Report on Drainage Strategy to Accompany Planning Application 3/2017/0232 Condition 8
Land East of Chipping Lane, Longridge

by

Barratt Manchester

Revision	Date	Prepared By	Revision Notes
-	14.03.24	CD	First Issue
A	03.12.24	CD	Section 6 on Discharge Rates and Section 8 Detailed Design amended

Contents

Appendices

1. Introduction

The following document has been prepared to assist the designer's preparation and the readers understanding of the drainage theory and calculations in one reference document.

This document covers all Phases 1, 2, & 3 of the Chipping Lane development, in order to demonstrate how the full site drains; supporting evidence has been provided. See Appendix A for the planning reference drawing.

This document has been prepared in order to discharge the following drainage condition linked with the **3/2017/0232** outline planning permission for the development of 363 homes off Chipping Lane, Longridge:

Condition 8

The drainage strategy shall accord with the approved Flood Risk Assessment and Drainage Appraisal (Ref:880500 R1 (03), dated March 2015, where amended by Betts Hydro Flood Risk Assessment and Sustainable Drainage Assessment ref: HYD068, dated March 2016) and shall demonstrate that the surface water run-off generated by the 1 in 100 year plus climate change critical storm shall not exceed the run-off from the undeveloped site should be limited to 8.3l/s/Ha (Greenfield Qbar). Prior to the commencement of development with a phase, the details of a scheme for surface water drainage and means of disposal for that phase, to accord with the Drainage Strategy approved and to include evidence of an assessment of site conditions, sustainable drainage principles, an assessment of the hydrological and hydro-geological context of the development, management and maintenance and timescales for implementation, shall be submitted to and approved in writing by the Local Planning Authority. The scheme shall be implemented, maintained and managed in accordance with the approved details at all times thereafter.

2. Site Details

Development Name	Bowland Meadows, Chipping Lane
Site Address	Land off Chipping Lane, Longridge, Preston, PR3 2NA
Longitude, Latitude (or OS Grid Ref)	360321; 437929
Site Description	7 No. open grassed fields separated by mature hedgerows and sporadic trees. Currently used by livestock for grazing.
Site Area (Ha)	14.41Ha Approx.
Site Area used for calculating Greenfield Run-Off Rates (Ha)	10.52Ha Approx. developable area, this excludes large areas of open spaces.
Existing Impermeable Area (Ha)	0Ha
Is the Site Steeply Sloping (Y/N), If "Yes" Typical Gradient.	No

Table 1

Refer to Appendix B for the pre-development topographical surveys for the site.

Site specific site investigations was carried out by soiltechnics for each phase individually.

- Phase 1, dated February 2016, Ref: STN3505NM-G01, Rev 0
- Phase 2, dated April 2016, Ref: STN3505NM-G02, Rev 0

Extracts of the reports which include existing ground conditions and soakaway testing can be found in Appendix C and D.

3. Pre-Development Greenfield Runoff Rates

A flood risk assessment which covers Phase 1 only, was carried out by Betts Hydro, dated March 2016. This document states that the surface water discharge rate should be restricted to 8.3 l/s/Ha, calculated using the ICP SuDS method within MicroDrainage. This FRA and discharge rate was approved under the Condition Discharge application 3/2016/1061. See Appendix E for the full report.

Return Period	**Greenfield Rate (L/s/Ha)**
1 in 1 Year (l/s)	7.2
QBar	8.3
1 in 30 Year (l/s)	14.0
1 in 100 Year (l/s)	17.2

Table 2

A separate flood risk assessment which covers Phases 2 & 3, was carried out by Betts Hydro, in December 2018. This document states that the surface water discharge rate should be restricted to 13.6l/s/Ha, calculated using the HR Wallingford tool for greenfield runoff rates on uksuds.com. This FRA was revised in November 2021 to include for all planning layout amendments. See Appendix F for the latest revision of the full report.

Return Period	**Greenfield Rate (L/s/Ha)**
1 in 1 Year (l/s)	11.8
QBar	13.6
1 in 30 Year (l/s)	23.1
1 in 100 Year (l/s)	28.3

Table 3

The deviations from the flow rates stated in Condition 8 of the outline have been explained by Betts Hydro that the greenfield runoff rates have been calculated by the preferred methodology at the time of writing the reports. A copy of this report was submitted to the Local Lead Flood Authority for approval, and can be found in Appendix G. The LLFA has subsequentially accepted the use of this Flood Risk Assessment by stating its use in the conditions of application 3/2021/1134.

4. Soakaway Testing

Soakaway testing was undertaken by soiltechnics for both phases, results can be found in Appendix C and D.

Ground conditions are typically 0.3m of topsoil overlaying cohesive Devensian Till to beyond depths of 4.7m. The Till is comprised of initially 1-1.5m of low to high strength clay, below which the shear strength increases. Varying amounts of silt, sand and gravel were also found.

4No soakaway tests were carried out as part of the site investigation. It was considered that the Devensian Till is impermeable and therefore indicates that infiltration drainage is NOT a feasible option.

5. Pre-Development Hydrology

Surface water management hierarchy is to first discharge via infiltration. As this is not a viable option on this development the second option would be to drain to watercourses. See Appendix H for the pre-development overland flow routes. The drainage is designed to follow these routes to existing watercourse *Higgin Brook* where possible. A hydraulic assessment of Higgin Brook was undertaken by Betts Hydro in July 2016. See Appendix H for the latest revision of the report.

6. Post-Development Surface Water Allowable Discharge Rates

Discharge rates have been limited to existing greenfield runoff rates of Qbar for all storm return periods. Refer to the phase specific FRA, and Tables 2 & 3 above for details of the greenfield runoff rates.

See Appendix I for the development area plan.

Surface Water Network	**Development Phase**	**Developable Area (Ha)**	**Greenfield Rate (L/s/Ha)**	**Allowable Discharge Rate L/s**
1	1	4.32	8.3	35.9
	2A	1.80	13.6	24.5
2	2B	2.69	13.6	36.6
3	3	1.71	13.6	23.3
			Total	**120.2**

Table 4

Please refer to the drainage network plans within Appendix J.

7. Design Parameters

M5-60	18.800
Ratio R	0.282
MADD Factor	2.0
Climate Change Allowance	30%
Urban Creep	10%

Table 5

Point of Connection	S14	S325	S415
Drainage Layout Drawing Number	459/ED/201	459/ED/202	459/ED/202
Proposed Impermeable Areas Drg No	459/ED/203	459/ED/204	459/ED/204
Lowest FFLs	105.175	107.700	111.900
Maximum TWL for Design	104.150	106.750	111.100
Discharge Location Minimum Levels	102.040	103.500	108.469
Surcharge Outfall Levels	102.560	104.400	109.370
Point of Connection	Watercourse		
Point of Connection approved by UU (Y/N)	Yes		

Table 6

8. Summary of Drainage Design

The drainage has been designed in accordance with the site specific FRA produced by Betts Hydro. Phase 1 was designed in accordance with the Phase 1 document dated July 2016; Phases 2 & 3 was designed in accordance with the Phase 2 & 3 document dated November 2021.

The drainage has also been designed to comply with DEFRA's non-statutory technical standards for sustainable drainage systems dated March 2015. Compliance to such is demonstrated within Section 13.

All surface water networks will drain to the adjacent watercourse named Higgin Brook. Discharge rates have been limited to existing greenfield runoff rates of Qbar for all storm return periods.

Attenuation storage is provided in the form of oversized pipes under highways and public open spaces. Attenuation storage in the highways is sized to provide attenuation for all flows up to and including 1 in 30 year storm events.

For storm events exceeding 1 in 30 year events, long term storage is provided in above ground storage areas to ensure no flooding to properties occurs for all storm events up to and including 1 in 100 year 6 hour storm event plus a 30% allowance for climate change.

All MicroDrainage simulations are available in Appendix J, a summary of the results are shown below:

1 in 1 Year Simulations

Drainage Network	**Pre-Development Flow Rates l/s**	**Allowable Discharge Rate l/s**	**Actual Discharge Rate l/s**
Network 1	52.3	60.4	49.9
Network 2	31.7	36.6	35.7
Network 3	20.2	23.2	22.7
Total	**104.2**	**120.2**	**108.3**

Development Phase	**Developable Area Ha**	**Allowable Discharge Rate l/s/Ha**	**Actual Discharge Rate L/s/Ha**
Phase 1	4.32	8.3	8.2
Phase 2A	1.80	13.6	8.2
Phase 2B	2.69	13.6	13.3
Phase 2	4.49	13.6	11.3
Phase 3	1.71	13.6	13.3
Phase 2 & 3	**6.20**	**13.6**	**11.8**

Table 7

The 1 in 1 year simulations demonstrate a rate less than the required restriction of Qbar. Please note that urban creep has been included for all areas, and has increased the actual flow rates. Should urban creep be removed, the actual flow rates would be also be less than pre-development flow rates. Please see Section 8 for more information on Urban Creep.

1 in 30 Year Simulations

Drainage Network	**Pre-Development Flow Rates l/s**	**Allowable Discharge Rate l/s**	**Actual Discharge Rate l/s**
Network 1	102.1	60.4	49.9
Network 2	62.1	36.6	35.6
Network 3	39.5	23.2	22.7
Total	**203.7**	**120.2**	**108.2**

Development Phase	Developable Area Ha	Allowable Discharge Rate l/s/Ha	Actual Discharge Rate L/s/Ha
Phase 1	4.32	8.3	8.2
Phase 2A	1.80	13.6	8.2
Phase 2B	2.69	13.6	13.2
Phase 2	4.49	13.6	11.2
Phase 3	1.71	13.6	13.3
Phase 2 & 3	**6.20**	**13.6**	**11.8**

Table 8

The 1 in 30 year simulations demonstrate a rate less than the required restriction of Qbar. It also demonstrates a betterment of 47% compared to the pre-development scenario.

1 in 100 Year Simulations

Drainage Network	Pre-Development Flow Rates l/s	Allowable Discharge Rate l/s	Actual Discharge Rate l/s
Network 1	125.2	60.4	49.9
Network 2	76.1	36.6	40.1
Network 3	48.4	23.2	25.6
Total	**249.7**	**120.2**	**115.6**

Development Phase	Developable Area Ha	Allowable Discharge Rate l/s/Ha	Actual Discharge Rate L/s/Ha
Phase 1	4.32	8.3	8.2
Phase 2A	1.80	13.6	8.2
Phase 2B	2.69	13.6	14.9
Phase 2	4.49	13.6	12.2
Phase 3	1.71	13.6	15.0
Phase 2 & 3	**6.20**	**13.6**	**13.0**

Table 9

The 1 in 100 year simulations demonstrate a rate less than the required restriction of Qbar. It also demonstrates a betterment of 54% compared to the pre-development scenario.

1 in 100 Year Simulations + 30% Climate Change

Drainage Network	Pre-Development Flow Rates l/s	Allowable Discharge Rate L/s	Actual Discharge Rate L/s
Network 1	125.2	60.4	49.9
Network 2	76.1	36.6	41.8
Network 3	48.4	23.2	26.4
Total	**249.7**	**120.2**	**118.1**

Development Phase	Developable Area Ha	Allowable Discharge Rate l/s/Ha	Actual Discharge Rate L/s/Ha
Phase 1	4.32	8.3	8.2

Phase 2A	1.80	13.6	8.2
Phase 2B	2.69	13.6	15.5
Phase 2	4.49	13.6	12.6
Phase 3	1.71	13.6	15.4
Phase 2 & 3	**6.20**	**13.6**	**13.4**

Table 10

The 1 in 100 year simulations demonstrate a rate less than the required restriction of Qbar. It also demonstrates a betterment of 53% compared to the pre-development scenario.

9. Urban Creep

When calculating the proposed impermeable areas for the development, an additional 10% has been added to all areas of domestic properties. This 10% is used to represent Urban Creep. The 10% has been applied to all phases; and is shown on the impermeable areas plans. These increased areas have been used on all pipes for all simulations within MicroDrainage, to enable us to design and model the system with greater areas of impermeability. The MicroDrainage calculations are found in Appendix J.

10. Design for Exceedance

All surface water drainage models have been modelled for storm events greater than the 1 in 100 year event to determine the impact of flooding. There was no flooding shown during this flood event, see Appendix K for the overland flow routing plans.

This demonstrates that properties are unlikely to flood during extreme flood events.

11. Maintenance

All Surface Water (coloured blue) on the attached maintenance plans in Appendix L, will be put forward for adoption under a S104 agreement with United Utilities. Prior to issue of the Vesting Declaration by United Utilities, the drainage shown on the included plan will be maintainable by Barratt Manchester and at the expense of Barratt Manchester.

All areas of public open space will be transferred to the management company for adoption and maintenance. This includes the overflow areas/ponds (coloured purple) on the maintenance plans. The management and maintenance will be funded by the purchasers/owners of the development by way of an annual fee levied on the owner. In order to ensure the long term operation of the swales, the maintenance contract will stipulate regular maintenance of the SUDS network, in accordance with this management plan.

All highway gullies, highway drains and culverts on the maintenance plans (coloured green) will be put forward for adoption under a 38 agreement with Lancashire County Council (LCC). After issue of the highway final certificate, the highways and highway drains, and gullies will be maintainable by the Local Highway Authority at the public expense. Prior to issue of the final Certificate by LCC, the highway drains shown on the included plan will be maintainable by Barratt Manchester and at the expense of Barratt Manchester.

All foul drainage (coloured brown) on the maintenance plans, will be put forward for adoption under a S104 agreement with United Utilities. Prior to issue of the Vesting Declaration by United Utilities,

the drainage shown on the included plan will be maintainable by Barratt Manchester and at the expense of Barratt Manchester.

See Appendix L for the operation and maintenance manual for the specific maintenance schedule and reporting.

12. Compliance with DEFRA's Non-statutory Technical Standards for Sustainable Drainage Systems dated March 2015

Flood risk outside the development

Criteria	Designers Comments
S1 Where the drainage system discharges to a surface water body that can accommodate uncontrolled surface water discharges without any impact on flood risk from that surface water body (e.g. the sea or a large estuary) the peak flow control standards (**S2** and **S3** below) and volume control technical standards (**S4** and **S6** below) need not apply.	The surface water discharges to existing watercourse/sewer, therefore this criteria does not apply.

Peak flow control

Criteria	Designers Comments
S2 For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event should never exceed the peak greenfield runoff rate for the same event.	All proposed discharge rates are less than or equal to Qbar. Therefore this criteria is deemed to comply.
S3 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 redevelopment for that event.	The site is greenfield therefore not applicable. Therefore, this criteria is deemed to comply.

Volume control

Criteria	Designers Comments
S4 Where reasonably practicable, for greenfield development, the runoff volume from the	As the infiltration test results do not allow infiltration drainage, it is not possible to reduce

development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event should never exceed the greenfield runoff volume for the same event.	the run-off volume to the greenfield volume, therefore Criteria S6 will apply.
S5 Where reasonably practicable, for developments which have been previously developed, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but should never exceed the runoff volume from the development site prior to redevelopment for that event.	The site is Greenfield therefore not applicable.
S6 Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body in accordance with **S4** or **S5** above, the runoff volume must be discharged at a rate that does not adversely affect flood risk.	As the infiltration test results do not allow infiltration drainage, it is not possible to reduce the run-off volume to the greenfield volume, therefore the discharge rate has been reduced to a maximum of Qbar for all rainfall events up to and including 1 in 100 year 6 hour event.

Flood risk within the development

Criteria	**Designers Comments**
S7 The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on any part of the site for a 1 in 30 year rainfall event.	The drainage system has been designed to ensure no flooding occurs for any part of the site for a 1 in 30 year event. Micro drainage simulation for a 1 in 30 year event are attached in Appendix J
S8 The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur during a 1 in 100 year rainfall event in any part of: a building (including a basement); or in any utility plant susceptible to water (e.g. pumping station or electricity substation) within the development.	The drainage system has been designed to ensure no flooding to properties occurs for any part of the site for a 1 in 100 year 6 Hour event. For flows in excess of the 1 in 30 year event, flows are allowed to overflow into Long Term Storage areas located in public open spaces. Some minor flooding to highways is accepted for the 1 in 100 year 6 hour event. Flooding is only permitted where it can be demonstrated that minor flooded is contained wholly within the adopted highway and will not flood properties. The location and flood extent are shown on the Flood Routing and Overland Flow drawing. Micro drainage simulation for a 1 in 100 year event are attached in Appendix J

S9 The design of the site must ensure that, so far as is reasonably practicable, flows resulting from rainfall in excess of a 1 in 100 year rainfall event are managed	All surface water drainage models have been modelled for storm events greater than the 1 in 100 Year event to determine the impact of flooding. The Flood locations are shown on the attached Flood Routing and over land flow drawing. Any exceedance flooding has been demonstrated to be managed within the site where reasonably practicable.

Structural integrity

Criteria	Designers Comments
S10 Components must be designed to ensure structural integrity of the drainage system and any adjacent structures or infrastructure under anticipated loading conditions over the design life of the development taking into account the requirement for reasonable levels of maintenance.	All Sewers are to be covered under a S104 agreement with United Utilities for future adoption. All sewers to be built to UU adoptable standards. A 12 month maintenance period is standard with all S104 sewers
S11 The materials, including products, components, fittings or naturally occurring materials, which are specified by the designer must be of a suitable nature and quality for their intended use.	All main sewers to be constructed to adoptable standards. All SUDS to be constructed in accordance with the Typical details as provided.

Designing for maintenance considerations

Criteria	Designers Comments
S12 Pumping should only be used to facilitate drainage for those parts of the site where it is not reasonably practicable to drain water by gravity.	Surface Water Pump Stations are not proposed on this development. A Foul ONLY Pump Stations is provided only where it is not possible to drain foul by gravity.

Construction

Criteria	Designers Comments
S13 The mode of construction of any communication with an existing sewer or drainage system must be such that the making of the communication would not be prejudicial to the structural integrity and functionality of the sewerage or drainage system.	All Sewers are to be covered under a S104 agreement with United Utilities for future adoption. All sewers to be built to UU adoptable standards. Connection to the ordinary watercourse will require LLFA land drainage consent. Details of the works have been submitted to the LLFA and subsequently approved. No works to within 8m of an ordinary watercourse will be permitted without LLFA approval.

S14 Damage to the drainage system resulting from associated construction activities must be minimised and must be rectified before the drainage system is considered to be completed.	All Sewers are to be covered under a S104 agreement with United Utilities for future adoption. All sewers to be built to UU adoptable standards. A 12 month maintenance period is standard with all S104 sewers. Connection to the ordinary watercourse will require LLFA land drainage consent. Details of the works have been submitted to the LLFA and subsequently approved. No works to within 8m of an ordinary watercourse will be permitted without LLFA consent.

13. Condition 8 Conclusion

The drainage strategy shall accord with the approved Flood Risk Assessment and Drainage Appraisal (Ref:880500 R1 (03), dated March 2015, where amended by Betts Hydro Flood Risk Assessment and Sustainable Drainage Assessment ref: HYD068, dated March 2016) and shall demonstrate that the surface water run-off generated by the 1 in 100 year plus climate change critical storm shall not exceed the run-off from the undeveloped site should be limited to 8.3l/s/Ha (Greenfield Qbar).

The surface water drainage has been designed in accordance with the above flood risk assessment and flow rate for Phase 1 only, this FRA is found in Appendix E. Phases 2 & 3 have been designed in line with the phase specific FRA, located in Appendix F. The deviations from the flow rate is described and accepted within Section 3 of this report and Appendix G.

Prior to the commencement of development with a phase, the details of a scheme for surface water drainage and means of disposal for that phase, to accord with the Drainage Strategy approved and to include evidence of an assessment of site conditions,

Pre development topographical surveys were done and available in Appendix B. Phase specific site investigations were undertaken for the development, see Appendix C and D.

sustainable drainage principles, an assessment of the hydrological and hydro-geological context of the development,

The surface water drainage has been designed to mimic pre-development hydrology as described in Section 5 of this report and Appendix H.

management and maintenance and timescales for implementation, shall be submitted to and approved in writing by the Local Planning Authority. The scheme shall be implemented, maintained and managed in accordance with the approved details at all times thereafter.

Details of the management for the proposed sewers are located in Section 11 of this report and Appendix L.