LAND WEST OF SMITHY WOOD LANE

Flood Risk Assessment and Drainage Strategy prepared on behalf of Vernon Wentworth Nominee Trustees

March 2016




MILESTONE
TRANSPORT PLANNING

FLOOD RISK ASSESSMENT

Flood Risk Assessment and Drainage Strategy prepared on behalf of Vernon Wentworth Nominee Trustees

March 2016

MTP Ref: 13/061

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FIGURES

APPENDICES

1 INTRODUCTION

1.1.1 Milestone has been appointed by The Wentworth Nominee Trustees to produce a site specific Flood Risk Assessment (FRA) and drainage strategy for the proposed development site at Smithy Wood Lane, Dodworth, Barnsley. Figure 1 below shows the location plan for the site.

1.2 Scope

1.2.1 This report describes the existing site conditions, the development proposals and the implications of flooding on the site as required by National Planning Policy framework (NPPF) and its technical guidance. This report will consider the following:

- Development proposals
- Sources of flooding and flood defences
- Flooding extents, depth and climate change predictions
- Impact of flooding on the development
- Dangers presented by flooding
- Foul and surface water drainage strategy

1.2.2 This FRA has been produced in support of a planning application for residential development of new dwellings on land to the west of Smithy Wood Lane, Dodworth. This site currently is in agriculture use. The indicative site layout is included as drawing 13-061 in Appendix A.

1.2.3 This assessment will demonstrate the strategy for draining the site and that it will not be subject to flooding with a probability of 0.1% or a 1 in 1000 annual chance of river flooding. The proposed residential dwellings will therefore be free from flooding and a safe access can be provided from the site.

1.3 Proposed development

1.3.1 The planning application seeks approval for the consent for the erection of up to 36 dwellings with full details of the vehicular access.

2 SITE LOCATION

2.1.1 The site is located to the west of Smithy Wood Lane, in Dodworth. The site has residential properties to north, east and west with open fields to the south. Figure 1 below shows the location of the site.

Figure 1 - Location Map

2.2 Site Geology

2.2.1 The proposed development is sited on Pennine Middle Coal Measures Formation - Sandstone. Sedimentary Bedrock formed approximately 309 to 312 million years ago in the Carboniferous Period. Local environment previously dominated by swamps, estuaries and deltas.

2.2.2 There are no superficial deposits indicated above the bedrock on the British Geological Survey records.

3 SOURCES OF FLOODING

3.1 Fluvial/Tidal Flooding

3.1.1 Detailed flood information was requested from the Environment Agency (EA) for the site. The EA have confirmed the site is within flood zone 1. They do not hold information on flood levels across the site only flood extents which indicate the site is in zone 1. The Planning Practice Guidance - Flood Risk and Coastal Changes (England) defines the flood zones as follows:

- Zone 1: 'Low Probability' This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding (1%-0.1%)

- Zone 2: 'Medium Probability' – This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5%-0.1%) in any year.

- Zone 3a: 'High Probability' – This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

- Zone 3b: 'The Functional Floodplain' – This zone comprises land where water has to flow or be stored in times of flood. SFRAs should identify this Flood Zone (land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1%) flood, or at another probability to be agreed between the LPA and the Environment Agency, including water conveyance routes).

3.1.2 The site is within flood zone 1. This is defined as land assessed as having a less than 0.1% probability of river or sea flooding in any year. Figure 2 shows an extract from the Environment Agency flood mapping for flood zones 2 and 3. The site is not close to any river or sea therefore will not be subject to fluvial flooding with a probability of 0.1% or greater, or tidal flooding with a probability of 0.5%.

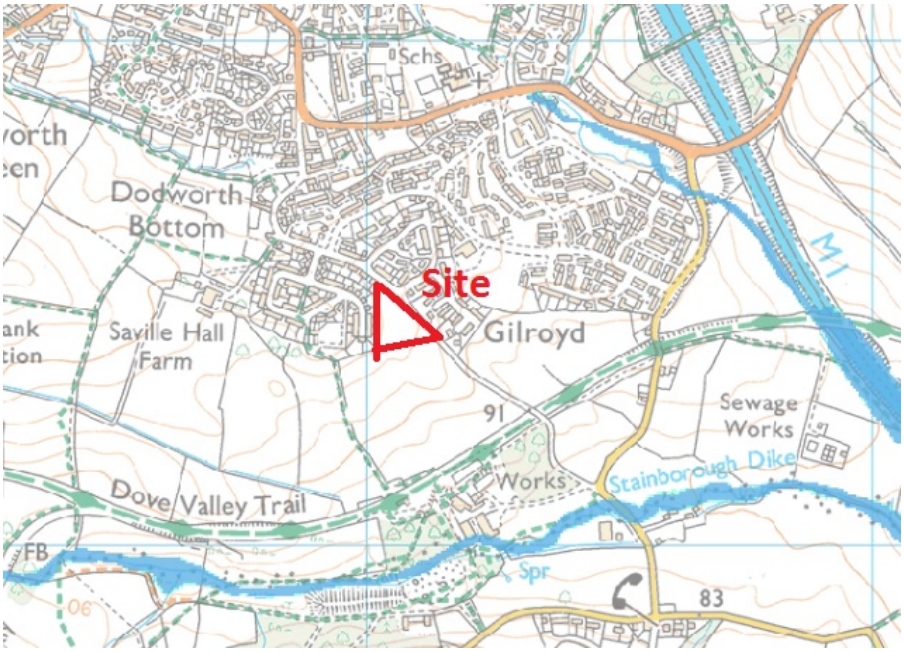

Figure 2 – Environment Agency Flood Map

3.1.3 The extent of flooding from an event with a probability of 1.0% or greater (zone3) is indicated on the above figure as dark blue and flood zone 2 in light blue.

3.1.4 The dark blue shaded areas in figure 2 above indicate areas at risk of flooding with a probability of 1.0% or greater (zone 3) and the light blue areas (zone 2).

3.2 Surface Water Flooding

3.2.1 There is no record of the site being subject to surface water flooding, the site is located to the south and downhill of a residential area. Given the nature of this residential area surface water runoff from this area is unlikely to reach the site as the majority of it will be intercepted by the surface water drainage network.

3.2.2 The Strategic Flood Risk Assessment (SFRA) for Barnsley Metropolitan Council shows that the site is not in a high flood risk area or has a history of surface water flooding. Figure 3 below shows an extract of the Environment Agency's surface water flooding map, which also indicates that the site is in a low risk area.

Figure 3 - Surface Water Flood Map

3.2.3 The dark blue shaded areas in figure 3 above indicate areas at high risk of surface water flooding and the light blue areas at less risk. The site is clear of the high and low risk area so the probability of the site being subject to surface water flooding is very low.

3.3 Groundwater Flooding

3.3.1 The site has not been subject to ground water flooding and is not shown as being at risk of flooding in the SFRA. The site is located on higher ground so any potential groundwater flooding is likely to occur to the south of the site and would not affect the proposed development. The EA's website shows the site in outside of any groundwater protection zones. Groundwater flooding is therefore highly unlikely to affect the proposed development.

3.4 Reservoir, Canal and sewer Flooding

3.4.1 The risk of reservoir flooding is considered to be very low, as the nearest reservoir is a considerable distance from the site and in the event of a failure it would have no impact on the development.

3.4.2 There are no canals or manmade water feature in the vicinity of the site that would cause flooding to the development.

3.4.3 There are no sewers that run through the site, the risk of flooding from surcharging sewers therefore is considered to be very low.

4 MODELLED FLOOD EVENTS AND CLIMATE CHANGE

4.1 Modelled Flood Levels

4.1.1 The Environmental Agency has confirmed they do not hold flood data for the site. The site is classified by the Environmental Agency as zone 1, having a risk of flooding with a probability of 0.1% or less.

4.1.2 This Assessment has considered changes in water level due to climate change, however as the proposed site is located some distance from flood zones 2 & 3 and well above the 1% probability flood level, when allowance for climate changes are factored in, this will not result in an increased risk of flooding on site. The site will still be some distance from flood zone 2 even when climate changes are taken in to in consideration.

5 FLOOD PROBABILITY AND LOCAL RESTRICTIONS

5.1 Flood probability

5.1.1 The Environment Agency's mapping indicates that the site lies outside of the projected flood plain for an event with a probability of 0.1%. When climate change has been factored into the flood levels the site is still some considerable distance above the 1 in 100 and 1 in 1000 year flood level plus climate change allowance. The SFRA also indicates the site has a probability of 0.1% or less risk of flooding.

5.1.2 It is therefore considered the site has a less than 0.1% probability of flooding (zone 1).

6 IMPACT OF FLOODING

6.1 Impact on Flood Waters

6.1.1 The proposed development is outside of flood zones 2 and 3 so it will not be subject to flooding with a probability of 0.1% or greater. There is no recorded fluvial flooding of the site. The development will therefore not have any impact on the flow of flood waters in the area.

6.2 Impact on Storage Volumes

6.2.1 The proposed development is outside of flood zone 2 and 3 and will therefore not result in the loss of flood storage for a flood event with a probability of 0.1% or greater. When increase in flood levels due to climate change are factored in, the site is still outside flood zone 2 and 3 so even in an extreme case the development will still not result in the loss of flood storage volume.

6.3 Flooding Impact on Development

6.3.1 The site is a considerable distance from the nearest source of fluvial flooding, there is no history of the site flooding in the past. The floor level of the proposed building will be set at existing ground level, and will therefore not be subject to flooding.

6.3.2 Flood waters from a 1% probability event, including allowances for climate change will not reach the site , there are no other sources of flooding that might impact the development and therefore it will not be at risk of flooding which a probability of 1.0% or greater including allowances for climate change.

6.4 Access From Site

6.4.1 As explained previously there are no records that the site has been subject to flooding in the past, it is unlikely that a 1% or greater probability event would cause flooding of the site, so a safe access along Smithy Wood Lane could be provided to and from the site at all times.

6.5 Residual Risk

6.5.1 Given the site is located in flood zone 1 and its elevation above flood zone 3. The residual risk is considered to be insignificant as the site is not at risk of flooding and a dry access can be provided at all times.

7 ONSITE DRAINAGE

7.1 Surface Water Drainage

7.1.1 The topographical survey for the site shows it falls from north to southeast. There is a level drop of approximately 12m from the north point around 114.90m AOD to 103.05m in the southeast corner of the site. The underlying ground of the site is formed of mudstone, to assess the suitability of soakaways for discharging surface water runoff from the site infiltration testing was undertaking.

7.1.2 Infiltration testing has been undertaken by Solmek Limited to inform this FRA, 3 tests were undertaken and the results of 2 of the tests indicated the ground would not be suitable for soakaways. Only one of the test returned an infiltration rate, the rate was not sufficient to allow the soakaways to empty within the required time.

7.1.3 Based on the infiltration testing the use of soakaways for disposal of surface water runoff from the development has been discounted. The limited infiltration rate means that soakaways would not meet the requirements of the building regulations. In the area where the higher infiltration results were obtained there may be the possibility of using permeable paving and this should be investigated further at the detailed design stage.

7.1.4 The use of infiltration techniques across the site are not practical for discharge of runoff from the site, the density of the development and falls across the site mean that the use of SWALEs and open basins are not practical. The only space available within the site that could accommodate a Swale or Open Basin is the open space in the centre. However this area is not suitable as there is a fall across it of over 1.5m, which would result in a very deep basin. The use of SWALEs would not be workable with such a fall as runoff would be transported too quickly across this area and risk flooding the southern section of the site.

7.1.5 There are no water courses or ditches within the proposed development site, however there is a ditch located to the south within the developer's land ownership. The ditch is located to the south of the site adjacent to a disused railway which now forms part of the national cycle network with the ditch formed on the southern boundary of the developers land ownership.

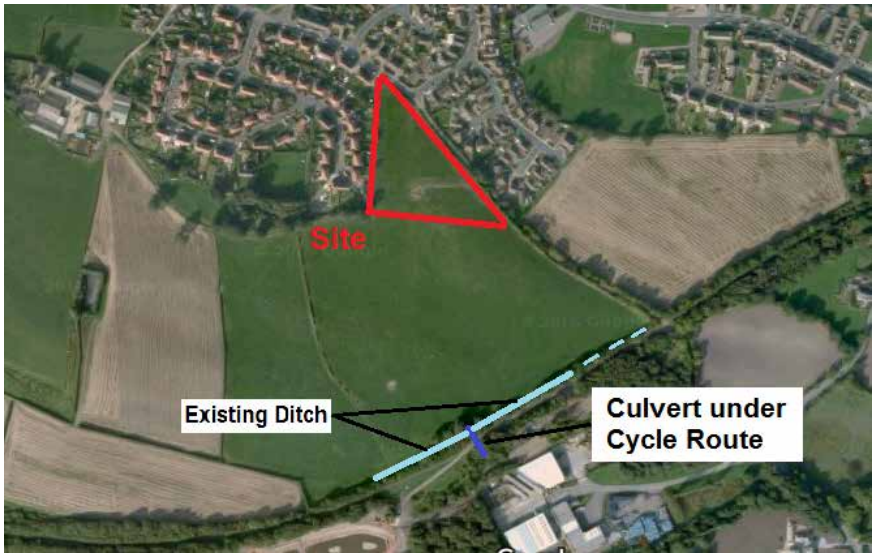

Figure 4 – Existing Ditch Network

7.1.6 The ditch network in the area is indicated in figure 4 above, along the northern side of the cycle route (old railway line) there are two ditches indicated in light blue falling to the culvert under the old line, the culvert is indicated in blue in figure 4.

7.1.7 A walk over of the site identified that the ditch to the east of the culvert most likely extended up to Smithy Wood Lane but over time it has filled with debris and only a shallow depression remains, this is indicted by a light blue dashed line in figure 4.

7.1.8 The proposed drainage strategy for the development is to connect to the existing ditch in the south, the existing ditch network will need to be cleaned out and re-profiled back to its original state to ensure it is fully operational. The site will be drained via a pipe along the western side of Smithy Wood Lane from the development to the existing ditch in the south, as indicated on drawing 13-061/FRA/01 in Appendix C. The drainage pipe route will be designed to avoid root areas from the trees along Smith Wood Lane

7.1.9 The flow from the development will be restricted back to the current greenfield runoff rate for the undeveloped site. The greenfield discharge rate for the site has been estimated at 6.2l/s based on IOH report 24, a copy of the calculations are include in Appendix B. The runoff from the buildings and roads will be collected via a series of drainage pipes within the estate, underground storage will be provided to attenuate the flows back to greenfield runoff.

7.1.10 The estimated storage requirements for the whole development is estimated at 191.2m^3. The tanks have been sized to cater for a 1in100 year storm event plus allowances for climate change. The storage will be provided across the site in the location indicated on the Drainage strategy plan in appendix C. A provisional network of drainage pipes is also indicated on the drainage strategy plan and will be developed further at the detailed design stage.

7.1.11 The storage requirement for the development will be provided in two attenuation tanks and a 1 metre diameter pipe. Locations of the storage features are indicated on drawing 13-061/FRA/01 in Appendix C. Appendix B contains the micro drainage calculations for the storage facilities.

7.1.12 The discharge off site will be controlled via the use of the hydrobrake in the manholes downstream of the attenuation facilities, pollution control measures will also be included to prevent contamination of the water course.

7.1.13 The final discharge to the ditch to the south will be via a new headwall to be constructed in the ditch with appropriate anti-scour protection. The existing ditch network to the south needs cleaning and the build-up of debris that has collected in the network over the years removed to bring them back to their full capacity.

7.2 Foul Drainage

7.2.1 The Sewer record drawings indicated the presence of a foul sewer in Smithy Wood Lane to the north of the site in the vicinity of the proposed site access. Given the 12m fall across the site from north to south it is impossible to provide a gravity connection to the adopted sewer in the north. The peak discharge rate from the properties on site have been estimated at 1.4l/s based on sewers for adoption.

7.2.2 The proposals are therefore to provide a pump station and storage to the south of the site and pump the foul discharges to the north to connect to the adopted foul sewer in Smithy Wood Lane, an indicative layout of pipes for the internal foul drainage and point of discharge to the sewer is indicated on the plan

8 SEQUENTIAL TEST

8.1.1 The principal of the sequential test is to assess locations and prioritise development to areas at less risk of flooding. NPPF and its technical guidance suggest that Regional Planning Bodies and Local Planning Authorities should ensure their regional spatial strategies include a broad consideration of flood risk.

8.1.2 The proposed development is located in a flood zone 1 which under NPPF is classified as a “low risk” area and suitable for all uses. The development will be a residential use which under NPPF is classed as a “more vulnerable” use and therefore acceptable development in flood zone 1.

8.1.3 The proposals therefore meet the sequential test to allocate development to sites at less risk of flooding.

9 SUMMARY AND CONCLUSION

9.1.1 The site is within flood zone 1 so it will not be subject to flooding from an extreme event with a probability of 0.1% or greater. The site will not present a restriction of flood waters or result in a loss of storage volumes nor will it suffer damage as a result of flooding.

9.1.2 A safe access can be provided at all times to an area within flood zone 1. Surface water discharge for the site will not be increased.

9.1.3 Adequate drainage provision will be provided onsite for the attenuation of surface water flows from the development to allow the discharge to be restrict back to the existing greenfield runoff rate, thereby ensuring that the proposed development will not increase the risk of surface water flooding in the area. Foul drainage will be pumped to the adopted sewer to the north.

9.1.4 The site is in a low flood risk area it will not be at risk of flooding or increase the risk of flooding in the area and therefor meets the requirements of the sequential test in NPPF to allocate development to areas at less risk of flooding.

9.1.5 For the above reason we do not believe the proposed development will have any impact on the flood plain or flow paths, the building will not be subject to flooding and we can see no reason why the site is not suitable for the development proposed.

APPENDIX A

13/061 – Proposed site layout

Smithy Wood Lane

Bradwell Avenue

Proposed dropped kerb crossover

1 P1 G1 3 BED
2 P2 G2 3 BED
3 P3 G3 3 BED
4 P4 G4 3 BED
5 P5 2 BED
6 P6 2 BED
7 P7 2 BED
8 P8 2 BED
9 P9 2 BED
10 P10 2 BED
11 P11 2 BED
12 P12 2 BED
13 P13 2 BED
14 P14 2 BED
15 G15 P15 4 BED
16 P16 G16 4 BED
17 P17 P18 G17 G18 3 BED 3 BED
18 19 P19 P20 G19 G20 3 BED 3 BED
20 21 4 BED P21 P22 G21 G22 4 BED
22 4 BED
23 4 BED
24 G23 G23 P23 P23
25 3 BED G25 3 BED G24 P25 P24
26 27 3 BED G27 3 BED G26 P27 P26
28 29 3 BED G29 3 BED G28 P29 P28
30 31 3 BED G31 3 BED G30 P31 P30
32 33 3 BED G33 3 BED G32 P33 P32
34 P34 G34 3 BED 3 BED
35 P35 G35 3 BED
36 4 BED P36 G36

Notes

Drawing Revisions

Rev	Date	Details

Client

Project
Smithy Wood Lane

Title
Proposed Layout

MILESTONE TRANSPORT PLANNING
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Guildford, Surrey, GU1 4QU
Tel: 01483 397888
web: www.milestonetp.co.uk

Status		Scale
		NS
Drawn	Checked	Date
Drawing Number		Revision
13-061/01		

APPENDIX B

Micro Drainage Output Results

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	110.066	0.246	3.1	49.1	O K
30 min Summer	110.145	0.325	3.1	64.9	O K
60 min Summer	110.223	0.403	3.1	80.6	O K
120 min Summer	110.291	0.471	3.1	94.2	O K
180 min Summer	110.318	0.498	3.1	99.6	O K
240 min Summer	110.326	0.506	3.1	101.3	O K
360 min Summer	110.322	0.502	3.1	100.4	O K
480 min Summer	110.312	0.492	3.1	98.4	O K
600 min Summer	110.299	0.479	3.1	95.8	O K
720 min Summer	110.285	0.465	3.1	93.0	O K
960 min Summer	110.255	0.435	3.1	86.9	O K
1440 min Summer	110.194	0.374	3.1	74.8	O K
2160 min Summer	110.113	0.293	3.1	58.7	O K
2880 min Summer	110.049	0.229	3.1	45.7	O K
4320 min Summer	109.967	0.147	3.0	29.3	O K
5760 min Summer	109.927	0.107	2.8	21.4	O K
7200 min Summer	109.912	0.092	2.4	18.3	O K
8640 min Summer	109.901	0.081	2.1	16.2	O K
10080 min Summer	109.894	0.074	1.9	14.8	O K
15 min Winter	110.096	0.276	3.1	55.2	O K
30 min Winter	110.186	0.366	3.1	73.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	115.731	0.0	50.2	18
30 min Summer	77.804	0.0	67.8	33
60 min Summer	49.937	0.0	87.9	62
120 min Summer	30.956	0.0	109.0	122
180 min Summer	23.058	0.0	121.9	182
240 min Summer	18.577	0.0	130.9	240
360 min Summer	13.656	0.0	144.4	314
480 min Summer	10.974	0.0	154.8	374
600 min Summer	9.254	0.0	163.1	434
720 min Summer	8.046	0.0	170.2	498
960 min Summer	6.447	0.0	181.9	634
1440 min Summer	4.709	0.0	199.2	896
2160 min Summer	3.432	0.0	218.4	1276
2880 min Summer	2.739	0.0	232.3	1620
4320 min Summer	1.989	0.0	252.7	2296
5760 min Summer	1.583	0.0	268.8	2992
7200 min Summer	1.325	0.0	281.2	3680
8640 min Summer	1.147	0.0	291.9	4408
10080 min Summer	1.015	0.0	301.2	5144
15 min Winter	115.731	0.0	56.3	18
30 min Winter	77.804	0.0	76.0	33

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Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	110.276	0.456	3.1	91.1	O K
120 min Winter	110.358	0.538	3.1	107.5	O K
180 min Winter	110.391	0.571	3.1	114.3	O K
240 min Winter	110.404	0.584	3.1	116.7	O K
360 min Winter	110.403	0.583	3.1	116.7	O K
480 min Winter	110.389	0.569	3.1	113.8	O K
600 min Winter	110.373	0.553	3.1	110.6	O K
720 min Winter	110.354	0.534	3.1	106.9	O K
960 min Winter	110.307	0.487	3.1	97.3	O K
1440 min Winter	110.209	0.389	3.1	77.7	O K
2160 min Winter	110.085	0.265	3.1	53.1	O K
2880 min Winter	109.999	0.179	3.0	35.8	O K
4320 min Winter	109.922	0.102	2.7	20.4	O K
5760 min Winter	109.902	0.082	2.2	16.4	O K
7200 min Winter	109.891	0.071	1.8	14.2	O K
8640 min Winter	109.884	0.064	1.6	12.8	O K
10080 min Winter	109.879	0.059	1.4	11.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	49.937	0.0	98.5	62
120 min Winter	30.956	0.0	122.2	120
180 min Winter	23.058	0.0	136.6	178
240 min Winter	18.577	0.0	146.7	234
360 min Winter	13.656	0.0	161.8	342
480 min Winter	10.974	0.0	173.4	436
600 min Winter	9.254	0.0	182.8	472
720 min Winter	8.046	0.0	190.7	550
960 min Winter	6.447	0.0	203.7	696
1440 min Winter	4.709	0.0	223.1	968
2160 min Winter	3.432	0.0	244.6	1340
2880 min Winter	2.739	0.0	260.2	1672
4320 min Winter	1.989	0.0	283.1	2268
5760 min Winter	1.583	0.0	301.0	2992
7200 min Winter	1.325	0.0	314.9	3672
8640 min Winter	1.147	0.0	327.0	4408
10080 min Winter	1.015	0.0	337.5	5144

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.236

Time (mins) From:	To:	Area (ha)
0	4	0.236

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Model Details

Storage is Online Cover Level (m) 111.820

Tank or Pond Structure

Invert Level (m) 109.820

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	200.0	0.800	200.0	0.801	0.0

Hydro-Brake Optimum® Outflow Control

Unit Reference	MD-SHE-0086-3100-0800-3100
Design Head (m)	0.800
Design Flow (l/s)	3.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	86
Invert Level (m)	109.820
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	3.1
Flush-Flo™	0.236	3.1
Kick-Flo®	0.514	2.5
Mean Flow over Head Range	-	2.7

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.6	1.200	3.7	3.000	5.7	7.000	8.5
0.200	3.1	1.400	4.0	3.500	6.1	7.500	8.8
0.300	3.0	1.600	4.2	4.000	6.5	8.000	9.1
0.400	2.9	1.800	4.5	4.500	6.9	8.500	9.3
0.500	2.6	2.000	4.7	5.000	7.2	9.000	9.6
0.600	2.7	2.200	4.9	5.500	7.6	9.500	9.8
0.800	3.1	2.400	5.1	6.000	7.9		
1.000	3.4	2.600	5.3	6.500	8.2		

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Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 103 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	105.955	0.505	0.0	6.2	6.2	34.5	O K
30 min Summer	106.056	0.606	0.0	6.2	6.2	44.2	O K
60 min Summer	106.145	0.695	0.0	6.2	6.2	53.0	O K
120 min Summer	106.239	0.789	0.0	6.2	6.2	62.6	O K
180 min Summer	106.288	0.838	0.0	6.2	6.2	65.7	O K
240 min Summer	106.293	0.843	0.0	6.2	6.2	65.9	O K
360 min Summer	106.255	0.805	0.0	6.2	6.2	64.0	O K
480 min Summer	106.217	0.767	0.0	6.2	6.2	60.3	O K
600 min Summer	106.190	0.740	0.0	6.2	6.2	57.6	O K
720 min Summer	106.169	0.719	0.0	6.2	6.2	55.5	O K
960 min Summer	106.137	0.687	0.0	6.2	6.2	52.2	O K
1440 min Summer	105.976	0.526	0.0	6.2	6.2	36.6	O K
2160 min Summer	105.575	0.125	0.0	5.1	5.1	6.7	O K
2880 min Summer	105.549	0.099	0.0	4.0	4.0	5.2	O K
4320 min Summer	105.538	0.088	0.0	3.4	3.4	4.6	O K
5760 min Summer	105.536	0.086	0.0	3.3	3.3	4.5	O K
7200 min Summer	105.536	0.086	0.0	3.3	3.3	4.5	O K
8640 min Summer	105.535	0.085	0.0	3.3	3.3	4.4	O K
10080 min Summer	105.535	0.085	0.0	3.2	3.2	4.4	O K
15 min Winter	106.004	0.554	0.0	6.2	6.2	39.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	115.731	0.0	184.2	17
30 min Summer	77.804	0.0	197.7	32
60 min Summer	49.937	0.0	213.1	62
120 min Summer	30.956	0.0	229.3	122
180 min Summer	23.058	0.0	239.1	174
240 min Summer	18.577	0.0	246.0	200
360 min Summer	13.656	0.0	256.3	268
480 min Summer	10.974	0.0	264.2	338
600 min Summer	9.254	0.0	270.6	416
720 min Summer	8.046	0.0	276.0	494
960 min Summer	6.447	0.0	284.9	644
1440 min Summer	4.709	0.0	298.2	824
2160 min Summer	3.432	0.0	312.5	1100
2880 min Summer	2.739	0.0	323.1	1468
4320 min Summer	1.989	0.0	339.0	692
5760 min Summer	1.583	0.0	350.6	672
7200 min Summer	1.325	0.0	360.2	680
8640 min Summer	1.147	0.0	368.5	664
10080 min Summer	1.015	0.0	375.8	640
15 min Winter	115.731	0.0	188.9	17

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Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	106.120	0.670	0.0	6.2	6.2	50.6	O K
60 min Winter	106.221	0.771	0.0	6.2	6.2	60.8	O K
120 min Winter	106.398	0.948	0.0	6.2	6.2	71.2	O K
180 min Winter	106.470	1.020	0.0	6.2	6.2	74.5	O K
240 min Winter	106.469	1.019	0.0	6.2	6.2	74.4	O K
360 min Winter	106.430	0.980	0.0	6.2	6.2	72.6	O K
480 min Winter	106.342	0.892	0.0	6.2	6.2	68.4	O K
600 min Winter	106.270	0.820	0.0	6.2	6.2	64.7	O K
720 min Winter	106.228	0.778	0.0	6.2	6.2	61.5	O K
960 min Winter	106.168	0.718	0.0	6.2	6.2	55.4	O K
1440 min Winter	105.905	0.455	0.0	6.2	6.2	30.1	O K
2160 min Winter	105.568	0.118	0.0	4.9	4.9	6.3	O K
2880 min Winter	105.544	0.094	0.0	3.8	3.8	4.9	O K
4320 min Winter	105.539	0.089	0.0	3.5	3.5	4.6	O K
5760 min Winter	105.537	0.087	0.0	3.4	3.4	4.6	O K
7200 min Winter	105.537	0.087	0.0	3.4	3.4	4.5	O K
8640 min Winter	105.536	0.086	0.0	3.3	3.3	4.5	O K
10080 min Winter	105.535	0.085	0.0	3.3	3.3	4.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	77.804	0.0	204.0	32
60 min Winter	49.937	0.0	221.2	60
120 min Winter	30.956	0.0	239.3	118
180 min Winter	23.058	0.0	250.3	172
240 min Winter	18.577	0.0	258.0	220
360 min Winter	13.656	0.0	269.6	276
480 min Winter	10.974	0.0	278.4	360
600 min Winter	9.254	0.0	285.6	446
720 min Winter	8.046	0.0	291.7	530
960 min Winter	6.447	0.0	301.6	694
1440 min Winter	4.709	0.0	316.6	834
2160 min Winter	3.432	0.0	332.5	792
2880 min Winter	2.739	0.0	344.4	692
4320 min Winter	1.989	0.0	362.2	624
5760 min Winter	1.583	0.0	375.3	688
7200 min Winter	1.325	0.0	385.9	688
8640 min Winter	1.147	0.0	395.2	688
10080 min Winter	1.015	0.0	403.4	680

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.180

Time (mins) From:	To:	Area (ha)
0	4	0.180

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Model Details

Storage is Online Cover Level (m) 107.450

Complex Structure

Tank or Pond

Invert Level (m) 105.450

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	50.0	0.800	50.0	0.801	0.0

Pipe

Diameter (m) 1.050 Length (m) 50.000
Slope (1:X) 100.000 Invert Level (m) 105.450

Hydro-Brake Optimum® Outflow Control

Unit Reference	MD-SHE-0116-6200-1050-6200
Design Head (m)	1.050
Design Flow (l/s)	6.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	116
Invert Level (m)	105.450
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.050	6.2
Flush-Flo™	0.313	6.2
Kick-Flo®	0.677	5.0
Mean Flow over Head Range	-	5.4

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)
0.100	4.1	1.000	6.0	2.400	9.1	5.500	13.5
0.200	6.0	1.200	6.6	2.600	9.4	6.000	14.1
0.300	6.2	1.400	7.1	3.000	10.1	6.500	14.6
0.400	6.1	1.600	7.5	3.500	10.9	7.000	15.1
0.500	5.9	1.800	7.9	4.000	11.6	7.500	15.6
0.600	5.6	2.000	8.3	4.500	12.3	8.000	16.1
0.800	5.4	2.200	8.7	5.000	12.9	8.500	16.6

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Hydro-Brake Optimum® Outflow Control

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
9.000	17.1	9.500	17.5				

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APPENDIX C

Proposed foul and surafce water layout

Notes

Drawing Revisions

Rev	Date	Details

Client

Project

Smithy Wood Lane

Title

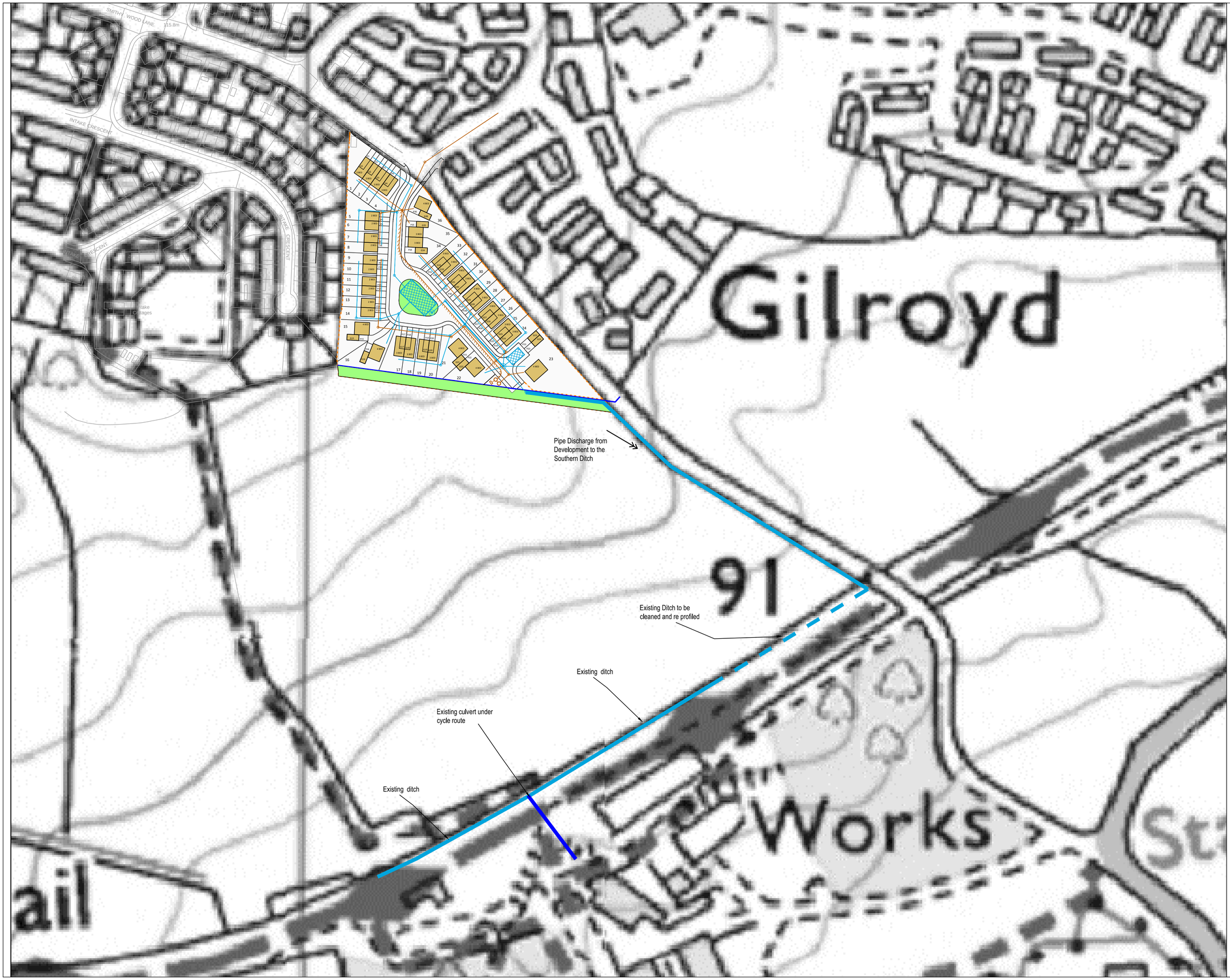
Drainage strategy
Proposed foul, surface water layout

MILESTONE TRANSPORT PLANNING
Heritage House, 7 Wey Court, Mary Road
Guildford, Surrey, GU1 4QU
Tel: 01483 397888
web: www.milestonetp.co.uk

Status	Scale
Approval	1:500

Drawn	Checked	Date
NJ	RS	02/12/2015

Drawing Number	Revision
13- 061/FRA/01	



Notes

Drawing Revisions

Rev	Date	Details

Client

Project

Smithy Wood Lane

Title

Proposed Route of
Discharge Outfall From Site

MILESTONE TRANSPORT PLANNING
Heritage House, 7 Wey Court, Mary Road
Guildford, Surrey, GU1 4QU
Tel: 01483 397888
web: www.milestonetp.co.uk

Status	Scale
Approval	1:500

Drawn	Checked	Date
NJ	RS	11/03/2016

Drawing Number	Revision
13- 061/FRA/02	