002	28.977	21.1	150	Circular_Default Sewer Type	158.288	156.938	1.200	157.882	155.563	2.169
1.003	69.656	31.0	150	Circular_Default Sewer Type	157.882	155.563	2.169	154.668	153.318	1.200
1.004	15.885	19.5	150	Circular_Default Sewer Type	154.668	153.318	1.200	153.853	152.503	1.200
1.005	27.846	41.1	150	Circular_Default Sewer Type	153.853	152.503	1.200	153.176	151.826	1.200

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	1200	Manhole	Adoptable	2	1200	Manhole	Adoptable
2.000	8	1200	Manhole	Adoptable	9	1200	Manhole	Adoptable
2.001	9	1200	Manhole	Adoptable	10	1200	Manhole	Adoptable
2.002	10	1200	Manhole	Adoptable	2	1200	Manhole	Adoptable
1.001	2	1200	Manhole	Adoptable	3	1200	Manhole	Adoptable
1.002	3	1200	Manhole	Adoptable	4	1200	Manhole	Adoptable
3.000	11	1200	Manhole	Adoptable	12	1200	Manhole	Adoptable
3.001	12	1200	Manhole	Adoptable	13	1200	Manhole	Adoptable
3.002	13	1200	Manhole	Adoptable	4	1200	Manhole	Adoptable
1.003	4	1200	Manhole	Adoptable	5	1200	Manhole	Adoptable
1.004	5	1200	Manhole	Adoptable	6	1200	Manhole	Adoptable
1.005	6	1200	Manhole	Adoptable	7	1200	Manhole	Adoptable

**Manhole Schedule**

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
1	443659.773	240014.013	160.525	1.350	1200		1.000	159.175	150
8	443748.086	239973.892	158.404	1.350	1200		2.000	157.054	150



**Manhole Schedule**

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
9	443732.546	239964.743	159.217	2.404	1200		1	2.000	156.813	150
							0	2.001	156.813	150
10	443713.195	239964.229	159.798	3.227	1200		1	2.001	156.571	150
							0	2.002	156.571	150
2	443692.012	239956.336	160.098	3.810	1200		1	2.002	156.288	150
							2	1.000	156.288	150
							0	1.001	156.288	150
3	443699.388	239939.110	159.136	2.973	1200		1	1.001	156.163	150
							0	1.002	156.163	150
11	443641.417	239932.830	159.264	1.350	1200		0	3.000	157.914	150
12	443647.543	239922.514	158.694	1.350	1200		1	3.000	157.344	150
							0	3.001	157.344	150
13	443669.623	239912.935	158.288	1.350	1200		1	3.001	156.938	150
							0	3.002	156.938	150
4	443698.582	239911.925	157.882	2.319	1200		1	3.002	155.563	150
							2	1.002	155.563	150
							0	1.003	155.563	150
5	443768.177	239909.008	154.668	1.350	1200		1	1.003	153.318	150
							0	1.004	153.318	150
6	443783.035	239914.628	153.853	1.350	1200		1	1.004	152.503	150
							0	1.005	152.503	150
7	443807.824	239927.312	153.176	1.350	1200		1	1.005	151.826	150

**Simulation Settings**

Analysis Speed	Normal	Drain Down Time (mins)	240
Skip Steady State	✓	Foul Event Duration (mins)	15

**Storm Durations**

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

**Pre-development Discharge Rate**

Site Makeup	Greenfield	Growth Factor 30 year	1.95
Greenfield Method	IH124	Growth Factor 100 year	2.48
Positively Drained Area (ha)		Betterment (%)	0
SAAR (mm)		QBar	
Soil Index	1	Q 1 year (l/s)	
SPR	0.10	Q 30 year (l/s)	
Region	1	Q 100 year (l/s)	
Growth Factor 1 year	0.85		

**Pre-development Discharge Volume**

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)		Storm Duration (mins)	360
Soil Index	1	Betterment (%)	0
SPR	0.10	PR	
CWI		Runoff Volume (m <sup>3</sup> )	

**Results for Foul Event Critical Storm Duration. Lowest mass balance: 81.86%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
Foul Event	1	4	159.189	0.014	0.5	0.0153	0.0000	OK
Foul Event	8	14	157.065	0.011	0.2	0.0128	0.0000	OK
Foul Event	9	14	156.829	0.016	0.4	0.0180	0.0000	OK
Foul Event	10	14	156.590	0.019	0.6	0.0218	0.0000	OK
Foul Event	2	15	156.319	0.031	1.1	0.0350	0.0000	OK
Foul Event	3	15	156.189	0.026	1.5	0.0296	0.0000	OK
Foul Event	11	3	157.923	0.009	0.2	0.0104	0.0000	OK
Foul Event	12	15	157.355	0.011	0.2	0.0121	0.0000	OK
Foul Event	13	14	156.950	0.012	0.4	0.0132	0.0000	OK
Foul Event	4	15	155.590	0.027	1.9	0.0310	0.0000	OK
Foul Event	5	15	153.342	0.024	1.9	0.0269	0.0000	OK
Foul Event	6	15	152.534	0.031	2.2	0.0347	0.0000	OK
Foul Event	7	16	152.323	0.497	2.2	0.5624	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
Foul Event	1	1.000	2	0.5	0.831	0.016	0.1112	
Foul Event	8	2.000	9	0.2	0.273	0.011	0.0144	
Foul Event	9	2.001	10	0.4	0.351	0.023	0.0224	
Foul Event	10	2.002	2	0.6	0.399	0.035	0.0445	
Foul Event	2	1.001	3	1.1	0.482	0.087	0.0437	
Foul Event	3	1.002	4	1.5	0.705	0.065	0.0577	
Foul Event	11	3.000	12	0.2	0.707	0.006	0.0056	
Foul Event	12	3.001	13	0.2	0.343	0.010	0.0142	
Foul Event	13	3.002	4	0.4	0.547	0.012	0.0409	
Foul Event	4	1.003	5	1.9	0.951	0.068	0.1389	
Foul Event	5	1.004	6	1.9	0.894	0.054	0.0348	
Foul Event	6	1.005	7	2.2	0.555	0.090	0.2811	0.0



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# CIVIL ENGINEERING



**Balmoral Avenue, Banbury (Phase 2)**  
SUDS Management Strategy  
September 2023

Report Ref: 27526-CIVL-0202

# Balmoral Avenue, Banbury (Phase 2) SUDS Management Strategy September 2023

REPORT REF: 27526-CIVL-0202

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## REGISTRATION OF AMENDMENTS

Date	Rev	Comment	Prepared By	Checked By	Approved By
September 2023	-	First issue	<b>Jack Wills</b> Civil Engineering Apprentice	<b>Danny Hinds</b> Assistant Civil Engineer	<b>Paul Tobin</b> Senior Civil Engineer

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## APPENDICES

A.	DRAWINGS 27056_02_02_01.4D / 27526_02_020_06 / 27056_02_070_03A
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## 1.0 INTRODUCTION

1.1 MEC, has been commissioned by Orbit Homes Limited (hereafter referred to as ‘the Client’) to undertake a SUDS Management Strategy for a proposed Phase 2 residential development at Balmoral Avenue, Banbury (hereafter referred to as ‘the Site’).

### **Disclaimer**

1.2 M-EC has completed this report for the benefit of the individuals referred to in paragraph 1.1 and any relevant statutory authority which may require reference in relation to approvals for the proposed development. Other third parties should not use or rely upon the contents of this report unless explicit written approval has been gained from M-EC.

1.3 M-EC accepts no responsibility or liability for:

- a) The consequence of this documentation being used for any purpose or project other than that for which it was commissioned;
- b) The issue of this document to any third party with whom approval for use has not been agreed.

## 2.0 THE SUDS PROPOSAL

- 2.1 SuDS on the proposed development site are to consist of 1 no. attenuation pond. The pond attenuates the contributions of site wide surface water as discharged from the on-site Independent Water Networks (IWNL) sewer system as per drawing 27526\_02\_020\_06, before a restricted flow runs off-site into an existing ditch.
- 2.2 Storm water generated in events up to and including the 1 in 100 year + climate change will be stored within the attenuation pond shown on drawing 27056\_02\_070\_03a.
- 2.3 This proposal has associated ecologically based landscaped approaches in line with the site related ecological mitigation strategy.





## 3.0 DESIGN AND ADOPTION

- 3.1 This SuDS feature will not be adopted by the local authority and will be maintained by a management company. The SuDS design accords with the planning permission and has been designed in line with the latest CIRIA guidance as per engineering good practice, and the yet to be adopted DeFRA SuDS design standards.
- 3.2 The associated inlet/outlet headwalls are to be adopted by IWNL and the designs for these will be assessed and approved under the Water Industry Act Section 104 process.
- 3.3 The proposed attenuation pond base is designed to fall at a gradient of 1:400 towards the proposed outlet and low flow channel within the pond to ensure there are no parts of the SuDS feature which become 'dead zones' and cause a build-up of silt.

### Water Quality

- 3.4 The SuDS Manual CIRIA document C753, indicates the minimum treatment indices appropriate for contributing pollution hazards for different land use classifications. To deliver adequate treatment, the selected SuDS components should have a total pollution mitigation index (for each contaminant) that equals or exceeds the pollution hazard index (see Table 3.1).
- 3.5 Surface water runoff from residential roofs will have a very low pollution hazard level, while the residential parking areas will have a low pollution hazard level. The exact pollution hazard levels are shown in Table 3.1.

**Table 3.1: Pollution Hazard Indices (Extract from CIRIA 753 Table 26.2)**

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very Low	0.2	0.2	0.05
Individual property driveways, residential car parks, low traffic roads.	Low	0.5	0.4	0.4
Totals		0.7	0.6	0.45

- 3.6 To provide the correct level of treatment, an assessment needs to be made of the mitigation provided by each SuDS feature. This is shown in Table 3.2 below.

**Table 3.2: SuDS Mitigation Indices (Extract from CIRIA 753 Table 26.3)**

Type of SuDS component	Mitigation indices		
	Total Suspended Solids	Metals	Hydrocarbons
Attenuation Pond	0.7	0.7	0.5

- 3.7 For the very low and low pollution hazard levels generated at the site, the proposed attenuation pond will provide sufficient treatment in accordance with the Simple Index Method.



## 4.0 MAINTENANCE

4.1 A proposed maintenance plan is shown in Table 4.1 below, breaking down the maintenance responsibility of the various proposed assets, which is based on good practice and general current procedures.

**Table 4.1: Proposed Maintenance Plan**

Drainage Asset	Responsible Organisation	Maintenance Work	Frequency
Pipework /Manholes	Independent Water Networks	Inspect pipework and clear blockages	Annually or after severe storms
		Inspect manholes and clear blockages	
		Repair any defects in the network	
Headwalls / Inlet / Outlet	Independent Water Networks	Inspect structure and remove any debris/litter on structure of inlet or outlet	Monthly or after severe storms
Flow Control Chamber	Independent Water Networks	Inspect structure and remove any debris/litter on structure	Annually or after severe storms.
Attenuation Pond	Management/ Maintenance company	Grass cutting – meadow grass in and around the pond.	Half-yearly (spring – before nesting season, and autumn)
		Grass cutting – public areas	Monthly (during the growing season)
		Litter and Debris removal from the open space around the inlets and outlets	Monthly (or as required)
		Inspect vegetation to pond and remove nuisance plants (for first three years)	Monthly (at the start, then as required)
		Hand-cut submerged and emergent aquatic plants (at min of 0.1 m above pond base. Include max 25% of pond surface)	Annually
		Remove 25% of bank vegetation from water's edge to a minimum of 1 m above water level	Annually
		Tidy all dead growth before the start of the growing season	Annually
		Prune and trim trees and remove cuttings	2 years, or as required
		Repair of erosion or other damage by re-seeding or re-turfing	As required
		Remove the sediment from the main body of pond when pool volume is reduced by 20%	3 – 10 years (or as required)
		Repair of erosion from natural events	As required
		Realignment of rip-rap or other damage	As required
Inspect banksides, structures, pipework for evidence of poor operation or physical damage	After large storms and as required		

Drainage Asset	Responsible Organisation	Maintenance Work	Frequency
		Inspect silt accumulation rates and establish appropriate removal, frequencies	Half-yearly
<b>Attenuation Pond</b>	Independent Water Networks	Realignment of inlet/outlet protection	As required
		Repair/rehabilitation of inlets, outlets and overflows	As required
		Check flow control and associated penstocks for mechanical operation	Half-yearly



## 5.0 MAINTENANCE AND INSPECTION PLAN

- 5.1 The proposed maintenance inspection access is illustrated on drawing 27056\_02\_020\_01.4d. A compacted gravel track of minimum width of 2.5m should be provided to link gate access off Broughton Road, to the hydrobrake. This provides access for maintenance directly to the pond to both the inlet and outlets. Furthermore, the access track should have turning areas located at either end that will allow for loading and offloading of maintenance equipment from a trailer.



## 6.0 WASTE MANAGEMENT

- 6.1 SUDS are designed to intercept silt and allow the natural breakdown of organic pollutants. Undertaking the above maintenance regime of the SUDS features, including occasional removal of silt and vegetation that gathers in SUDS, is required to ensure long term performance.
- 6.2 Organic waste should be used around the SUDS components or scheme to form wildlife piles. If this is not practical it should be composted or, as a last resort, removed to a licensed landfill site. The environment agency has adopted a risk-based approach in relation to removal of silt from SUDS (Environment Agency 2011).
- 6.3 Green waste from SUDS components and schemes is much the same as waste from normal landscape maintenance and can be managed by:
- Shredded for surface spreading like a mulch
  - The development of wildlife piles to provide habitat, refuges, shelter etc. When they biodegrade, they can compost
  - The development of wildlife piles to provide habitat, refuges, shelter etc. When they biodegrade, they can compost
  - Disposal to landfill often as a last resort

## 7.0 RELIABILITY

- 7.1 The reliability of SUDS is critically dependant on the quality of the design and construction, in particular the management of silt.
- 7.2 The proposed development SUDS features have been designed to accommodate flows up to the 100yr +40% envelope within which they are intended to operate with additional freeboard (circa 400mm).
- 7.3 We understand that this design envelope mitigates future flooding risks to the development and also provides an abundant whole life cycle design life in line with modern planning requirements.



## 8.0 HEALTH AND SAFETY

- 8.1 These SUDS features have been designed to be as shallow as possible with as gentle as practical side slopes, which should minimise health and safety risks.
- 8.2 The design guide used for these features (CIRIA's SUDS Manual and DeFRA's Technical Standards for Sustainable Drainage Systems) incorporates health and safety implications of these SUDS components. Also, the proposals are incorporated within the Construction, Design and Management Regulations 2015, which requires hazards to be removed by good design wherever possible rather than providing mitigation to manage risk.
- 8.3 Those responsible for the maintenance and management of SUDS should take appropriate health and safety precautions for activities and risk assessments should be undertaken.





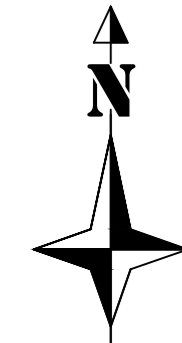
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# APPENDICES



## APPENDIX A



**KEY**

- SITE BOUNDARY
- ADAPTABLE SURFACE WATER SEWER (SECTION 104 WATER INDUSTRY ACT) (COVER AND INVERT LEVELS SHOWN)
- ADAPTABLE FOUL SEWER (SECTION 104 WATER INDUSTRY ACT) (COVER AND INVERT LEVELS SHOWN)
- PRIVATE LATERAL CONNECTION TO ADAPTABLE SEWER (CONNECT SOFFIT TO SOFFIT UNLESS NOTED OTHERWISE)
- 450mm DIA X 900mm DEEP TRAPPED ROAD GULLY GRATING AND 150mm GULLY CONNECTION (SEE DRG NO. 27526\_02\_000\_01)
- PHASE 1 SURFACE WATER SEWER (COVER AND INVERT LEVELS SHOWN)
- PHASE 1 FOUL SEWER (COVER AND INVERT LEVELS SHOWN)

**OVERLAND FLOW ROUTE NOTES:**

- FLOW ROUTES ARE REQUIRED TO FACILITATE THE POTENTIAL ROUTE OF SURFACE WATER FLOW FLOWS FOR ALL EVENTS EXCEEDING THE STORM SEWER DESIGN CRITERIA.
- FLOW ROUTES ILLUSTRATED ON THE DRAWINGS SHALL BE KEPT CLEAR OF PERMANENT PHYSICAL OBSTRUCTIONS WHICH MAY IMPED THE FLOW OF SURFACE WATER (E. WALLS, RETAINING WALLS) FAILURE TO DO THIS WILL INCREASE THE RISK OF FLOODING TO PROPERTIES.
- HOUSE SLAB LEVELS, EXTERNAL WORKS, DRIVE AND GARDEN GRADIENTS SHALL BE DESIGNED IN SUCH A WAY AS TO MINIMIZE THE RISK OF FLOODING TO PROPERTIES IMMEDIATELY ADJACENT TO FLOW ROUTES.
- SURFACE WATER REGULATION & ATTENUATION FACILITIES SHALL BE CONSTRUCTED TO THEIR ENTIRETY PRIOR TO THE CONNECTION OF ANY IMPERMEABLE AREAS FROM THE SURFACE WATER SYSTEM. THIS WILL LIMIT FLOOD RISK TO DOWN STREAM PROPERTIES DURING CONSTRUCTION.

- NOTES:**
- DO NOT SCALE THIS DRAWING.
  - THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEERS, ARCHITECTS AND SPECIALIST DESIGN DRAWINGS AND DETAILS.
  - ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE. ALL LEVELS ARE IN METRES UNLESS NOTED OTHERWISE.
  - ANY DISCREPANCIES NOTED ON SITE ARE TO BE REPORTED TO THE ENGINEER IMMEDIATELY.
  - SEWERS SHALL BE CONSTRUCTED TO THE SATISFACTION OF THAMES AND IN ACCORDANCE WITH DESIGN AND CONSTRUCTION GUIDANCE FOR FOUL AND SURFACE WATER SEWERS OFFERED FOR ADOPTION UNDER THE CODE FOR ADOPTION AGREEMENTS FOR WATER AND SEWERAGE COMPANIES OPERATING WHOLLY OR MAINLY IN ENGLAND ("THE CODE") APPROVED VERSION 2.2 JUNE 2022.
  - THE CONTRACTOR SHALL CHECK ALL THE-INS FOR LINE AND LEVEL WITH EXISTING BEFORE COMMENCING ANY WORKS. THE ENGINEER SHALL BE NOTIFIED IMMEDIATELY IN WRITING, SHOULD ANY ERRORS BE FOUND.
  - IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO LOCATE ANY SERVICE APPARATUS IN THE VICINITY OF THE WORKS. THE CLIENT WILL ACCEPT NO CLAIMS WHATSOEVER IN RESPECT OF ANY LOSSES OR DAMAGE CAUSED IN RESPECT OF SUCH APPARATUS, HOWEVER CAUSED.
  - IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO EXECUTE THE WORKS AT ALL TIMES IN STRICT ACCORDANCE WITH THE REQUIREMENTS OF THE HEALTH AND SAFETY AT WORK ACT 1974, AND THE C.D.M. REGULATIONS 2015. THE CONTRACTOR WILL BE DEEMED TO HAVE ALLOWED FOR FULL COMPLIANCE WITH THESE REGULATIONS.
  - THE CONTRACTOR IS RESPONSIBLE FOR ENSURING THAT ALL WORKS ARE TO THE SATISFACTION OF THE ENGINEER AND SHALL BE DEEMED TO HAVE INCLUDED WITHIN THEIR RATES FOR ANY NECESSARY TESTING.
  - THE CONTRACTOR WILL BE RESPONSIBLE FOR PROVIDING ALL NECESSARY DE-WATERING AND TRENCH SUPPORT TO EXECUTE THE WORKS IN A SATISFACTORY MANNER, AND SHALL BE DEEMED TO HAVE ALLOWED FOR THE SAME WITHIN THEIR RATES.
  - ALL BURIED CONCRETE PRODUCTS AND MORTAR SHALL BE MADE USING SULPHATE RESISTING CEMENT.
  - ALL PRECAST CONCRETE PRODUCTS FOR USE IN THE CONTRACT MUST BE BS ITEMARKED.
  - ALL LIFTING EYES IN PRECAST CONCRETE PRODUCTS SHALL BE POINTED SMOOTH AFTER FIXING.
  - FOR HIGHWAY & DRAINAGE LONGITUDINAL SECTIONS REFER TO DRG NOS. 27526\_02\_110\_01-1-01.2
  - FINISHED FLOOR LEVELS AND DRAINAGE LATERALS SUBJECT TO CHANGE UPON COMPLETION OF EXTERNAL WORKS & PRIVATE DRAINAGE DESIGN.
  - THE FIRST MANHOLE UPSTREAM FROM CONNECTION TO THE EXISTING PUBLIC SEWER SHALL, WHEN CONSTRUCTED BE FITTED WITH A SCREEN IN ORDER TO PREVENT DEBRIS ENTERING THE PUBLIC SEWER. THE SCREEN SHALL NOT BE REMOVED UNTIL IMMEDIATELY PRIOR TO THE OCCUPATION OF PREMISES TO BE SERVED BY THE SEWER.
  - EASEMENTS AT ANY CHANGE IN WIDTH WILL BE 2.5m EITHER SIDE OF THE PIPE FOR PIPE SIZES UP TO 300mm, AND 5m EITHER SIDE OF THE PIPE FOR PIPES GREATER THAN 300mm.
  - PROTECTIVE COVER SLABS REQUIRED WHERE DEPTH OF COVER TO SEWERS IS LESS THAN: 0.9m (NON-TRAFFICKED AREAS) 1.2m (TRAFFICKED AREAS)
  - ALL MANHOLE COVERS TO BE 675 x 675mm COVER AND FRAME TO MAINTAIN CLEAR 600 x 600mm CLEAR OPENING, UNLESS OTHERWISE STATED IN ACCORDANCE WITH BS EN 124 CLASS D400 AND EMBOSSED FW OR SW AS APPROPRIATE.
  - PRECAST CONCRETE RINGS SHALL NOT BE CUT UNDER ANY CIRCUMSTANCES. MANHOLES TO BE BUILT UP WITH CONCRETE OR BRICK WORK TO THE REQUIRED LEVEL.
  - PIPES OF DIFFERENT DIAMETERS ENTERING MANHOLES SHOULD BE INSTALLED WITH SOFFITS AT THE SAME LEVEL UNLESS STATED OTHERWISE.

ALL HIGHWAY WORKS TO BE CARRIED OUT IN ACCORDANCE WITH NATIONAL HIGHWAYS MOH/SHW SPECIFICATION

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REV	AMENDMENTS	DATE	BY	CHK	APP	DATE
1	FIRST ISSUE					
<b>PROJECT:</b> BALMORAL AVENUE BANBURY (PHASE 2)						
<b>DRAWING TITLE:</b> ENGINEERING LAYOUT						
<b>CLIENT:</b> ORBIT HOMES (2020) LIMITED						
<b>DRAWING NUMBER:</b> 27526_02_020_06						
<b>REVISION:</b> AO SCALE: 1:250						
<b>STATUS:</b> FOR INFORMATION / APPROVAL						

**M-EC**  
Consulting Development Engineers

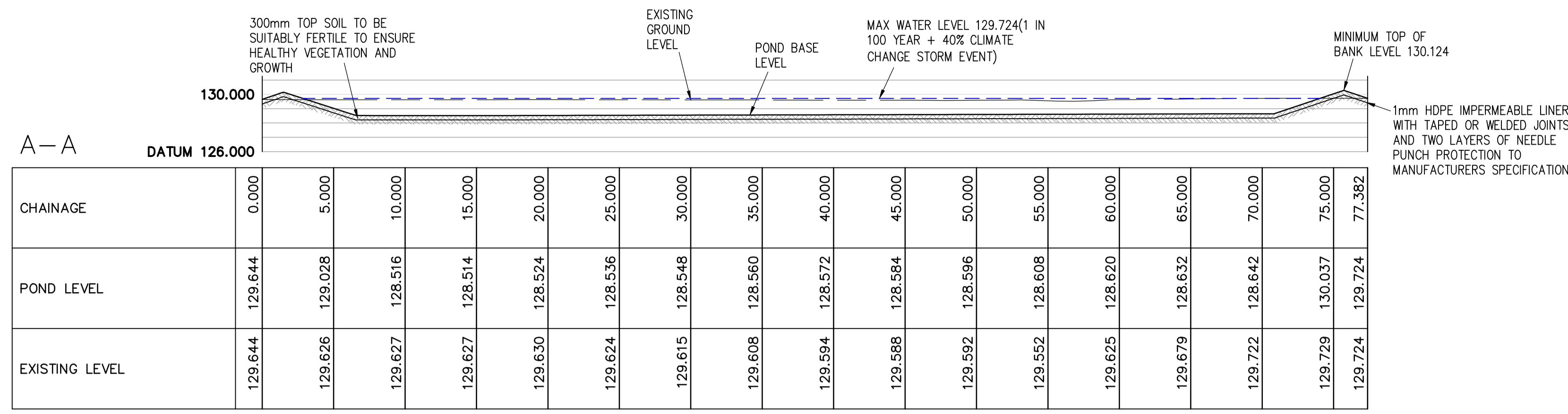
Telephone: 01235 264 753  
Email: group@me-ec.co.uk  
Website: www.me-ec.co.uk

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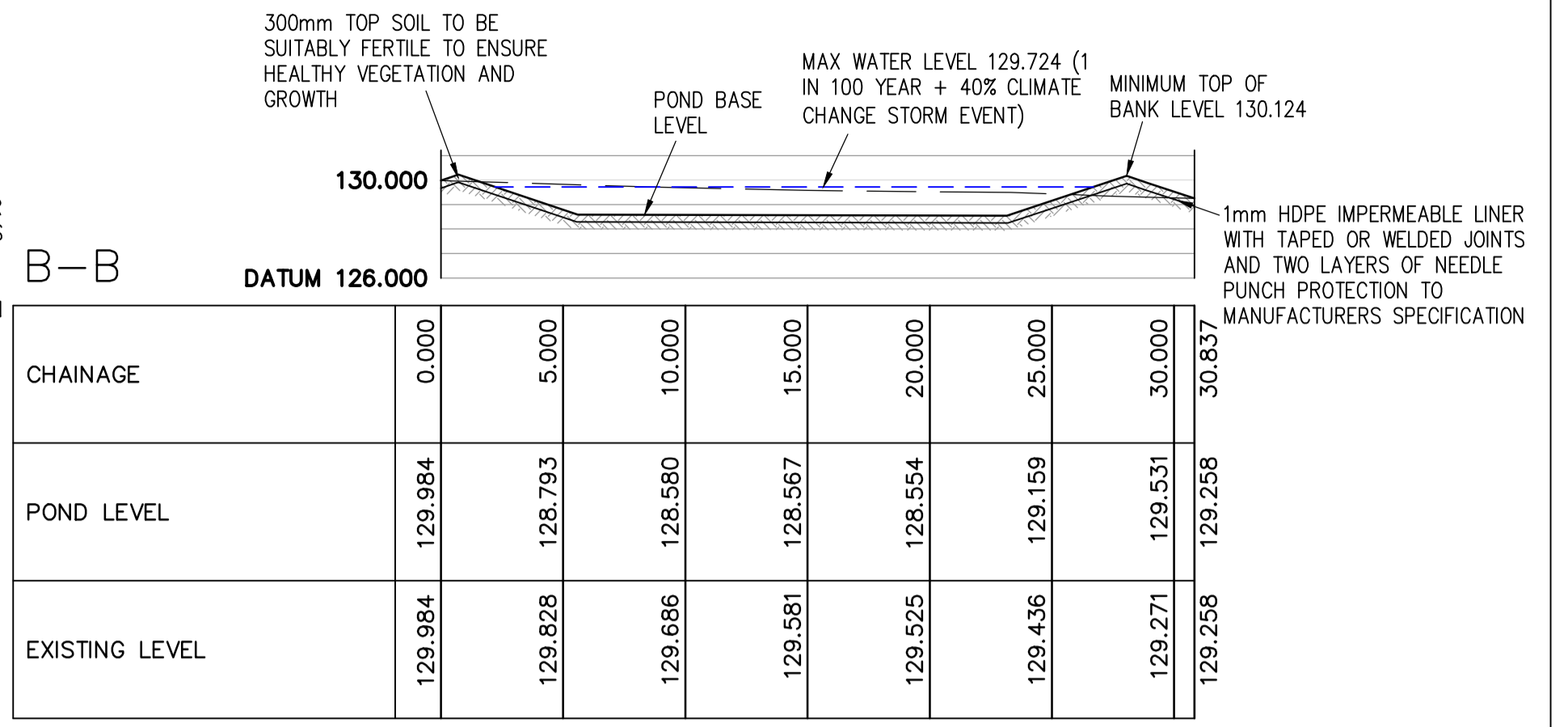


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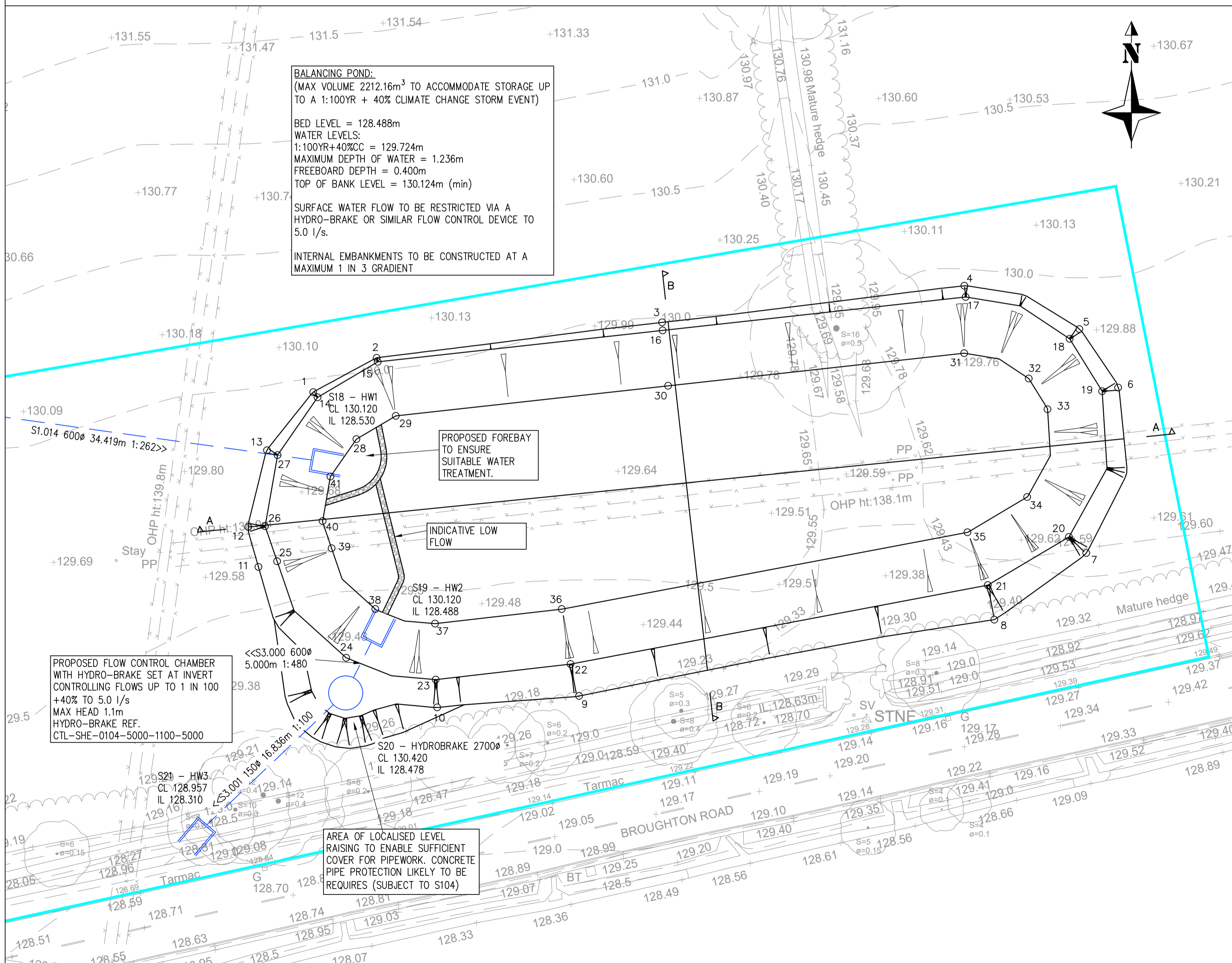
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**SECTION VIEW**  
SCALE H1:100 V1:100



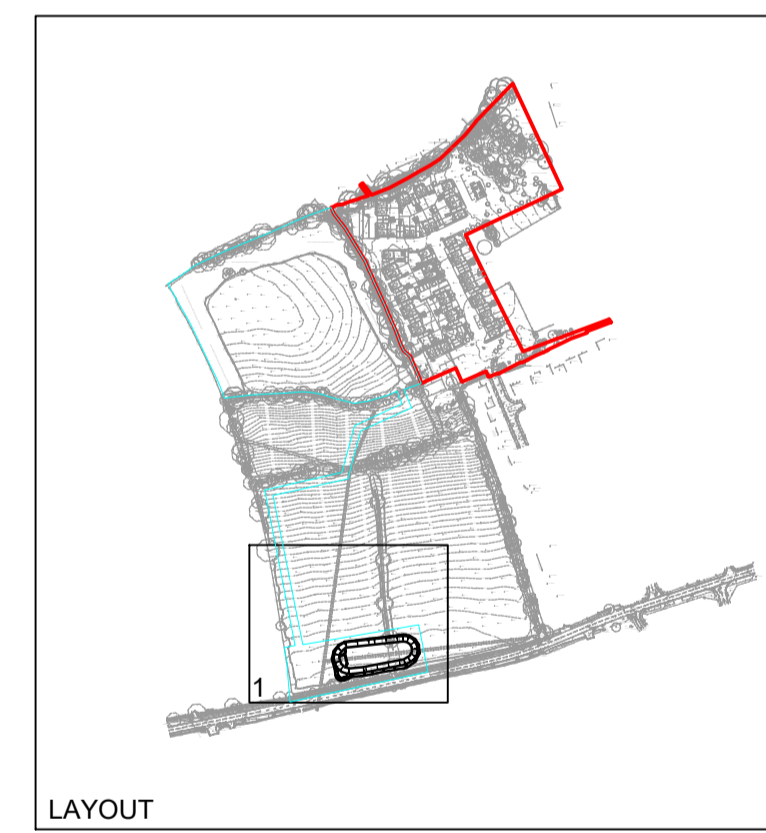
**SECTION VIEW**  
SCALE H1:100 V1:100



**KEY**

- S2 1200# CL 150.00 IL 150.80: ADOPTABLE SURFACE WATER SEWER (SECTION 104 WATER INDUSTRY ACT) (COVER AND INVERT LEVELS SHOWN)
- [Symbol]: ADOPTABLE SURFACE WATER HEADWALL
- [Red Line]: PHASE 1 SITE BOUNDARY
- [Cyan Line]: PHASE 2 SITE BOUNDARY
- [Symbol]: PROPOSED BALANCING POND

	EASTINGS	NORTHINGS	LEVELS
1	443728.927	239680.953	129.960
2	443734.505	239683.975	130.037
3	443759.610	239687.093	129.982
4	443786.183	239690.312	129.957
5	443796.291	239686.502	129.873
6	443799.703	239681.362	129.794
7	443796.894	239666.815	129.567
8	443788.816	239660.962	129.211
9	443752.302	239654.249	129.185
10	443739.831	239653.245	129.301
11	443724.114	239665.589	129.572
12	443723.225	239669.102	129.644
13	443724.861	239675.842	129.813
14	443729.311	239680.501	130.166
15	443734.605	239683.621	130.166
16	443759.648	239686.387	130.227
17	443786.294	239689.328	130.291
18	443795.433	239685.642	130.291
19	443798.300	239681.044	130.291
20	443795.372	239668.231	130.266
21	443788.243	239663.992	130.243
22	443751.556	239657.047	130.152
23	443739.702	239655.687	130.124
24	443731.827	239657.601	130.124
25	443725.758	239666.087	130.148
26	443724.700	239669.169	130.156
27	443725.796	239675.419	130.166
28	443732.729	239676.832	128.530
29	443736.187	239678.870	128.530
30	443760.139	239681.515	128.590
31	443786.162	239684.388	128.655
32	443791.838	239682.155	128.655
33	443793.491	239679.459	128.655
34	443791.699	239671.743	128.630
35	443786.458	239668.637	128.607
36	443750.777	239661.886	128.516
37	443739.635	239660.608	128.488
38	443734.389	239661.884	128.488
39	443730.543	239667.228	128.511
40	443729.751	239669.628	128.520
41	443730.444	239673.539	128.530



**BALMORAL AVENUE BANBURY**

**POND SECTIONS & SETTING OUT PLAN**

**ORBIT HOMES (2020) LIMITED**

**27056\_02\_070\_03**

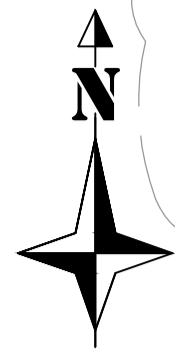
**FOR INFORMATION / APPROVAL**

**M-EC**  
Consulting Development Engineers

Telephone: 01530 364 753  
Email: group@m-ec.co.uk  
Website: www.m-ec.co.uk

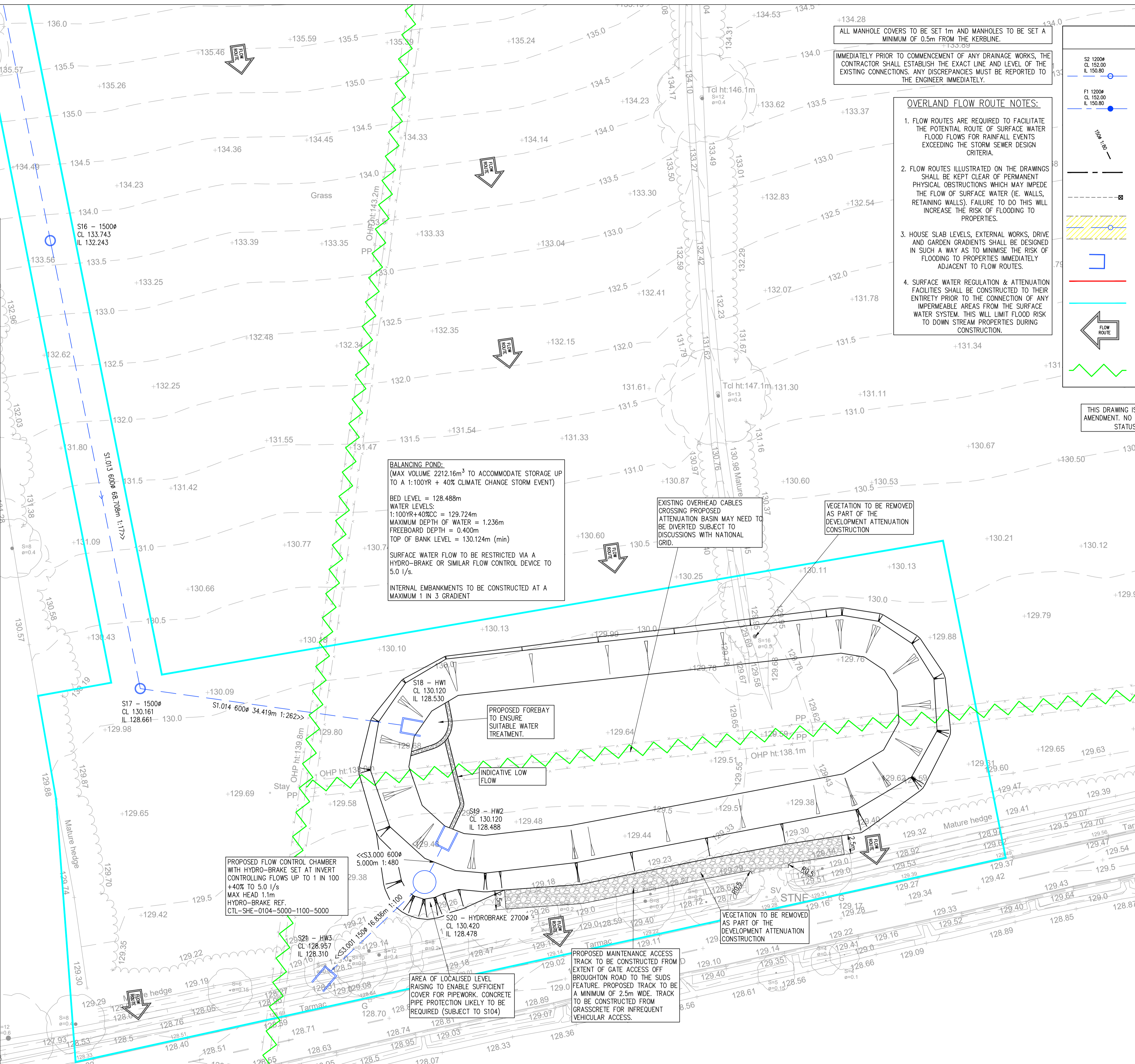
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ALL MANHOLE COVERS TO BE SET 1m AND MANHOLES TO BE SET A MINIMUM OF 0.5m FROM THE KERBLINE.

IMMEDIATELY PRIOR TO COMMENCEMENT OF ANY DRAINAGE WORKS, THE CONTRACTOR SHALL ESTABLISH THE EXACT LINE AND LEVEL OF THE EXISTING CONNECTIONS. ANY DISCREPANCIES MUST BE REPORTED TO THE ENGINEER IMMEDIATELY.

**OVERLAND FLOW ROUTE NOTES:**

- FLOW ROUTES ARE REQUIRED TO FACILITATE THE POTENTIAL ROUTE OF SURFACE WATER FLOOD FLOWS FOR RAINFALL EVENTS EXCEEDING THE STORM SEWER DESIGN CRITERIA.
- FLOW ROUTES ILLUSTRATED ON THE DRAWINGS SHALL BE KEPT CLEAR OF PERMANENT PHYSICAL OBSTRUCTIONS WHICH MAY IMPEDE THE FLOW OF SURFACE WATER (IE. WALLS, RETAINING WALLS). FAILURE TO DO THIS WILL INCREASE THE RISK OF FLOODING TO PROPERTIES.
- HOUSE SLAB LEVELS, EXTERNAL WORKS, DRIVE AND GARDEN GRADIENTS SHALL BE DESIGNED IN SUCH A WAY AS TO MINIMISE THE RISK OF FLOODING TO PROPERTIES IMMEDIATELY ADJACENT TO FLOW ROUTES.
- SURFACE WATER REGULATION & ATTENUATION FACILITIES SHALL BE CONSTRUCTED TO THEIR ENTIRETY PRIOR TO THE CONNECTION OF ANY IMPERMEABLE AREAS FROM THE SURFACE WATER SYSTEM. THIS WILL LIMIT FLOOD RISK TO DOWN STREAM PROPERTIES DURING CONSTRUCTION.

**KEY**

- ADOPTABLE SURFACE WATER SEWER (SECTION 104 WATER INDUSTRY ACT) (COVER AND INVERT LEVELS SHOWN)
- ADOPTABLE FOUL SEWER (SECTION 104 WATER INDUSTRY ACT) (COVER AND INVERT LEVELS SHOWN)
- PRIVATE LATERAL CONNECTION TO ADOPTABLE SEWER (CONNECT SOFFIT TO SOFFIT UNLESS NOTED OTHERWISE)
- EXISTING THAMES WATER COMBINED SEWER
- 450mm DIA X 900mm DEEP TRAPPED ROAD GULLY GRATING AND 150mmØ GULLY CONNECTION (SEE DRG NO. 27056\_02\_080\_01).
- DRAINAGE SEWER EASEMENT (DIMENSIONED) AREA TO BE KEPT CLEAR OF VEGETATION AND STRUCTURES
- ADOPTABLE SURFACE WATER HEADWALL
- PHASE 1 SITE BOUNDARY
- PHASE 2 SITE BOUNDARY
- OVERLAND FLOW ROUTE (SEE NOTES)
- EXISTING OVERHEAD POWER CABLES

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**BALANCING POND:**  
(MAX VOLUME 2212.16m<sup>3</sup> TO ACCOMMODATE STORAGE UP TO A 1:100YR + 40% CLIMATE CHANGE STORM EVENT)

BED LEVEL = 128.488m  
WATER LEVELS:  
1:100YR+40%CC = 129.724m  
MAXIMUM DEPTH OF WATER = 1.236m  
FREEBOARD DEPTH = 0.400m  
TOP OF BANK LEVEL = 130.124m (min)

SURFACE WATER FLOW TO BE RESTRICTED VIA A HYDRO-BRAKE OR SIMILAR FLOW CONTROL DEVICE TO 5.0 l/s.

INTERNAL EMBANKMENTS TO BE CONSTRUCTED AT A MAXIMUM 1 IN 3 GRADIENT

EXISTING OVERHEAD CABLES CROSSING PROPOSED ATTENUATION BASIN MAY NEED TO BE DIVERTED SUBJECT TO DISCUSSIONS WITH NATIONAL GRID.

VEGETATION TO BE REMOVED AS PART OF THE DEVELOPMENT ATTENUATION CONSTRUCTION

PROPOSED FOREBAY TO ENSURE SUITABLE WATER TREATMENT.

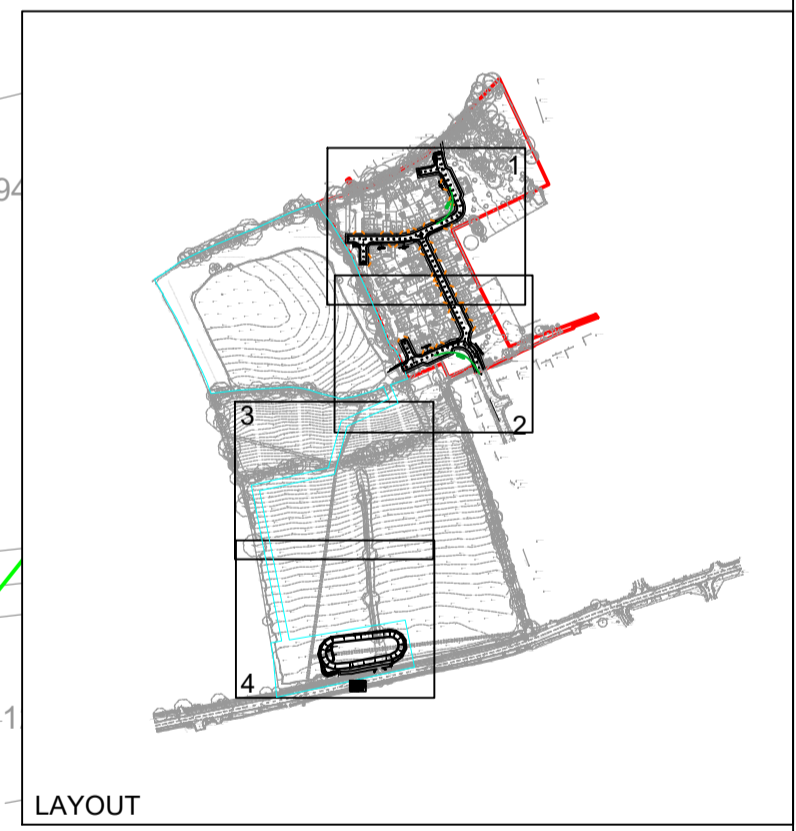
INDICATIVE LOW FLOW

PROPOSED FLOW CONTROL CHAMBER WITH HYDRO-BRAKE SET AT INVERT CONTROLLING FLOWS UP TO 1 IN 100 +40% TO 5.0 l/s  
MAX HEAD 1.1m  
HYDRO-BRAKE REF. CTL-SHE-0104-5000-1100-5000

VEGETATION TO BE REMOVED AS PART OF THE DEVELOPMENT ATTENUATION CONSTRUCTION

AREA OF LOCALISED LEVEL RAISING TO ENABLE SUFFICIENT COVER FOR PIPEWORK. CONCRETE PIPE PROTECTION LIKELY TO BE REQUIRED (SUBJECT TO S104)

PROPOSED MAINTENANCE ACCESS TRACK TO BE CONSTRUCTED FROM EXTENT OF GATE ACCESS OFF BROUGHTON ROAD TO THE SUDS FEATURE. PROPOSED TRACK TO BE A MINIMUM OF 2.5m WIDE. TRACK TO BE CONSTRUCTED FROM GRASSCRETE FOR INFREQUENT VEHICULAR ACCESS.



PROJECT: BALMORAL AVENUE BANBURY		DATE: 09.08.23
DRAWING TITLE: ENGINEERING LAYOUT SHEET 4 OF 4		DATE: 09.08.23
CLIENT: ORBIT HOMES (2020) LIMITED		DATE: 04.04.23
DRAWING NUMBER: 27056_02_020_01.4		DATE: 21.03.23
REVISION: D	SHEET SIZE: A1	SCALE: 1:250
STATUS: FOR INFORMATION / APPROVAL		
		Telephone: 01530 264 753 Email: group@mec.co.uk Website: www.mec.co.uk ORDNANCE SURVEY © CROWN COPYRIGHT 2015. ALL RIGHTS RESERVED. LICENCE NUMBER 100055865.

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CIVIL ENGINEERING



ACOUSTIC AIR



TRANSPORT



UTILITIES



FLOOD RISK & DRAINAGE



GEOMATICS



STRUCTURES



LIGHTING



GEO-ENVIRONMENTAL



EXPERT WITNESS



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