Technical Note

Project:	**Garstang Business Park**	Job No:	**3396**
Subject:	**Drainage Strategy Amendments**		
Prepared by:	**M Fenton**	Date:	**23/08/2019**
Approved by:	**P Graveney**	Date:	**23/08/2019**

Introduction

Scott Hughes Design (SHD) has been appointed by Keyworker Homes to carry out design services for a proposed building consisting of retail and residential space. The site is located just off the B6430 in Preston and the nearest postcode is WN8 6SR.

A Flood Risk Assessment (by RSK) and a 'Report to Discharge Drainage Related Planning Conditions' (by Scott Hughes Design) have been created for the site and are available upon request. However, the proposals have now changed, and majority of surrounding car parking areas will be retained. The only changes to the surrounding car parking areas will be to facilitate the new building level.

The new proposals can be summarised as follows:

- A new building will be constructed with an FFL of 18.870. This is higher than the existing building's split-level FFL.
- Localised level changes to the car park will be carried out to facilitate the raised FFL.
- Proposed works to the existing car parking areas will be kept to a minimum to minimise disruption in service.
- Parking areas with no change of level or change of use will not form part of the proposed drainage works as the existing arrangements are acceptable and work well.

This technical note has been created to summarise how these design changes impact the drainage strategy.

Existing Drainage

This section should be read in conjunction with the existing drainage drawings in Appendix A. All drainage catchments and flow rates described in this section only relate to those generated within the proposed site boundary. Catchments upstream/downstream of the site will not be impacted by the proposed works.

The existing site has 3 drainage outfalls which are summarised in the table below:

Table 1: Drainage Outfalls

Outfall Ref	Location	Upstream Catchment
1	Surface water public sewer.	Surface water flows from the parking areas surrounding the existing building. Flows are conveyed into the River Wyre.
2A + 2B	2A Combined sewer overflow into the River Wyre. 2B Combined water public sewer.	The existing buildings foul and surface water flows.
3	River Wyre	The car park and associated access road just south of the site boundary.

The existing drainage catchments are clearly defined, likely owing to the previous phasing associated with the existing development.

Existing Discharge Rates

Using FSR rainfall data for a 15 minute storm, which gives a like for like comparison with the proposed simulations that will be analysed, the following existing discharge rates, based on the revised site boundary, for each outfall can be calculated.

Table 2: FSR Rainfall Intensities

Return Period (1:X)	Rainfall Intensity (mm/hr)	Flow (l/s/ha)
1	26.2	72.7
30	64.0	177.7
100	82.5	229.1

Table 3: Existing Discharge Rates

		Flow (l/s)		
Outfall	Contributing Area (ha)	1:1 Year	1:30 Year	1:100 Year
1	0.170	12.4	30.2	39.0
2A/2B	0.078	5.7	13.9	17.9
3	0.024	1.7	4.3	5.5

Proposed Discharge Rates

As described in the FRA, Lancashire County Council (LCC) would normally follow the Non-statutory technical standards for sustainable drainage systems, which states the following:
"For developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to re redevelopment for that event."

A proposed flow restriction of 26.6l/s for all return period events was calculated in the FRA, assuming a site boundary of approximately 0.7ha. Now the site boundary has reduced to approximately 0.313ha, the flow restriction will be prorated to **11.9l/s**.

Proposed Outfall Location

Proposals are to discharge surface water flows from the site into Outfall 1, via an existing sewer. Therefore, comparing the proposed 11.9l/s restriction with Table 3, proposed flows discharging into Outfall 1 will be reduced for all return period events.

Furthermore, as the proposed building roof drainage will be diverted away from the combined sewer, there will be a significant reduction in the frequency that the combined sewer overflow (Outfall 2A) discharges into the River Wyre.

As shown on the 'Proposed Impermeable Area' drawing (Appendix B), a small amount of hard standing area will freely discharge into Outfall 3, via the existing private road drainage network. This is a reduction in impermeable area, and therefore flow, when compared to the existing impermeable area.

Therefore, there will be a reduction in flow to all outfalls for all return periods as a result of the proposed development.

Design Criteria

The proposed surface water drainage system will be designed based on:

- Discharge restriction of 11.9l/s;
- Surface water flows from the car parking areas will be conveyed through bypass separators to improve the water quality;
- No flooding during a 1:30 year return period event;
- Controlled flooding is acceptable for the 1:100 year return period event with an additional 40% allowance for climate change providing it doesn't put people or property at risk.

Proposed Simulation Results

The proposed surface water simulation results are available in Appendix C. It can be seen all the design criteria described above is adhered to. There is approximately 1.4m³ of flooding for the 1:100 year return period event. This volume of flooding can be considered negligible in a car park.

Conclusion

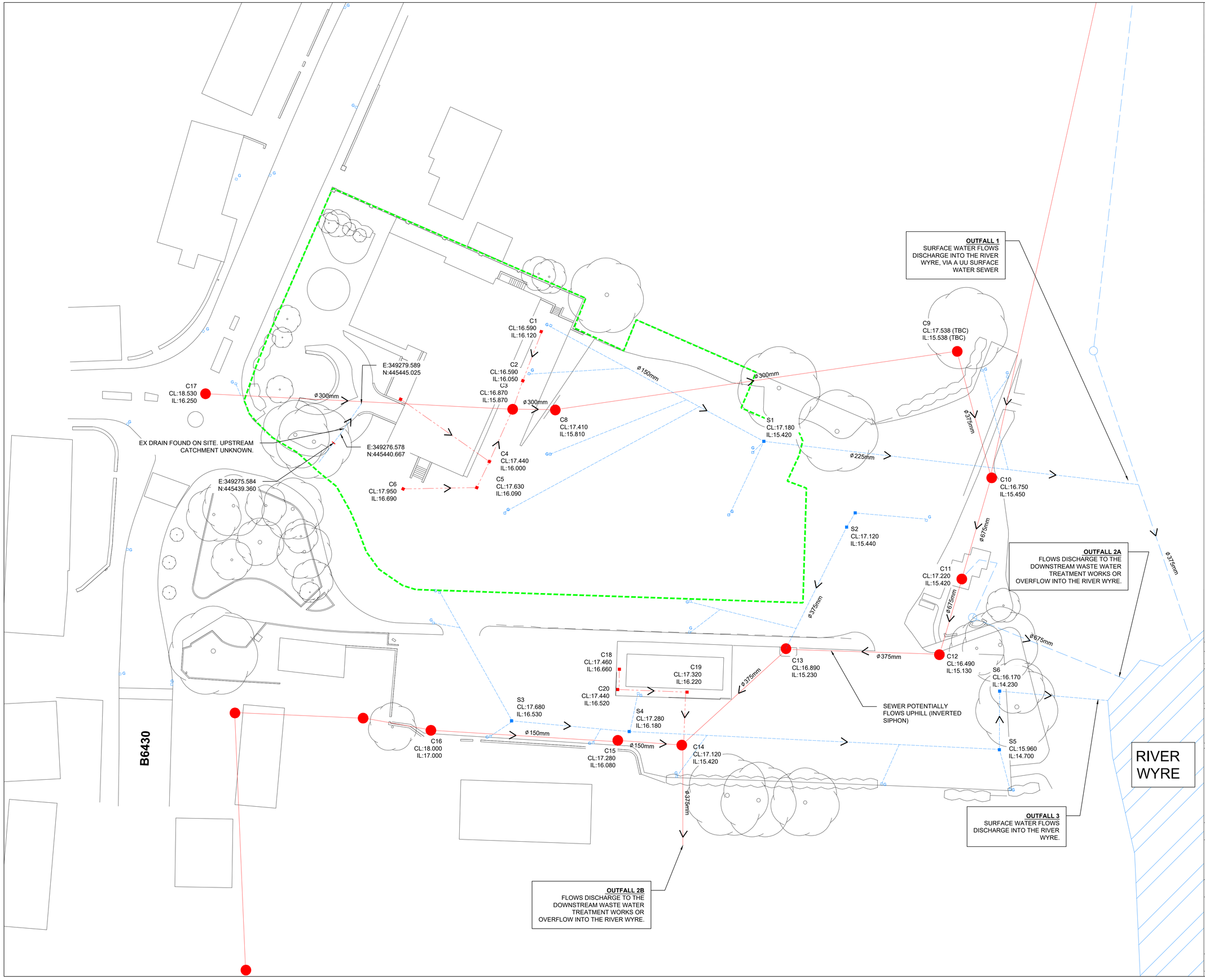
This technical note has been created to summarise how these design changes impact the proposed drainage strategy.

The proposed surface water flow restriction has been reduced proportionally in line with the revised site boundary area. All the design principles set out in the FRA have still been adhered to and the drainage proposals will offer a significant reduction in discharge rates to all existing drainage networks associated with the site.

Bypass separators will be utilised to ensure an improvement in water quality. In addition to this, the existing combined sewer overflow in the River Wyre will operate less frequently as a result of the proposed development.

Overall, the proposed drainage strategy offers a significant improvement when compared to the existing scenario, following guidance from Lancashire County Council.

Appendix A – Existing Drainage Drawings



GENERAL NOTES

1. DRAWINGS ARE TO BE READ IN CONJUNCTION WITH ALL RELEVANT SPECIFICATIONS, ENGINEERS, ARCHITECTS & SERVICES DRAWINGS, INCLUDING APPROVED BUILDERS WORK DRAWINGS. CONTRACTOR TO NOTIFY ENGINEER OF DISCREPANCIES BETWEEN STRUCTURAL DRAWINGS AND SPECIFICATIONS OR OTHER DRAWINGS.

2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.

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4. INFORMATION CONTAINED ON THIS DRAWING IS SCHEME DESIGN ONLY AND REQUIRES FURTHER DETAILED DESIGN AND CO-ORDINATION WITH THE CONTRACTOR, DESIGN TEAM AND APPROPRIATE SUB-CONTRACTORS.

5. RESURFACING WORK MAY TAKE PLACE OUTSIDE THE SITE BOUNDARY. AS THERE IS NO CHANGE OF LEVEL OR CHANGE OF USE, THE EXISTING DRAINAGE ARRANGEMENTS OUTSIDE THE BOUNDARY CAN BE RETAINED.

KEY

- SITE BOUNDARY (REFER TO NOTE 5)
- EXISTING UU COMBINED SEWER & MANHOLE
- EXISTING UU SW SEWER & MANHOLE
- EXISTING PRIVATE FW SEWER & MANHOLE
- EXISTING PRIVATE SW SEWER & MANHOLE
- EXISTING GULLY & SEWER

ALL EXISTING GULLY SEWER ROUTES ASSUMED

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D2	TENDER

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CLIENT: KEYWORKER HOMES

PROJECT: GARSTANG BUSINESS CENTRE

DRAFTER	ENGINEER
MF	PG

TITLE: EXISTING DRAINAGE

PROJECT REFERENCE: 3396

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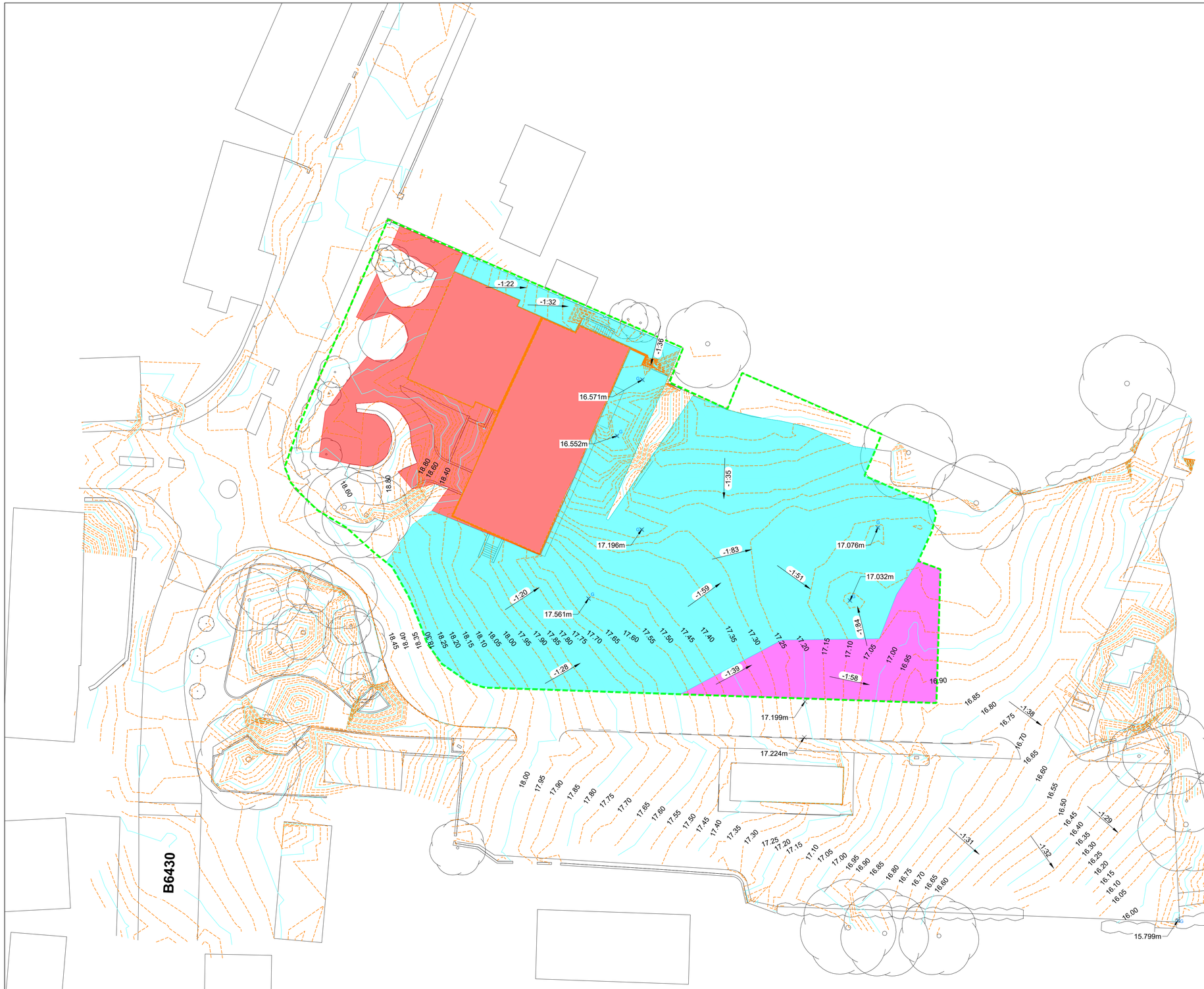
1-250	A1	GAR-SHD-00-ZZ-DR-C-0110	P1



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KEY

- SITE BOUNDARY (REFER TO NOTE 5)
- EXISTING GULLY DRAINING AREA WITHIN SITE BOUNDARY
- EXISTING IMPERMEABLE AREA DISCHARGING TO OUTFALL 1 (0.170ha)
- EXISTING IMPERMEABLE AREA DISCHARGING TO OUTFALL 2A/2B (0.078ha)
- EXISTING IMPERMEABLE AREA DISCHARGING TO OUTFALL 3 (0.024ha)
- MAJOR CONTOUR (0.2m)
- MINOR CONTOUR (0.05m)
- -1:38 GROUND SLOPE

DRAWING TO BE READ IN CONJUNCTION WITH THE DRAINAGE TECHNICAL NOTE

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CLIENT: KEYWORKER HOMES

PROJECT: GARSTANG BUSINESS CENTRE

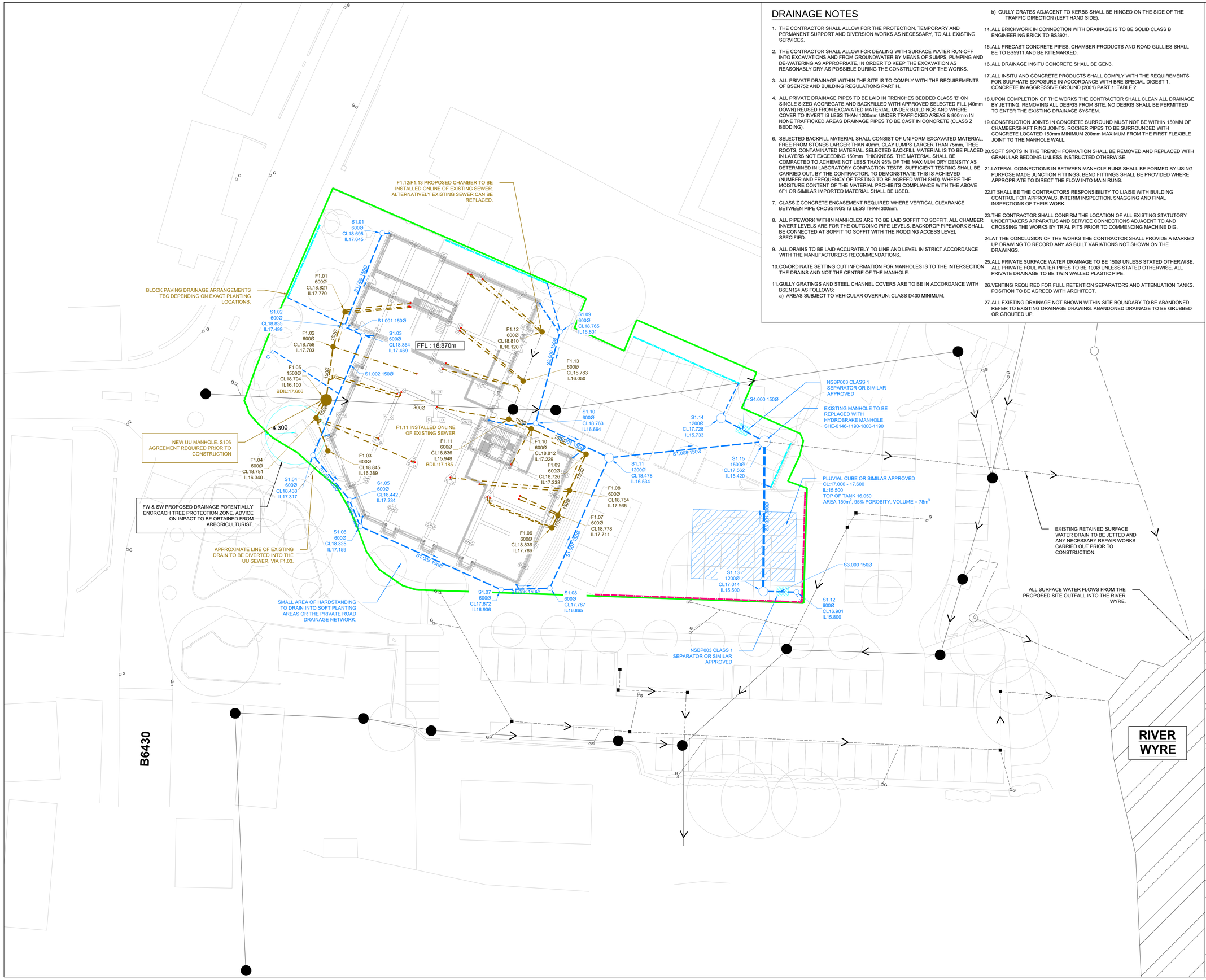
DRAFTER: MF | ENGINEER: PG

TITLE: EXISTING CONTRIBUTING AREAS

PROJECT REFERENCE: 3396

SCALE	SHEET	DRAWING No	REV
1-250	A1	GAR-SHD-00-ZZ-DR-C-0111	P1

Appendix C – Surface Water Simulation Results



DRAINAGE NOTES

1. THE CONTRACTOR SHALL ALLOW FOR THE PROTECTION, TEMPORARY AND PERMANENT SUPPORT AND DIVERSION WORKS AS NECESSARY, TO ALL EXISTING SERVICES.
2. THE CONTRACTOR SHALL ALLOW FOR DEALING WITH SURFACE WATER RUN-OFF INTO EXCAVATIONS AND FROM GROUNDWATER BY MEANS OF SUMPS, PUMPING AND DE-WATERING AS APPROPRIATE, IN ORDER TO KEEP THE EXCAVATION AS REASONABLY DRY AS POSSIBLE DURING THE CONSTRUCTION OF THE WORKS.
3. ALL PRIVATE DRAINAGE WITHIN THE SITE IS TO COMPLY WITH THE REQUIREMENTS OF BSEN752 AND BUILDING REGULATIONS PART H.
4. ALL PRIVATE DRAINAGE PIPES TO BE LAID IN TRENCHES BEDDED CLASS 'B' ON SINGLE SIZED AGGREGATE AND BACKFILLED WITH APPROVED SELECTED FILL (40mm DOWN) REUSED FROM EXCAVATED MATERIAL. UNDER BUILDINGS AND WHERE COVER TO INVERT IS LESS THAN 1200mm UNDER TRAFFICKED AREAS & 900mm IN NONE TRAFFICKED AREAS DRAINAGE PIPES TO BE CAST IN CONCRETE (CLASS Z BEDDING).
5. SELECTED BACKFILL MATERIAL SHALL CONSIST OF UNIFORM EXCAVATED MATERIAL, FREE FROM STONES LARGER THAN 40mm, CLAY LUMPS LARGER THAN 75mm, TREE ROOTS, CONTAMINATED MATERIAL. SELECTED BACKFILL MATERIAL IS TO BE PLACED IN LAYERS NOT EXCEEDING 150mm THICKNESS. THE MATERIAL SHALL BE COMPACTED TO ACHIEVE NOT LESS THAN 95% OF THE MAXIMUM DRY DENSITY AS DETERMINED IN LABORATORY COMPACTION TESTS. SUFFICIENT TESTING SHALL BE CARRIED OUT, BY THE CONTRACTOR, TO DEMONSTRATE THIS IS ACHIEVED (NUMBER AND FREQUENCY OF TESTING TO BE AGREED WITH SHD). WHERE THE MOISTURE CONTENT OF THE MATERIAL PROHIBITS COMPLIANCE WITH THE ABOVE 6F1 OR SIMILAR IMPORTED MATERIAL SHALL BE USED.
6. CLASS Z CONCRETE ENCASEMENT REQUIRED WHERE VERTICAL CLEARANCE BETWEEN PIPE CROSSINGS IS LESS THAN 300mm.
7. ALL PIPEWORK WITHIN MANHOLES ARE TO BE LAID SOFFIT TO SOFFIT. ALL CHAMBER INVERT LEVELS ARE FOR THE OUTGOING PIPE LEVELS. BACKDROP PIPEWORK SHALL BE CONNECTED AT SOFFIT TO SOFFIT WITH THE RODDING ACCESS LEVEL SPECIFIED.
8. ALL DRAINS TO BE LAID ACCURATELY TO LINE AND LEVEL IN STRICT ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS.
9. CO-ORDINATE SETTING OUT INFORMATION FOR MANHOLES IS TO THE INTERSECTION THE DRAINS AND NOT THE CENTRE OF THE MANHOLE.
10. GULLY GRATINGS AND STEEL CHANNEL COVERS ARE TO BE IN ACCORDANCE WITH BSEN124 AS FOLLOWS:
    a) AREAS SUBJECT TO VEHICULAR OVERRUN: CLASS D400 MINIMUM.
    b) GULLY GRATES ADJACENT TO KERBS SHALL BE HINGED ON THE SIDE OF THE TRAFFIC DIRECTION (LEFT HAND SIDE).
11. ALL BRICKWORK IN CONNECTION WITH DRAINAGE IS TO BE SOLID CLASS B ENGINEERING BRICK TO BS3921.
12. ALL PRECAST CONCRETE PIPES, CHAMBER PRODUCTS AND ROAD GULLIES SHALL BE TO BS5911 AND BE KITEMARKED.
13. ALL DRAINAGE INSITU CONCRETE SHALL BE GEN3.
14. ALL INSITU AND CONCRETE PRODUCTS SHALL COMPLY WITH THE REQUIREMENTS FOR SULPHATE EXPOSURE IN ACCORDANCE WITH BRE SPECIAL DIGEST 1, CONCRETE IN AGGRESSIVE GROUND (2001) PART 1: TABLE 2.
15. UPON COMPLETION OF THE WORKS THE CONTRACTOR SHALL CLEAN ALL DRAINAGE BY JETTING, REMOVING ALL DEBRIS FROM SITE. NO DEBRIS SHALL BE PERMITTED TO ENTER THE EXISTING DRAINAGE SYSTEM.
16. CONSTRUCTION JOINTS IN CONCRETE SURROUND MUST NOT BE WITHIN 150MM OF CHAMBER/SHAFT RING JOINTS. ROCKER PIPES TO BE SURROUNDED WITH CONCRETE LOCATED 150mm MINIMUM 200mm MAXIMUM FROM THE FIRST FLEXIBLE JOINT TO THE MANHOLE WALL.
17. SOFT SPOTS IN THE TRENCH FORMATION SHALL BE REMOVED AND REPLACED WITH GRANULAR BEDDING UNLESS INSTRUCTED OTHERWISE.
18. LATERAL CONNECTIONS IN BETWEEN MANHOLE RUNS SHALL BE FORMED BY USING PURPOSE MADE JUNCTION FITTINGS. BEND FITTINGS SHALL BE PROVIDED WHERE APPROPRIATE TO DIRECT THE FLOW INTO MAIN RUNS.
19. IT SHALL BE THE CONTRACTORS RESPONSIBILITY TO LIAISE WITH BUILDING CONTROL FOR APPROVALS, INTERIM INSPECTION, SNAGGING AND FINAL INSPECTIONS OF THEIR WORK.
20. THE CONTRACTOR SHALL CONFIRM THE LOCATION OF ALL EXISTING STATUTORY UNDERTAKERS APPARATUS AND SERVICE CONNECTIONS ADJACENT TO AND CROSSING THE WORKS BY TRIAL PITS PRIOR TO COMMENCING MACHINE DIG.
21. AT THE CONCLUSION OF THE WORKS THE CONTRACTOR SHALL PROVIDE A MARKED UP DRAWING TO RECORD ANY AS BUILT VARIATIONS NOT SHOWN ON THE DRAWINGS.
22. ALL PRIVATE SURFACE WATER DRAINAGE TO BE 150Ø UNLESS STATED OTHERWISE. ALL PRIVATE FOUL WATER PIPES TO BE 100Ø UNLESS STATED OTHERWISE. ALL PRIVATE DRAINAGE TO BE TWIN WALLED PLASTIC PIPE.
23. VENTING REQUIRED FOR FULL RETENTION SEPARATORS AND ATTENUATION TANKS. POSITION TO BE AGREED WITH ARCHITECT.
24. ALL EXISTING DRAINAGE NOT SHOWN WITHIN SITE BOUNDARY TO BE ABANDONED. REFER TO EXISTING DRAINAGE DRAWING. ABANDONED DRAINAGE TO BE GRUBBED OR GROUTED UP.

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KEY

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- PROPOSED SURFACE WATER SEWER
- PROPOSED SURFACE WATER INSPECTION CHAMBER / MANHOLE
- PROPOSED FOUL WATER SEWER
- PROPOSED FOUL WATER INSPECTION CHAMBER / MANHOLE
- PROPOSED SLOT DRAIN
- PROPOSED CHANNEL DRAIN
- PROPOSED PETROL INTERCEPTOR
- PROPOSED ATTENUATION TANK
- G □ PROPOSED YARD GULLY
- EXISTING UU COMBINED SEWER & MANHOLE
- EXISTING UU SW SEWER & MANHOLE
- EXISTING PRIVATE FW SEWER & MANHOLE
- EXISTING PRIVATE SW SEWER & MANHOLE
- G EXISTING GULLY & SEWER

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CLIENT: KEYWORKER HOMES

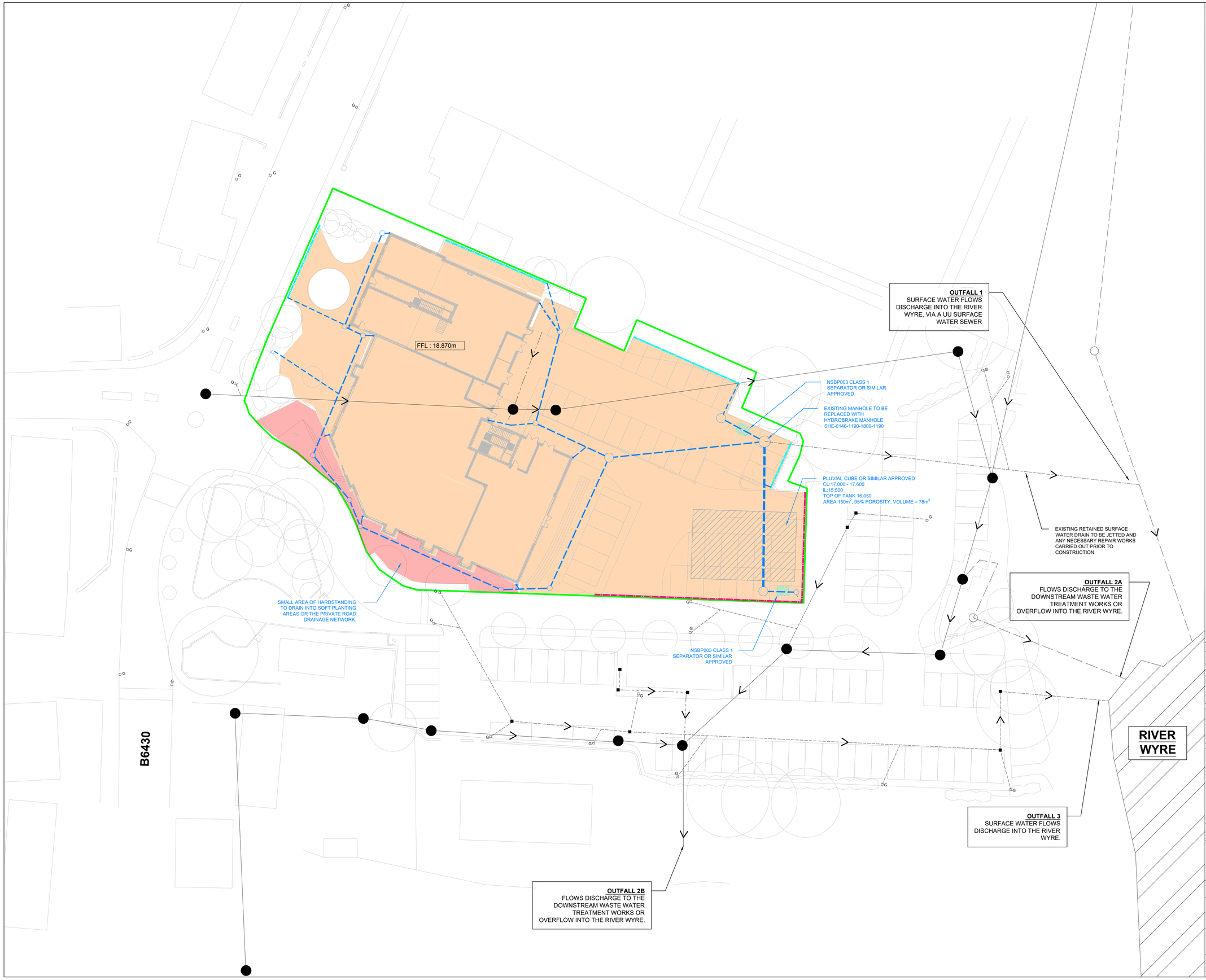
PROJECT: GARSTANG BUSINESS CENTRE

DRAFTER	ENGINEER
MF	MF

TITLE: PROPOSED DRAINAGE

PROJECT REFERENCE: 3396

SCALE	SHEET	DRAWING No	REV
1-250	A1	GAR-SHD-00-ZZ-DR-C-0201	P1



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KEY

- BOUNDARY FOR REVISED DRAINAGE
- PROPOSED IMPERMEABLE AREA CONTRIBUTING TO SW OUTFALL 1 (0.262ha)
- PROPOSED IMPERMEABLE AREA CONTRIBUTING TO SW OUTFALL 3 (0.016ha)
- PROPOSED SURFACE WATER SEWER
- PROPOSED SURFACE WATER INSPECTION CHAMBER / MANHOLE
- PROPOSED SLOT DRAIN
- PROPOSED CHANNEL DRAIN
- PROPOSED PETROL INTERCEPTOR
- PROPOSED ATTENUATION TANK
- PROPOSED YARD GULLY
- EXISTING UU COMBINED SEWER & MANHOLE
- EXISTING UU SW SEWER & MANHOLE
- EXISTING PRIVATE FW SEWER & MANHOLE
- EXISTING PRIVATE SW SEWER & MANHOLE
- EXISTING GULLY & SEWER

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CLIENT: KEYWORKER HOMES

PROJECT: GARSTANG BUSINESS CENTRE

DRAFTER	ENGINEER
MF	MF

TITLE: PROPOSED IMPERMEABLE AREA

PROJECT REFERENCE: 3396

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1-250	A1	GAR-SHD-00-ZZ-DR-C-0112	P1

Appendix B – Proposed Drainage Drawings

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for SW

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	14.557	0.146	100.0	0.014	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	2.979	0.030	99.3	0.024	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	18.772	0.153	123.0	0.014	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.003	8.324	0.083	100.0	0.010	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.004	4.127	0.075	55.1	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.005	22.328	0.223	100.1	0.023	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.006	7.045	0.070	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.007	20.713	0.331	62.6	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
2.000	13.702	0.137	100.0	0.021	5.00	0.0	0.600	o	150	Pipe/Conduit	
2.001	11.746	0.129	90.7	0.028	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.008	22.612	1.052	21.5	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
3.000	4.604	0.150	30.6	0.076	5.00	0.0	0.600	o	150	Pipe/Conduit	
3.001	21.647	0.080	270.6	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
4.000	7.142	0.238	30.0	0.054	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.009	8.521	0.046	185.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.24	17.645	0.014	0.0	0.0	0.0	1.00	17.8	1.9
1.001	50.00	5.29	17.499	0.038	0.0	0.0	0.0	1.01	17.8	5.1
1.002	50.00	5.64	17.469	0.052	0.0	0.0	0.0	0.90	16.0	7.0
1.003	50.00	5.77	17.317	0.062	0.0	0.0	0.0	1.00	17.8	8.4
1.004	50.00	5.83	17.234	0.062	0.0	0.0	0.0	1.36	24.0	8.4
1.005	50.00	6.20	17.159	0.085	0.0	0.0	0.0	1.00	17.7	11.5
1.006	50.00	6.31	16.936	0.085	0.0	0.0	0.0	1.00	17.8	11.5
1.007	50.00	6.58	16.865	0.085	0.0	0.0	0.0	1.27	22.5	11.5
2.000	50.00	5.23	16.801	0.021	0.0	0.0	0.0	1.00	17.8	2.8
2.001	50.00	5.41	16.664	0.049	0.0	0.0	0.0	1.06	18.7	6.6
1.008	50.00	6.76	16.534	0.134	0.0	0.0	0.0	2.18	38.6	18.1
3.000	50.00	5.04	15.800	0.076	0.0	0.0	0.0	1.83	32.3	10.3
3.001	50.00	5.42	15.500	0.076	0.0	0.0	0.0	0.95	67.2	10.3
4.000	50.00	5.06	15.733	0.054	0.0	0.0	0.0	1.84	32.6	7.3
1.009	50.00	6.90	15.420	0.264	0.0	0.0	0.0	0.96	38.1	35.7

Free Flowing Outfall Details for SW

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.009	EX SEWER	17.174	15.374	0.000	300	0

Simulation Criteria for SW

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

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

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	18.240	Cv (Summer)	0.750
Return Period (years)	2	Ratio R	0.320	Cv (Winter)	0.840
Region	England and Wales	Profile Type	Summer	Storm Duration (mins)	30

Online Controls for SW

Hydro-Brake® Optimum Manhole: S1.15, DS/PN: 1.009, Volume (m³): 5.7

Unit Reference	MD-SHE-0146-1190-1800-1190	Sump Available	Yes
Design Head (m)	1.800	Diameter (mm)	146
Design Flow (l/s)	11.9	Invert Level (m)	15.420
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	225
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1500
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.800	11.9	Kick-Flo®	1.100	9.4
Flush-Flo™	0.525	11.9	Mean Flow over Head Range	-	10.4

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.3	0.600	11.9	1.600	11.2	2.600	14.1	5.000	19.3	7.500	23.5
0.200	10.3	0.800	11.5	1.800	11.9	3.000	15.1	5.500	20.2	8.000	24.2
0.300	11.3	1.000	10.4	2.000	12.5	3.500	16.3	6.000	21.1	8.500	24.9
0.400	11.7	1.200	9.8	2.200	13.1	4.000	17.4	6.500	21.9	9.000	25.6
0.500	11.9	1.400	10.6	2.400	13.6	4.500	18.4	7.000	22.7	9.500	26.3

Storage Structures for SW

Tank or Pond Manhole: S1.13, DS/PN: 3.001

Invert Level (m) 15.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	142.5	0.550	142.5	0.551	0.0

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.240 Cv (Summer) 0.750
Region England and Wales Ratio R 0.320 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Maximum Vol (m³)	Discharge Vol (m³)	Pipe Flow (l/s)	Status
1.000	S1.01	15 minute 1 year Winter I+0%	18.695	17.677	-0.118	0.000	0.10	0.008	0.769	1.6	OK
1.001	S1.02	15 minute 1 year Winter I+0%	18.835	17.563	-0.086	0.000	0.37	0.048	2.088	4.0	OK
1.002	S1.03	15 minute 1 year Winter I+0%	18.864	17.532	-0.087	0.000	0.36	0.031	2.857	5.4	OK
1.003	S1.04	15 minute 1 year Winter I+0%	18.438	17.384	-0.083	0.000	0.41	0.058	3.406	6.4	OK
1.004	S1.05	15 minute 1 year Winter I+0%	18.442	17.297	-0.087	0.000	0.37	0.046	3.406	6.4	OK
1.005	S1.06	15 minute 1 year Winter I+0%	18.325	17.235	-0.074	0.000	0.51	0.038	4.670	8.5	OK
1.006	S1.07	15 minute 1 year Winter I+0%	17.872	17.017	-0.069	0.000	0.56	0.062	4.670	8.5	OK
1.007	S1.08	15 minute 1 year Winter I+0%	17.787	16.932	-0.084	0.000	0.41	0.047	4.670	8.6	OK
2.000	S1.09	15 minute 1 year Winter I+0%	18.765	16.840	-0.111	0.000	0.15	0.010	1.154	2.5	OK
2.001	S1.10	15 minute 1 year Winter I+0%	18.763	16.722	-0.092	0.000	0.31	0.043	2.692	5.2	OK
1.008	S1.11	15 minute 1 year Winter I+0%	18.478	16.598	-0.087	0.000	0.37	0.112	7.362	13.4	OK
3.000	S1.12	15 minute 1 year Winter I+0%	16.901	15.863	-0.087	0.000	0.37	0.016	4.175	8.9	OK
3.001	S1.13	30 minute 1 year Winter I+0%	17.014	15.552	-0.247	0.000	0.05	7.521	1.711	2.9	OK
4.000	S1.14	15 minute 1 year Winter I+0%	17.728	15.782	-0.101	0.000	0.23	0.049	2.967	6.3	OK
1.009	S1.15	15 minute 1 year Winter I+0%	17.562	15.650	0.005	0.000	0.35	1.372	11.465	10.6	SURCHARGED

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.240 Cv (Summer) 0.750
Region England and Wales Ratio R 0.320 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Maximum Vol (m³)	Discharge Vol (m³)	Pipe Flow (l/s)	Status
1.000	S1.01	15 minute 30 year Winter I+0%	18.695	17.742	-0.053	0.000	0.24	0.026	1.880	3.9	OK
1.001	S1.02	15 minute 30 year Winter I+0%	18.835	17.728	0.078	0.000	0.93	0.273	5.104	10.1	SURCHARGED
1.002	S1.03	15 minute 30 year Winter I+0%	18.864	17.712	0.093	0.000	0.90	0.109	6.984	13.4	SURCHARGED
1.003	S1.04	15 minute 30 year Winter I+0%	18.438	17.601	0.134	0.000	0.97	0.385	8.327	15.0	SURCHARGED
1.004	S1.05	15 minute 30 year Winter I+0%	18.442	17.524	0.141	0.000	0.88	0.217	8.327	15.2	SURCHARGED
1.005	S1.06	15 minute 30 year Winter I+0%	18.325	17.469	0.160	0.000	1.20	0.149	11.415	20.2	SURCHARGED
1.006	S1.07	15 minute 30 year Winter I+0%	17.872	17.135	0.049	0.000	1.34	0.261	11.415	20.3	SURCHARGED
1.007	S1.08	15 minute 30 year Winter I+0%	17.787	16.981	-0.034	0.000	0.96	0.086	11.415	20.3	OK
2.000	S1.09	15 minute 30 year Winter I+0%	18.765	16.864	-0.087	0.000	0.37	0.017	2.821	6.0	OK
2.001	S1.10	15 minute 30 year Winter I+0%	18.763	16.773	-0.041	0.000	0.86	0.087	6.581	14.6	OK
1.008	S1.11	15 minute 30 year Winter I+0%	18.478	16.674	-0.011	0.000	0.89	0.306	17.996	32.5	OK
3.000	S1.12	15 minute 30 year Winter I+0%	16.901	15.912	-0.038	0.000	0.90	0.030	10.207	21.8	OK
3.001	S1.13	60 minute 30 year Winter I+0%	17.014	15.712	-0.088	0.000	0.17	30.400	12.960	10.1	OK
4.000	S1.14	15 minute 30 year Summer I+0%	17.728	15.930	0.047	0.000	0.54	0.217	6.475	14.9	SURCHARGED
1.009	S1.15	15 minute 30 year Summer I+0%	17.562	15.864	0.219	0.000	0.39	2.419	25.801	11.8	SURCHARGED

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.240 Cv (Summer) 0.750
Region England and Wales Ratio R 0.320 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Maximum Vol (m³)	Discharge Vol (m³)	Pipe Flow (l/s)	Status
1.000	S1.01	15 minute 100 year Winter I+40%	18.695	18.695	0.900	0.456	0.53	0.749	3.396	8.6	FLOOD
1.001	S1.02	15 minute 100 year Summer I+40%	18.835	18.710	1.061	0.000	1.14	0.588	8.229	12.4	FLOOD RISK
1.002	S1.03	15 minute 100 year Summer I+40%	18.864	18.677	1.057	0.000	1.12	0.382	11.260	16.8	FLOOD RISK
1.003	S1.04	15 minute 100 year Winter I+40%	18.438	18.439	0.972	0.855	1.41	1.491	15.036	21.8	FLOOD
1.004	S1.05	15 minute 100 year Summer I+40%	18.442	18.380	0.997	0.000	1.21	0.459	13.425	20.8	FLOOD RISK
1.005	S1.06	15 minute 100 year Winter I+40%	18.325	18.325	1.017	0.067	1.53	0.458	20.613	25.7	FLOOD
1.006	S1.07	15 minute 100 year Winter I+40%	17.872	17.866	0.780	0.000	1.68	0.646	20.613	25.5	FLOOD RISK
1.007	S1.08	15 minute 100 year Winter I+40%	17.787	17.702	0.687	0.000	1.22	0.349	20.613	25.8	FLOOD RISK
2.000	S1.09	15 minute 100 year Winter I+40%	18.765	17.517	0.566	0.000	0.55	0.201	5.093	9.0	SURCHARGED
2.001	S1.10	15 minute 100 year Winter I+40%	18.763	17.472	0.658	0.000	1.32	0.459	11.884	22.3	SURCHARGED
1.008	S1.11	15 minute 100 year Winter I+40%	18.478	17.291	0.607	0.000	1.16	1.392	32.497	42.2	SURCHARGED
3.000	S1.12	15 minute 100 year Winter I+40%	16.901	16.192	0.242	0.000	1.60	0.109	18.432	38.9	SURCHARGED
3.001	S1.13	120 minute 100 year Winter I+40%	17.014	16.025	0.226	0.000	0.21	75.508	36.239	12.6	SURCHARGED
4.000	S1.14	15 minute 100 year Winter I+40%	17.728	16.121	0.238	0.000	0.99	0.434	13.096	27.5	SURCHARGED
1.009	S1.15	120 minute 100 year Winter I+40%	17.562	16.024	0.379	0.000	0.39	2.761	138.744	11.9	SURCHARGED