

Nutrient Neutrality Assessment and Mitigation Strategy (NNAMS)

Brick Hill Farm, Warminster

Reference: 2500357-ENV-S1-SW-TR-E-0001

Date: 05/11/2025

 **Enviren**

DOCUMENT PRODUCTION RECORD

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REPORT REFENCE:	2500357-ENV-S1-SW-TR-E-0001
DOCUMENT STATUS:	First issue

DOCUMENT REVISION RECORD

Issue	Date	Author	Revision Details
1.1	05/11/2025	Chang Gao, PhD	First issue

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Executive Summary

This report has been compiled for the support of the development of nine dwellings along with associated infrastructure (Grid reference: ST 86378 46144).

This report demonstrates that the development will achieve Nutrient Neutrality through the implementation of Sustainable Drainage Systems (SuDS) and the acquisition of credits through a third party marketplace.

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1. Introduction

- 1.1. This report has been compiled for the support of nine dwellings at Brick Hill Farm, Warminster (Grid reference: ST 86378 46144). The proposals are for nine dwellings along with associated infrastructure. This report demonstrates that through the implementation of Sustainable Drainage Systems (SuDS) and the acquisition of credits through a third party marketplace, the development will achieve Nutrient Neutrality. The site is approximately 0.440 Hectares when considering the areas outlined in the site plan.
- 1.2. The existing site currently consists of grazing land. The construction of the new dwellings would result in an increase in phosphorus discharging into the surrounding water network due to foul water and surface water discharge from the proposed dwellings; however, through the implementation of Sustainable Drainage Systems (SuDS) and the acquisition of credits through a third party marketplace, the development will achieve nutrient neutrality (see **Appendix 1**).

Table 1.1 – Site Specific Information	
Category	Site Specific Information
Site name	Brick Hill Farm, Warminster
Site location	Warminster, Wiltshire
Grid reference	ST 86378 46144
Local Authority	
Overall site area	0.440 Hectares
Nutrient(s) considered	Phosphorus
Catchment (Surface Water)	River Avon
Catchment (Foul Water)	River Avon
Receiving Wastewater Treatment Works (WwTW)	13325 – Warminster
Existing land use	Lowland grazing
Proposed land use	Residential Urban Land

2. Local Context to Nutrient Neutrality

Mitigation and the Local Nutrient Mitigation Fund

- 2.1. Wiltshire Council has been awarded £9.8m of grant funding to aid the delivery of nutrient mitigation within the River Avon catchment. This grant enables mitigation projects to be identified and delivered, and for mitigation credits to be sold. Third party mitigation providers are also beginning to deliver measures in the catchment of the River Avon.
- 2.2. Within this catchment developers will take responsibility for securing nutrient mitigation for their development proposal. Mitigation can be secured:
 - on-site or through land in the ownership of the developer
 - through an agreement with an accredited third party mitigation provider
 - through a Wiltshire Council nutrient mitigation scheme
- 2.3. In all instances, the mitigation will need to be secured in perpetuity through the necessary legal agreements or planning condition.

Decision making in the River Avon catchment

- 2.4. Within the River Avon catchment, there is a need for qualifying developments to demonstrate neutrality for phosphorus. Qualifying development includes:
 - any form of development that increases overnight stays within the catchment
 - some commercial development that either attract large numbers of people into the catchment (such as a tourist attraction) or where there is a significant discharge into the catchment for example from an industrial process
 - development which results in the intensification of agricultural practices, such as an additional cattle barn
- 2.5. Development that increases overnight stays in the catchment may comprise permanent residential development, gypsy and traveller development, care homes, nursing homes, tourist accommodation including both permanent and temporary campsites and hotels.

3. Background Information

Site Location

- 3.1. The site is located 1.540 kilometres northwest of Warminster and around 5.210 kilometres southeast of Chapmanslade. The exact location of the site can be found in **Figure 3.1**:

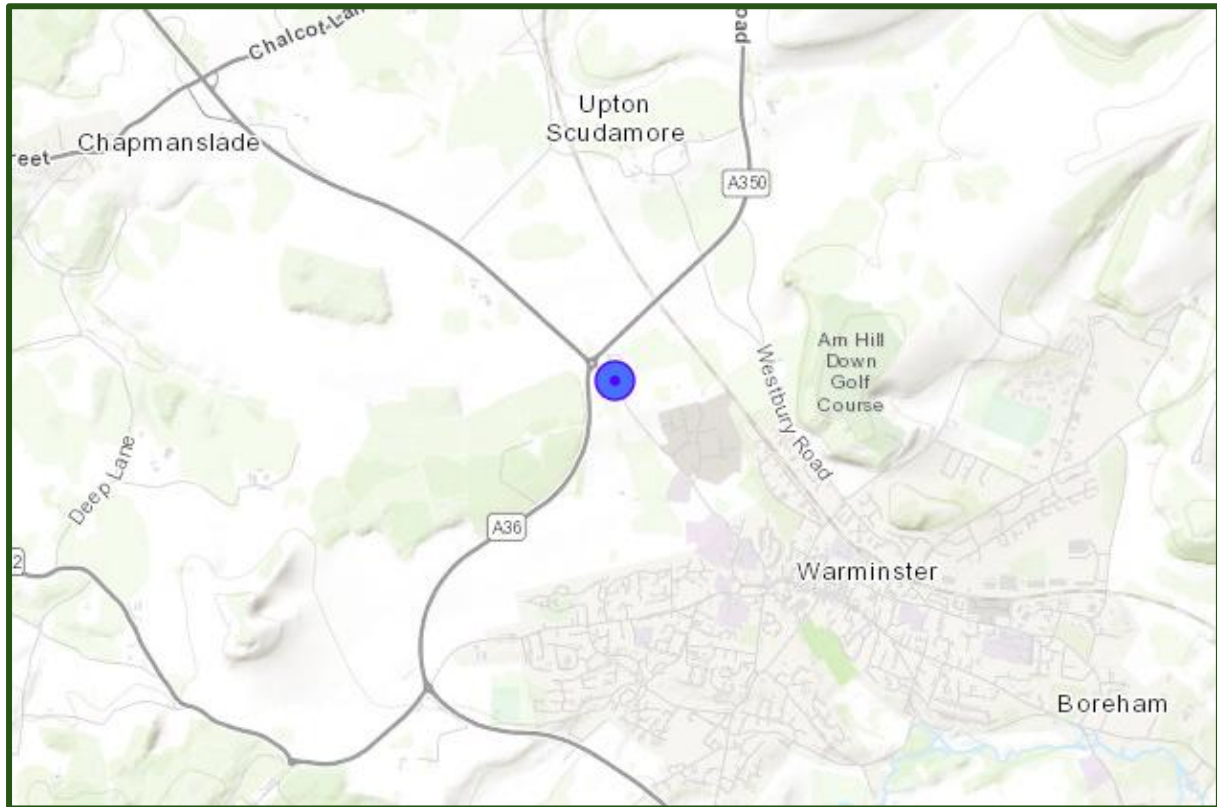


Figure 3.1 – Site Location

Outline Site Hydrology

- 3.2. Interrogation of local topographical information around the development parcel identifies that runoff from the site flows southeast towards The Were (see **Figure 3.2**), then the flow continues running southeast, discharging into River Wylfe, which finally joins the River Avon. The River Avon continues in a southerly direction until it discharges into the sea.



Figure 3.2 – SCALGO Topographic Data – Site Hydrology

- 3.3. Statutory Undertaker mapping indicates that there are foul sewers around the site parcel (see **Appendix 2**).
- 3.4. The development sits within the hydrological catchment of the River Avon SAC as indicated in **Figure 3.3**.



Figure 3.3 – Hydrological Catchment Plan

Existing Site Description

- 3.5. The area to be developed currently constitutes grazing land. The site is approximately 0.440 hectares in size when considering the areas in the site plan (see **Appendix 3**). The site parcel sits on the east of Bath Road and is bordered to the north by agricultural land, to the south by residential properties, and to the east by urban land.



Figure 3.4 – Aerial Reconnaissance Photography

4. Development Proposals

- 4.1. The development is to consist of nine dwellings along with associated infrastructure.

Foul Water Drainage

- 4.2. The foul water from the proposed dwellings shall discharge to the main sewers, where it will then be treated at Warminster WwTW (see **Appendix 2**). The applicant will commit to a lower water usage of 95l/p/d as per Wiltshire Council Guidance (Wiltshire Council's Local Plan Pre-Submission Draft 2020-2038). This is evidenced in **Appendix 4**.

Surface Water Drainage

- 4.3. The discharge of surface water from the site shall be discharged to adjacent surface water drains, after significant onsite treatment through SuDS. The proposed SuDS features comprise porous paving with diffuser boxes connected to the diffuser downpipes from the roofs (Plots 2-8), and a combination of porous paving and retention basins located to the south of the dwellings (Plots 1 and 9) (see **Appendix 3**).
- 4.4. Maintenance requirements of the SuDS features can be found in **Appendix 5** with measures based on the associated schedules contained in CIRIA C753 and CIRIA 808. SuDS considerations outlined in CIRIA C808 are reviewed in **Appendix 6**. The design life for the SuDS measures are 100 years and will all remain in perpetuity.

**Table 4.1 – Phosphorus Removal Efficiency of Various SuDS Components
(as per CIRIA C808)**

SuDS Component	Swale	Detention basin	Retention basin	Pond	Floating wetland	Bioretention zone	Tree pit	Filter strip	Filter drain	Willow bed	Permeable pavement	Vortex grit separator	Oil water separator	Stormwater filter	Granular media	Rainwater capture
Particulate Phosphorus Removal (%)	28	28	28	39	39	44	44	22	22	55	39	28	28	44	44	55
Dissolved Phosphorus Removal (%)	0*	5	23	23	TBC	0*	0*	0*	0*	45	0*	0*	0*	41		45
Total Phosphorus Removal [average] (%)	28	33	51	62	≥39	44	44	22	22	100	39	28	28	≤85	≤85	100

*Can be increased providing specific, referenced media is used.

- 4.5. The phosphorus removal efficiencies of the onsite treatment trains are outlined in **Table 4.1**. As per CIRIA C808, the particulate phosphorus removal of the SuDS components is already pre-weighted to accommodate the proportion of Total Phosphorus (TP) that is in solid form (55%) and Phosphorus that is in soluble form (45%).

Table 4.2 – Total Phosphorus Removal Percentage of Treatment Train

Treatment Train	Phosphorus Removal Efficiency of SuDS Component (Average between Dissolved and Particulate Phosphorus)				Cumulative Removal**		Calculated Phosphorus Removal Efficiency
	Permeable Paving		Retention Basin				
	PP	DP	PP	DP	PP	DP	
Treatment Train A for Plots 2-8: Permeable Paving	39	N/A	N/A	N/A	39	N/A	39
Treatment Train B for Plots 1 and 9: Permeable Paving + Retention basin	39	N/A	14	23	41.24	23	64.24
Mean Phosphorus Removal of Onsite Treatment Trains							51.62
100% Removal Considered		50% Removal Considered			Not Applicable		

- 4.6. The methodology for calculating the values in the proposed treatment trains can be found in **Appendix 7** and is based on influent concentrations and effluent concentrations from the preceding component.

5. Development Nutrient Calculator Calculations

- 5.1. The direct output of the Natural England Budget Calculator can be found in **Appendix 1**. This section shall outline the observations made on the site and shall discuss the results generated by the Natural England Budget Calculator. The figures for the inputs utilised in this section can be found in the **Figures** section to the rear of the report.

Table 5.1 – Development Nutrient Budget Calculations		
Stage 1 – Foul Water Arisings from dwellings		
Number of dwellings	9	
Average occupancy rate	2.4	
Water usage	95	
Wastewater treatment works	Warminster WwTW	
Wastewater treatment works TP permit (mg/litre)	0.50 (Pre-LURA) 0.25 (Post-LURA)	
Annual wastewater TP load	+0.34 kg/year (Pre-LURA) +0.17 kg/year (Post-LURA)	
Stage 2 – Existing Land Use		
Catchment	River Avon	
Soil drainage type	Freely Draining	
Annual average rainfall (mm)	900.1-950	
Within Nitrate Vulnerable Zone	Yes	
Former Land Use	Land Use	Area (hectares)
	Lowland	0.440
Annual nutrient export (kg TP)	-0.05 kg/year	
Stage 3 – Proposed Land Use		
Proposed Land Use	Land Use	Area (hectares)
	Residential Urban	0.390
	Greenspace	0.050
SuDS removal efficiency	51.62 % (0.390 hectares)	
Annual nutrient export (kg TP)	+0.35 kg/year	
Stage 4 – Final Nutrient Budget		
The total annual nutrient load generated	+0.77 kg/year (Pre-LURA) +0.56 kg/year (Post-LURA)	

6. Mitigation

- 6.1. The development shall achieve nutrient neutrality through the acquisition of credits through a third party marketplace. The credits will be acquired for the Pre-LURA limits, at 0.77 kg/year.

7. Conclusion

- 7.1. As can be seen in this report, the nutrient arisings associated with the development have been extensively considered, along with off-site and on-site mitigation methods.
- 7.2. The applicant will purchase nutrient neutrality credits to offset the increase in nutrients from the development. The applicant shall achieve Nutrient Neutrality through the proposals and therefore nutrient arisings should not prevent planning approval.

Figures

For convenience – press “Alt + Left Arrow” to return to the section of the report



Figure 1 - Soil Drainage Type

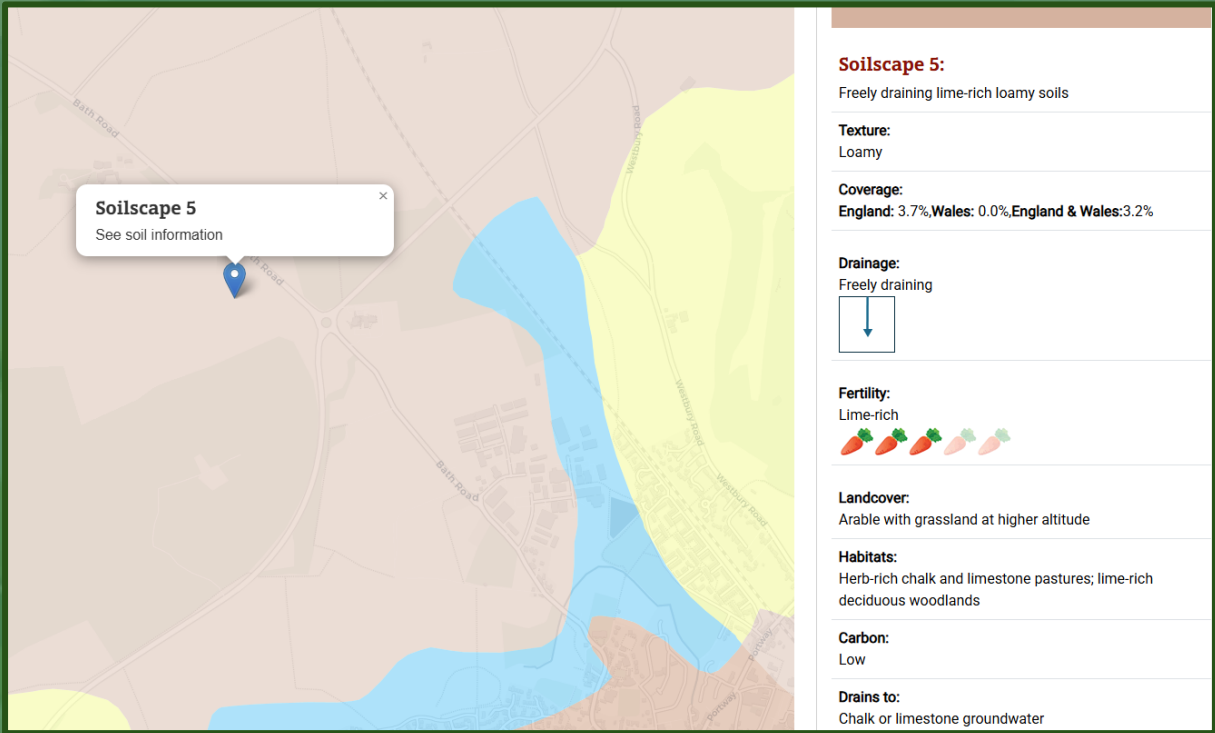


Figure 2 - Annual Average Rainfall

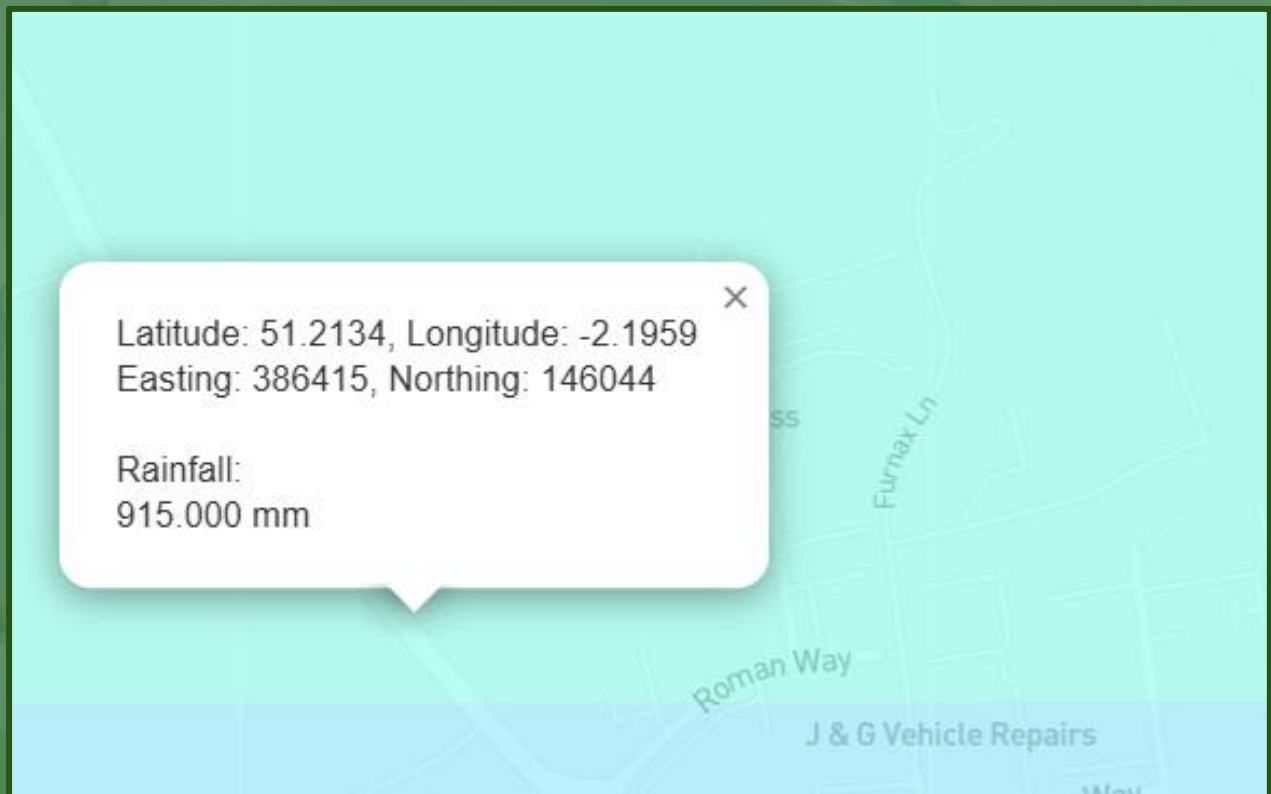
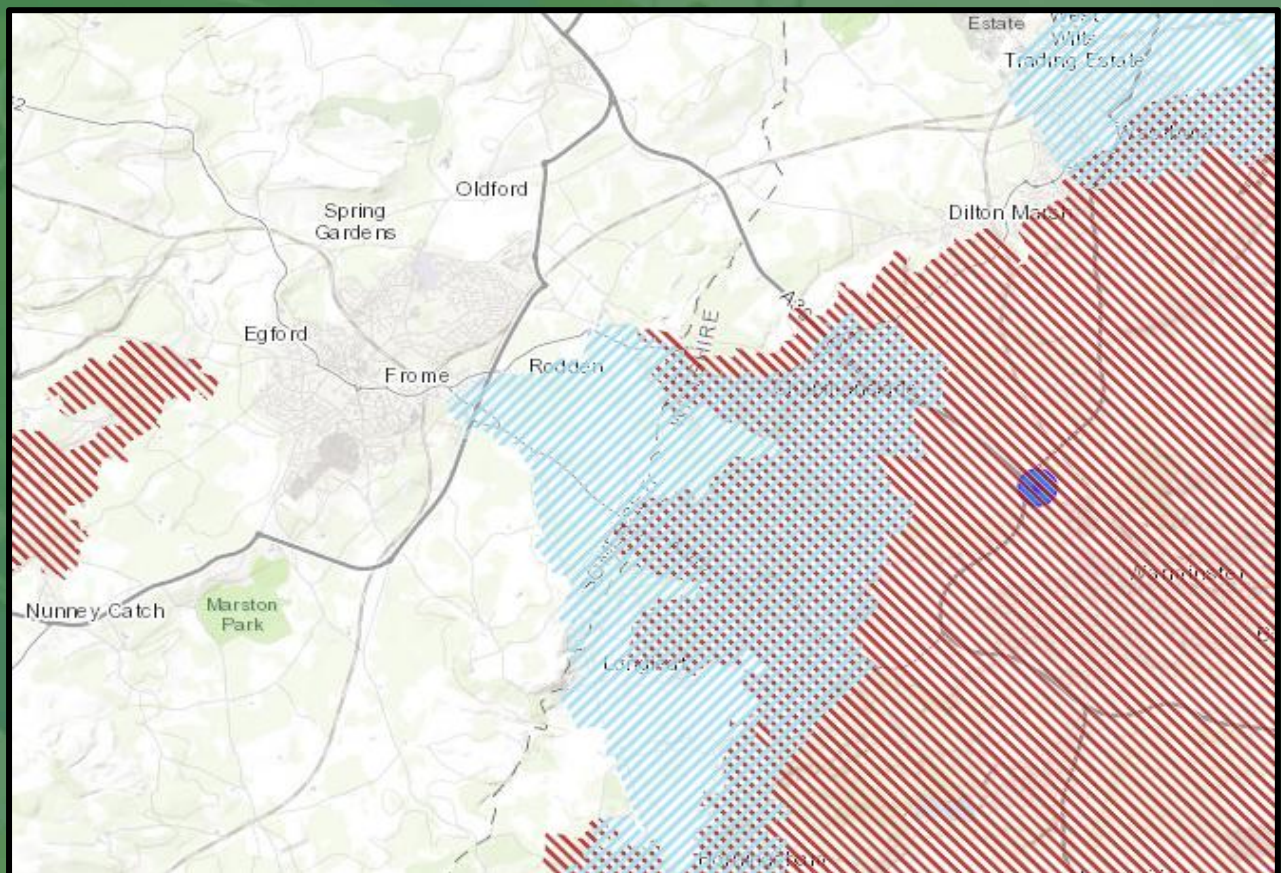


Figure 3 - Nitrate vulnerable zone (NVZ)



Appendix 1

Development Nutrient Budget Calculations

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Nutrients from wastewater

This sheet contains 2 tables. The tables are separated by a heading, which describes the following table.

Note: You will need to fill in cells B5 to B9 in the first table 'Water infrastructure information'. Cells B10 is automatically calculated and will state '0.00' unless the user inputs have been entered. Cells A11 to A12 and B11 to B12 are automatically generated and will state 'Not applicable' depending on the inputs to cells B5 and B9. You may need to fill in cell C10 depending on the information you entered in cell B9. Cells C5 to C9 and cells C11 to C12 are intentionally blank cells. You do not need to fill in any cells in the second table 'Final calculation of nutrient load from wastewater'. Cells B16 to B18 are automatically calculated and will state '0.00' unless the user inputs have been entered to the first table 'Water infrastructure information'. Cells A19 to A22, cells B20 and B22 are automatically generated and will state 'Not applicable' depending on the user inputs to the first table 'Water infrastructure information'. Cell B15, cell B19 and cell B21 are intentionally blank cells.

How to fill in the table 'Water infrastructure information'

Cell B5: Enter the date of first occupancy.

Cell B6: Enter the average occupancy rate of the development. The default rate is 2.4, this should not be edited without sufficient evidence.

Cell B7: Enter the water usage. This value should be kept at 120 unless other efficiency measures are used.

Cell B8: Enter the total number of dwellings or units that will be within the development site as of the project completion date.

Cell B9: Choose the receiving wastewater treatment works (WwTW) from the dropdown list.

If you select 'Package Treatment Plant user defined' or 'Septic Tank user defined', you must enter their certified value of total phosphorus (TP) in cell C10. Otherwise the default values will be used in the calculation of the nutrient load associated with wastewater.

Nutrient permits may be changing for the WwTW you select, from 01/01/2025, or 01/04/2030. If the date of first occupancy is in-between changing permit dates, multiple permit limits may be automatically generated in cells B10 to B12. If applicable, up to 3 values for the nutrient loading associated with wastewater will be presented in cell B18, B20 or B22.

Water infrastructure information

Description of required information	Data entry column - user inputs required	Additional data entry column - user inputs may be required
Date of first occupancy (dd/mm/yyyy):		
Average occupancy rate (people/dwelling or people/unit):	2.40	
Water usage (litres/person/day):	95	
Development proposal (dwellings/units):	9	
Wastewater treatment works:	Warminster WwTW	
Current wastewater treatment works P permit (mg TP/litre):	1.00	
Post 2025 WwTW P permit (mg TP/litre):	0.5	
Post 2030 WwTW P permit (mg TP/litre):	0.25	

Final calculation of nutrient load from wastewater

Description of values generated	Values generated
Post-2030 wastewater nutrient Loading	
Additional population (people):	21.60
Wastewater by development (litres/day):	2052.00
Annual wastewater TP load (kg TP/yr):	0.17
Pre-2030 wastewater nutrient loading	
Annual wastewater TP load (kg TP/yr):	0.34
Pre-2025 wastewater nutrient loading	
Annual wastewater TP load (kg TP/yr):	0.67

Nutrients from current land use

This sheet contains 2 tables. The tables are separated by a heading, which describes the following table.

Note: You will need to fill in cells B5 to B8 in the first table 'Current land use information'. You will need to fill in cells A11 to A27, and B11 to B27 in the second table 'Current land uses'. Cells B28, C11 to C28 are automatically calculated and will state '0.00' unless the user inputs have been entered. Cells D11 to D27 are automatically generated and will state 'Not applicable' depending on automatically generated data in cells C11 to C27. Row 28 is a Total Row. The Total Row states 'Totals:' in cell A28 and automatically calculates the total sum of cells B11 to B27 in cell B28 and C11 to C27 in cell C28. Cell D28 is intentionally blank.

How to fill in the table 'Current land use information'

Cell B5: Choose the operational catchment the site is located within from the dropdown list.

Cell B6: Choose the soil drainage type associated with the predominant soil type within the development site from the dropdown list.

Cell B7: Choose the annual average rainfall the development will receive from the dropdown list. If the rainfall volume is not on the list, select the nearest value.

Cell B8: Choose whether the development is in a nitrate vulnerable zone (NVZ) from the dropdown list.

How to fill in the table 'Current land uses'

Cell A11-A27: Choose the existing (pre-development) land use type(s) from the dropdown list. Cells B11-B27: Enter the area in hectares of each land use type.

The nutrient load from current land uses is shown in cells C11-C27 for total phosphorus (TP). The total nutrient load from current land uses is shown in cell C28 for TP.

Current land use information

Description of required information	Data entry column - user inputs required
Operational catchment:	Avon Hampshire
Soil drainage type:	Freely draining
Annual average rainfall (mm):	900.1 - 950
Within nitrate vulnerable zone (NVZ):	Yes

Current land uses

Existing land use type(s) - user inputs required	Area (ha) - user inputs required	Annual phosphorus export (kg TP/yr)	Notes on data
Lowland	0.44	0.05	Not applicable
		0.00	Not applicable
		0.00	Not applicable
		0.00	Not applicable
		0.00	Not applicable
		0.00	Not applicable
		0.00	Not applicable
		0.00	Not applicable
		0.00	Not applicable
		0.00	Not applicable
		0.00	Not applicable
		0.00	Not applicable
		0.00	Not applicable
		0.00	Not applicable
		0.00	Not applicable
		0.00	Not applicable
		0.00	Not applicable
		0.00	Not applicable
Totals:	0.44	0.05	

Nutrients from future land use

This sheet contains one table.

Note: You will need to fill in cells A5 to A21 and B5 to B21. Cells B22 and C5 to C22 are automatically generated calculations and will state '0.00' unless the user inputs have been entered. Row 22 is a Total Row. The Total Row states 'Totals:' in cell A22 and automatically calculates the total sum of cells B5 to B21 in cell B22 and C5 to C21 in cell C22.

How to fill in the table 'Future land uses'

Cells A5-A21: Choose the future (post-development) land use type(s) of landcover present on the new site from the dropdown list
Cells B5-B21: Enter the area in hectares of each land use type.

The nutrient load from future land uses is shown in cells C5 to C21 for total phosphorus (TP).

The total nutrient load from future land uses is shown in cell C22 for TP.

Future land uses

New land use type(s) - user inputs required	Area (ha) - user inputs required	Annual phosphorus export (kg TP/yr)
Residential urban land	0.39	0.72
Greenspace	0.05	0.00
		0.00
		0.00
		0.00
		0.00
		0.00
		0.00
		0.00
		0.00
		0.00
		0.00
		0.00
		0.00
		0.00
		0.00
		0.00
		0.00
		0.00
		0.00
		0.00
Totals:	0.44	0.72

Final nutrient budgets

This worksheet contains one table. This table is automatically populated using the outputs from the previous worksheets.

Note: You do not need to fill in any cells in the table.
Cells B5 to B8 and cells B10 are automatically calculated and will state '0.00' unless the user inputs have been entered to all of the required worksheets.
Cells A11 to A14, cell B12 and cell B14 are automatically generated and will state 'Not applicable' depending on the user inputs to the worksheet
'Nutrients_from_wastewater'.
Cell B9, B11 and B13 are intentionally blank.

This table presents calculations that underpin the final annual nutrient budget for the development site. Up to 3 values for the nutrient budget may be presented in cells B10, B12 and B24 for total phosphorus (TP).

Total nutrient budget calculations

Description of values generated	Values generated
Wastewater TP load (kg TP/year):	0.17
Net land use TP change (kg TP/year):	0.30
TP budget:	0.47
TP budget + 20% buffer:	0.56
Post-2030 annual nutrient budget	
The total annual phosphorus load to mitigate is (kg TP/yr):	0.56
Pre-2030 nutrient budget	
The total annual phosphorus load to mitigate is (kg TP/yr):	0.77
Pre-2025 nutrient budget	
The total annual phosphorus load to mitigate is (kg TP/yr):	1.16

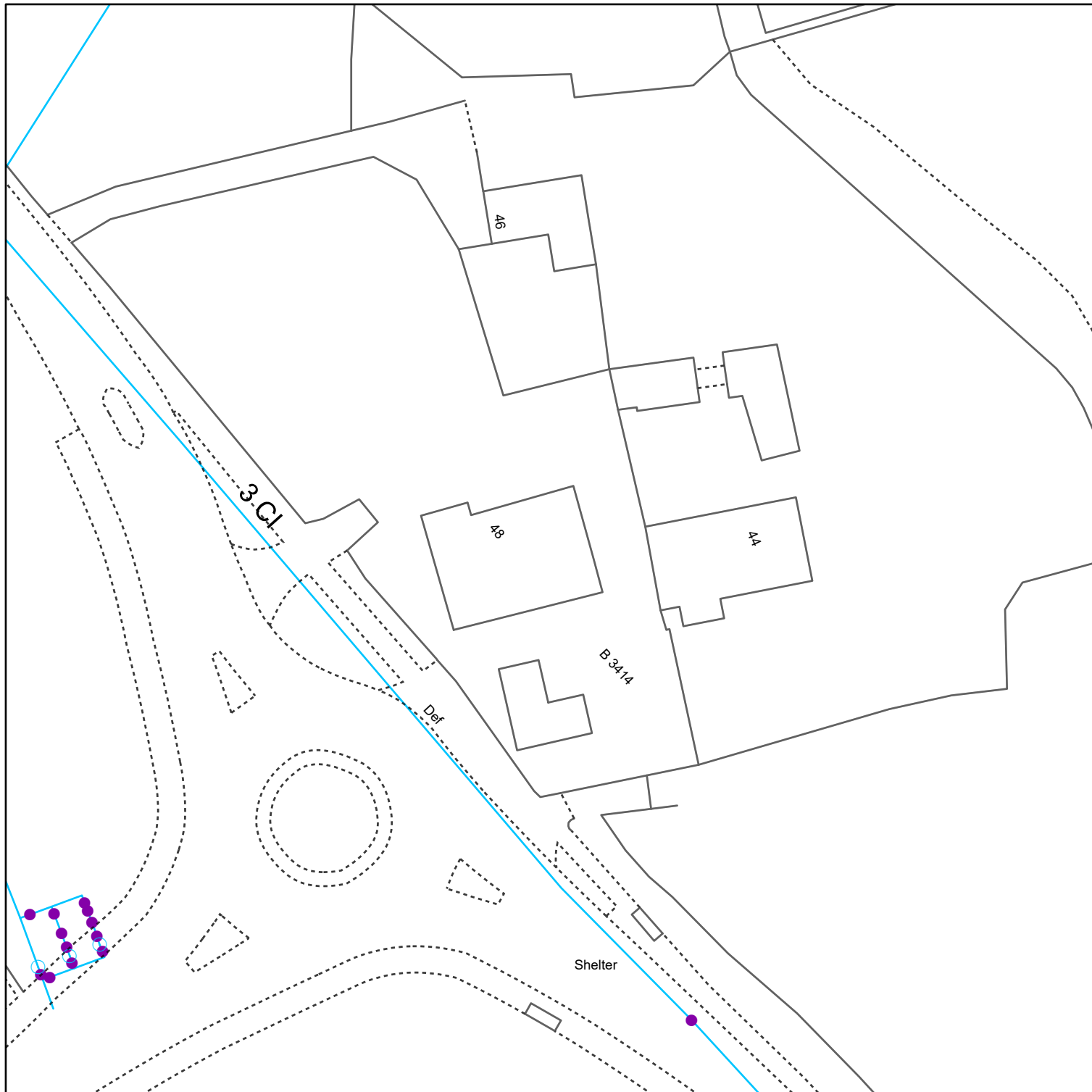
Appendix 2

Statutory Undertaker Maps

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Wessex Water Network Map



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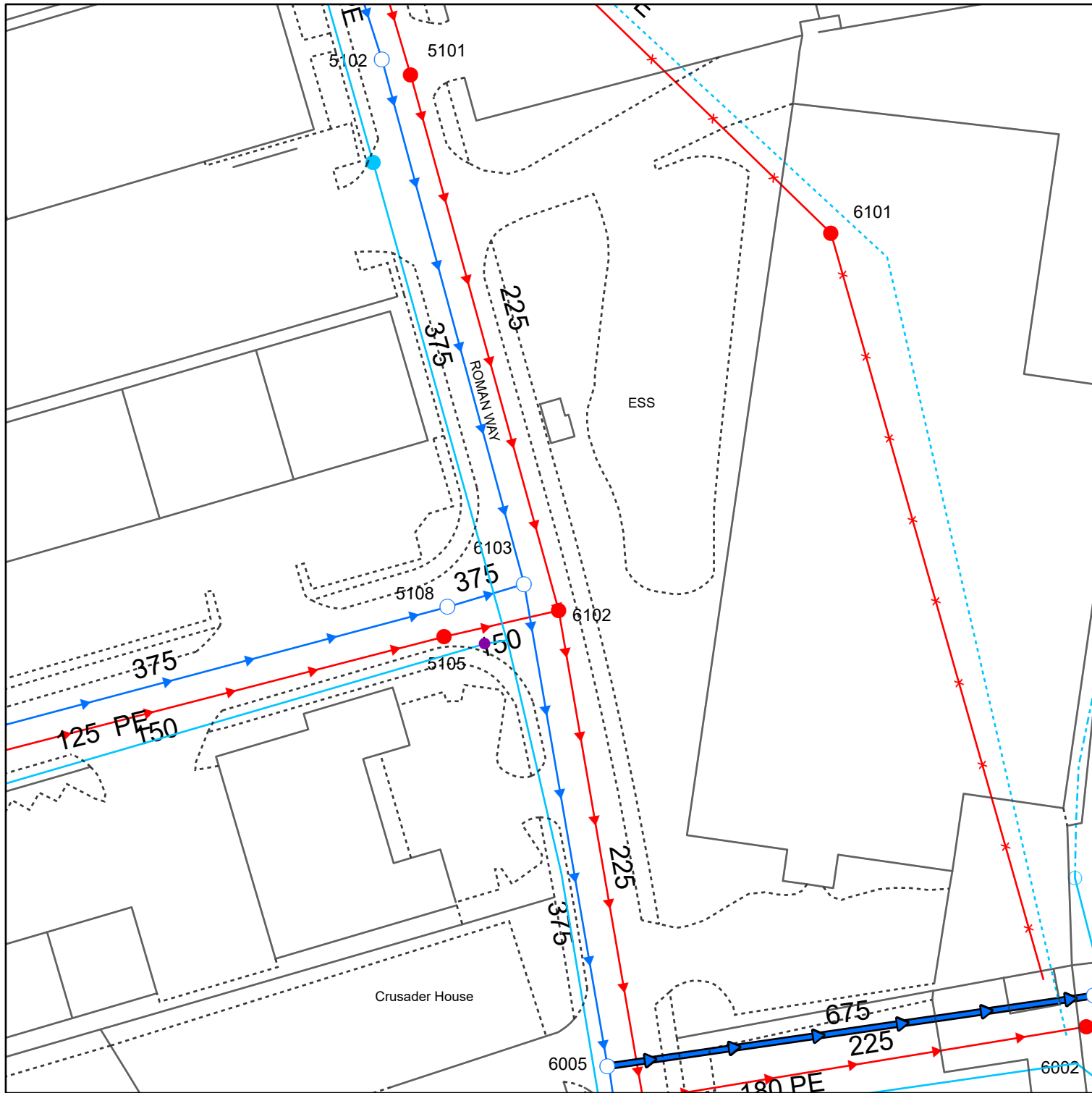
WATER MAINS		SEWERS		STRATEGIC		PUBLIC		PRIVATE		SECTION 104		OTHER WESSEX PIPES		NON-WESSEX / UNKNOWN	
	Distribution		Foul		Surface								Rising Mains		Private Rising Mains
	Washout		Combined										Standby Rising Mains		Culverted Watercourse
	Raw Water		Abandoned										Effluent Disposal		Highway Drain
	Abandoned												Overflow		Use Unknown
	Private												Syphon		Status Unknown
FITTINGS		STRUCTURES													
	Hydrant		Manhole - Foul		Pumping Station - Surface										
	Other		Manhole - Surface		Pumping Stn - Foul/Combined										
			Manhole - Combined		Gully										
			Inlet		Vent Column										
			Outfall		Rodding Eye										
			Lamphole		Catchpit										
			Bifurcation - Foul		Flushing Chamber										
			Bifurcation - Surface		Soakaway										
			Bifurcation - Combined		Non Return Valve										
			Combined Sewage Overflow		Air Valve										
					Hatch Box										
					Washout										
												OTHER STRUCTURES			
													Attenuation Tank		Tunnel
													Storage Tank		Interceptor

Information in this map is provided for identification purposes only. No warranty as to accuracy is given or implied. The precise route of pipe work may not exactly match that shown. Wessex Water does not accept liability for inaccuracies. Sewers and lateral drains adopted by Wessex Water under the Water Industry (Schemes for Adoption of Private Sewers) Regulations 2011 are to be plotted over time and may not yet be shown. In carrying out any works, you accept liability for the cost of any repairs to Wessex Water apparatus damaged as a result of your works. You are advised to commence excavations using hand tools only. Mechanical digging equipment should not be used until pipe work has been precisely located. If you are considering any form of building works and pipe work is shown within the boundary of your property or a property to be purchased (or very close by) a surveyor should plot its exact position prior to commencing works or purchase. If you are proposing to build over or near Wessex Water's apparatus you should contact the Developer Services Team, tel: 01225 526633 or e-mail: developer.enquiries@wessexwater.co.uk to discuss your proposals. Details of assets within Wessex Water's land ownership are unavailable through this service.

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Wessex Water Network Map



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WATER MAINS		SEWERS		STRATEGIC		PUBLIC		PRIVATE		SECTION 104		OTHER WESSEX PIPES		NON-WESSEX / UNKNOWN	
	Distribution		Foul		Surface								Rising Mains		Private Rising Mains
	Washout		Combined										Standby Rising Mains		Culverted Watercourse
	Raw Water		Abandoned										EDM		Highway Drain
	Abandoned												Overflow		Use Unknown
	Private												Syphon		Status Unknown
Colours generally indicate the use of the sewer/drain (i.e Red - Foul, Dark Blue - Surface, Magenta - Combined/Dual Use, Light Green - Highway Drain, Mid Green - Overflow).															
Some styles of line and symbol are shown on the key in sample/typical colours.															
FITTINGS		STRUCTURES													
	Hydrant		Manhole - Foul		Pumping Station - Surface										
	Other		Manhole - Surface		Pumping Stn - Foul/Combined										
			Manhole - Combined		Gully										
			Inlet		Vent Column										
			Outfall		Rodding Eye										
			Lamphole		Catchpit										
			Bifurcation - Foul		Flushing Chamber										
			Bifurcation - Surface		Soakaway										
			Bifurcation - Combined		Non Return Valve										
			Combined Sewage Overflow		Air Valve										
					Hatch Box		Washout								
OTHER STRUCTURES															
		Attenuation Tank				Tunnel									
		Storage Tank				Interceptor									
Wessex Water YTL GROUP															

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Appendix 3

Proposed Site Plan

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Legend

-  Site boundary
-  Proposed new building
-  Existing tree/hedge planting
-  Proposed tree/ native mix hedge planting
-  Grass surface
-  5m ecological buffer
-  Rainwater garden/mini swale
-  Tarmac access road
-  Private drive surface (grey colour permeable block paving)
-  Bin storage area
-  EV charge point
-  Patio area (sandstone or similar)
-  1.8m high brick screen wall
-  1.8m high render screen wall
-  1.8m high timber close boarded fence
-  1.2m high timber post & rail fence
-  Timber gate (height to match adjoining boundary wall/fence)
-  Proposed slab level

Scale Assist Bar (1:500)



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CLIENT:
Greatworth

PROJECT:
Land North of Brick Hill Farm, Warminster
Wiltshire

DRAWING TITLE:
Proposed Site Plan

SCALE: 1:500@A3 **DATE:** 23/09/2024 **DRAWN:** JNM

DRAWING NUMBER: 13270/002 **REVISION:**

Appendix 4

Water Efficiency Calculator

For convenience – press “Alt + Left Arrow” to return to the section of the report



Installation Type	Unit of Measure	Capacity/Flow rate (1)	Use Factor (2)	Fixed use (litres/person/day) (3)	Litres/person/day = [(1)x(2)] + (3) (4)
WC (single flush)	Flush Volume (litres)		4.42	0.00	0
WC (dual flush)	Full flush Volume (litres)	4	1.46	0.00	5.84
	Part flush Volume (litres)	2	2.96	0.00	5.92
WC (multiple fittings)	Average effective flushing Volume (litres)		4.42	0.00	0
Taps (excluding kitchen/utility room taps)	Flow rate (litres/min)	5.00	1.58	1.58	9.48
Bath (where shower also present)	Capacity to overflow(litres)		0.11	0.00	0
Shower (where bath also present)	Flow Rate(litres / minute)		4.37	0.00	0
Bath Only	Capacity to overflow(litres)		0.50	0.00	0
Shower Only	Flow Rate (litres/minute)	6.00	5.60	0.00	33.60
Kitchen/Utility room sink taps	Flow rate (litres/minute)	3.50	0.44	10.36	11.90
Washing Machine	(Litres/kg dry load)	8.17	2.1	0.00	17.157
Dishwasher	(Litres/place setting)	1.25	3.6	0.00	4.5
Waste disposal unit	(Litres/use)	☐ Present	3.08	0.00	0
Water Softener	(Litres/person/day)		1.00	0.00	0
	(5)	Total Calculated use (litres/person/day) =SUM(column 4)			88.40
	(6)	Contribution from greywater (litres/person/day)			0
	(7)	Contribution from rainwater (litres/person/day)			0
	(8)	Normalisation factor			0.91
	(9)	Total internal water consumption = [(5)-(6)-(7)]x(8) (litres/person/day)			80.44
	(10)	External water use			5.0
	(11)	Total water consumption (Building Regulation 17.K) = (9)+(10)(litres/person/day)			85.4

Installation Type	Make/Model (mandatory)	Litres/Person/Day
WC (dual flush)	IS Concept Air 4/2L	11.76
Taps	Sandringham Basin Mixer	9.48
Showers Only	Mira React EV	33.60
Kitchen Taps	Caron Pura	12.56
Washing Machines		17.157
Dishwasher		4.5



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Appendix 5

SuDS Maintenance Requirements

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Table A5.1 – SuDS Maintenance Requirements – Permeable Paving		
CIRIA C753 Maintenance Requirement		
Maintenance schedule	Required action	Typical Frequency
Regular Maintenance	Annually	Brushing and vacuuming (standard cosmetic sweep over whole surface)
Occasional Maintenance	As necessary	Stabilise and mow contributing and adjacent areas.
	As necessary	Removal of weeds
Regular Maintenance	As necessary	Remediate any landscaping which through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving
	As necessary	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material
	Every 10-15 years	Rehabilitation of surface and upper substructure by remedial sweeping
CIRIA C808 Maintenance Requirement		
It is unlikely that the permeable paving will be lifted to replace the subsurface layers. The only maintenance activity that is required is sweeping the surface when needed.		

Table A5.2 – SuDS Maintenance Requirements – Retention Basin

CIRIA C753 Maintenance Requirement		
Maintenance schedule	Typical Frequency	Required action
Regular Maintenance	Monthly or as required	Remove litter and debris
		Cut the grass – public areas
		Inspect marginal and bankside vegetation and remove nuisance plants (for first 3 years)
		Inspect inlets, outlets, banksides, structures, pipework etc for evidence of blockage and/or physical damage
		Inspect water body for signs of poor water quality
	Half yearly	Cut the meadow grass
		Inspect silt accumulation rates in any forebay and in main body of the pond and establish appropriate removal frequencies; undertake contamination testing once some build-up has occurred, to inform management and disposal options.
		Check any mechanical devices, eg penstocks
	Annually	Hand cut submerged and emergent aquatic plants (at minimum of 0.1m above pond base; include max 25% of pond surface)
		Remove 25% of bank vegetation from water's edge to a minimum of 1m above water level
		Tidy all dead growth (scrub clearance) before start of growing season (Note: tree maintenance is usually part of overall landscape management contract)
	Every 5 years, or as required	Remove sediment and planting from one quadrant of the main body of ponds without sediment forebays.

Occasional maintenance	With effective pre-treatment, this will only be required rarely, eg every 25–50 years	Remove sediment from the main body of big ponds when pool volume is reduced by 20%
Remedial Actions	As required	Repair erosion or other damage
		Replant, where necessary
		Aerate pond when signs of eutrophication are detected
		Realign rip-rap or repair other damage
		Repair / rehabilitate inlets, outlets and overflows.
CIRIA C808 Maintenance Requirement		
- Sediment may need to be removed from the base of the basin periodically, although this can be avoided by installing and maintaining an upstream sediment removal device for initial gross particle removal. - Inlet and outlet structures need to be kept clear and operational. - Plants from around the freeboard above the permanent water level can be mown and harvested and removed.		

Appendix 6

SuDS Considerations

For convenience – press “Alt + Left Arrow” to return to the section of the report



Table A6.1 – SuDS Considerations

Consideration	Site Relevance
Previous land use	The site is not believed to have legacy phosphorus.
The influent to the system or device must contain phosphorus in adequate levels to achieve the anticipated treatment. If the TP level in the influent is too low, then the anticipated level of treatment may not be met.	The influent to the system will have adequate levels of phosphorus.
Treatment flow rate or volume to be treated by the nutrient removal devices	To be covered within Civil Engineers Drainage Design.
TP removal by infiltration to the ground	N/A
The SuDS management train should be designed to manage both particulate phosphorus and dissolved phosphorus. The design should demonstrate which of the devices capture particulate P, DP, or both and the quantity of TP captured.	The SuDS management train has been designed to manage particulate and dissolved phosphorus.
The nature of treatment media and growth media in devices will have significant consequences for the level of phosphorus removal that the device can achieve.	Treatment media will be selected to specifically capture phosphorus.
DP is bioavailable and represents a significant concern for receiving water quality.	Components have been selected to reduce both DP and PP.
Maintenance requirements of new, innovative treatment devices cannot always be defined so regular inspection and monitoring may be needed until adequate data and experience is gathered.	SuDS measures deployed on-site are well studied, however they will need to be monitored and regularly inspected to ensure performance.
Routine maintenance of SuDS devices to remove sequestered forms of phosphorus before they become bioavailable again is a critical factor in effective phosphorus removal (Clary et al, 2020)	SuDS will be maintained in accordance with CIRIA C753 and CIRIA C808.
If maintenance requires removal of vegetation, it must be removed from	SuDS will be maintained in accordance with CIRIA C753 and CIRIA C808.

site and has the potential to be used as commercial or municipal compost feed.	
Runoff from surrounding land	Drainage from surrounding land will not enter SuDS treatment train.
Capture or by-pass large rainfall events for sedimentation devices.	Civil Engineering Drainage Plan will include exceedance paths for large storm events, in order to not 'flush' and resuspend particulate phosphorus.
Sustainability of materials.	The treatment media is quarried stone, which would have otherwise been installed if the development were not affected by nutrient neutrality.
Effectiveness of 2 nd and 3 rd devices needs to be considered carefully.	N/A
Despite this process being for the reduction of phosphorus pollution, the SuDS management train should still satisfy the requirement of CIRIA C753 and deliver all four ' Pillars of SuDS'	The proposed SuDS are designed to enhance water quality and reduce flood risks by minimising surface water runoff.
Sediment capture upstream of ponds, basins and wetlands.	N/A

Appendix 7

SuDS Removal Calculations

For convenience – press “Alt + Left Arrow” to return to the section of the report

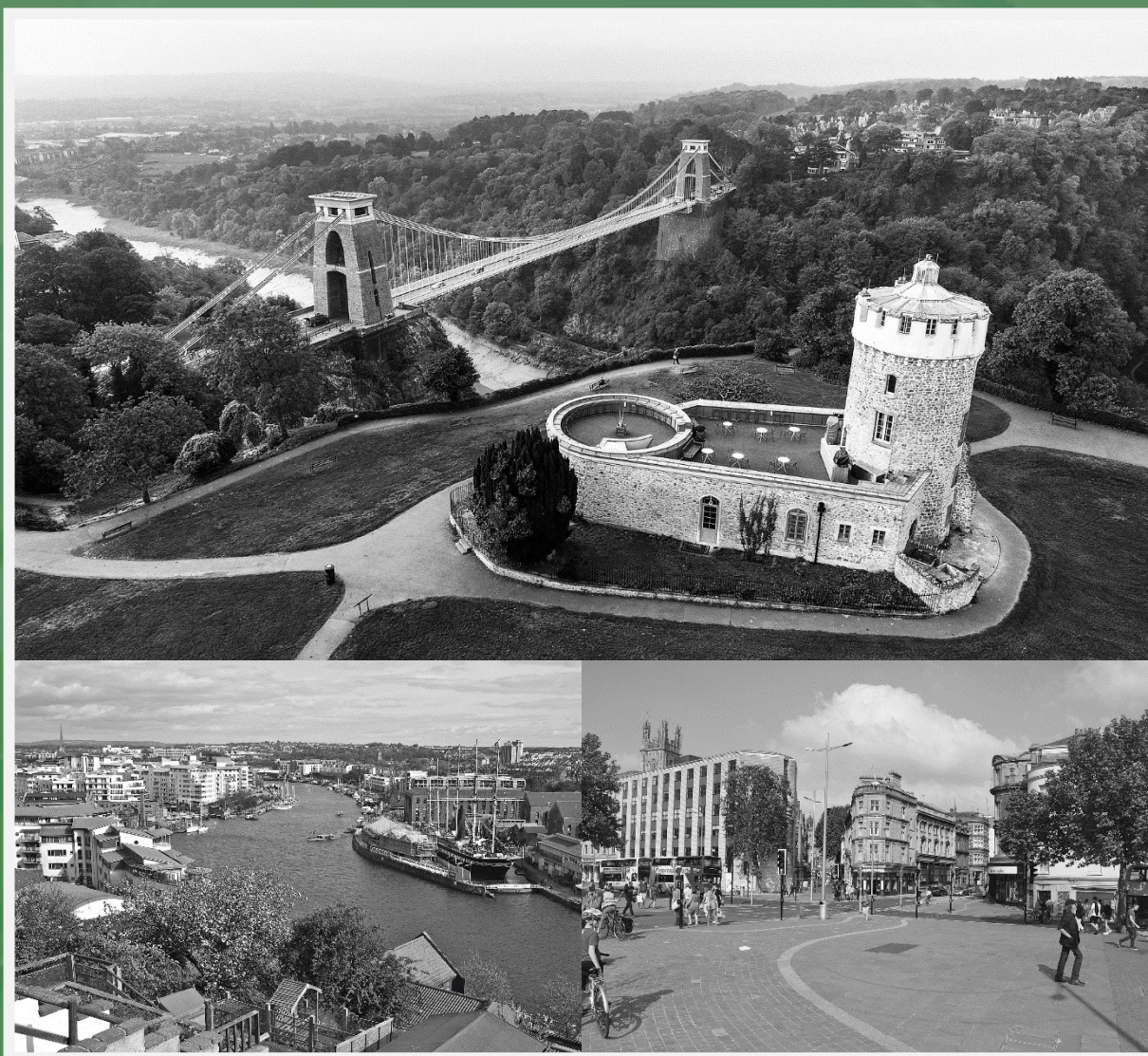


Table 7.1 – Total Phosphorus Removal Percentage of Treatment Train

Treatment Train	Phosphorus Removal Efficiency of SuDS Component (Average between Dissolved and Particulate Phosphorus)				Cumulative Removal**		Calculated Phosphorus Removal Efficiency
	Permeable Paving		Retention Basin		PP	DP	
	PP	DP	PP	DP			
Treatment Train A: Permeable Paving	39%	N/A	N/A	N/A	39%	N/A	39%
Treatment Train B: Permeable Paving + Retention basin	39%	N/A	28%×50%=14%	23%	41.24%	23%	64.24%
100% Removal Considered		50% Removal Considered			Not Applicable		
Mean Phosphorus Removal of Onsite Treatment Trains = (39%+64.24%)/2 = 51.62%							
**Calculation for the Cumulative PP removal: 39%+[(55%-39%)×14%] = 41.24%							

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Project	
0XXX	Project Number
Originator	
ENV	Enviren
Functional Breakdown	
S1	Planning submission
S2	Technical submission
S3	Construction Information
S4	As built details
Spatial Breakdown	
SW	Southwest
EE	East of England
SE	South East
WM	West Midlands
EM	East Midlands
YO	Yorkshire
NW	North West
NE	North East
LO	London
OT	Other
Form	
DR	Drawing
GR	Diagram
TR	Textual Report
Discipline (relevant)	
C	Civil Engineering
E	Environmental Engineering
G	Ground Engineering
O	Other Discipline
T	Town and Country Planning and Building Control
W	Water Engineering
Z	Multiple Discipline
Number	
000X	Report number



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