Parcel N and Linear Park Ph3A, Arborfield Green, Wokingham

Flood Risk Assessment Compliance Note

August 2025

Woods Hardwick

Architecture | Engineering | Planning | Surveying

Contents

Appendices

Report Reference

19632/FRA-C

Revision History

Rev	Amendments	Prepared By	Checked By	Date
First Issue	N/A	GBR	GBR	31/07//2025
Second Issue	Linear Park Ph3A added to Document	SE	ShD	11/08/2025
Third Issue	Layout revised	ShD	GBR	29/09/2025

Introduction

Introduction

The following paragraphs state the document's purpose and provide a summary of the site's planning history; together with the relevant conditions to which the report seeks to demonstrate compliance.

1.1 This Flood Risk Assessment Compliance Report (FRA-C) has been prepared by Woods Hardwick Ltd on behalf of Crest Nicholson in support of their Reserved Matters Planning Application for a site known as 'Parcel N, Arborfield Green, Wokingham' and the Reserved Matters Planning Application pursuant to outline permission O/2014/2280 comprising landscaping, substation and balancing pond at the site 'Linear Park Ph3A, Arborfield Green'.

1.2 This document has been prepared to demonstrate that the proposed FRA-C for Parcel N and Linear Park Ph3A is to be discharged of conditions.

1.3 The site forms part of a wider scheme known as Arborfield Green which benefits from Outline Planning Approval (Ref: 14/02121/OUT) for the following;

OUTLINE PERMISSION FOR: Demolition of buildings and phased redevelopment of Arborfield Garrison and adjoining land for: Up to 2,000 new dwellings (including up to 80 units of extra care housing). District centre comprising a foodstore up to 4,000 sq m gross with up to a further 3,500 sq m (gross) floor space within Classes A1, A2, A3, A4, A5, B1, D1 and D2 (with residential above - Class C3)), and transport interchange, village square, car parking, servicing and drop off area. Up to a further 1,500 sq m (gross) floor space within Classes D1 and D2. Neighbourhood centre to provide up to 300 sq m (gross) floor space within Classes A1, A2, A3, A4, A5, B1, D1 and D2, with parking/servicing area. Secondary school for up to 1,500 pupils (Class D1) including sports pitches, floodlit all-weather pitch, and indoor swimming pool and parking areas. Up to three-form primary school (Class D1) with sports pitch and parking areas. Associated phased provision of: car parking; public open space including sports pitches, informal/incidental open space, children's play areas including multi-use games area (MUGA), skate park, community gardens/allotments; landscaping/buffer areas; boundary treatments; new roads, footpaths, cycleways and bridleways; sustainable urban drainage systems, including flood alleviation works.

PART 2 - FULL PERMISSION FOR phased development of: Creation of two new areas of Suitable Alternative Natural Greenspace (SANGS) (In the north-eastern part of the application site ("Northern SANGS") and at West Court ("West Court SANGS") including car parking areas, path/walkways, fencing and associated landscaping; re-use Application No: O/2014/2280 - 2 - of existing MoD gymnasium for sports/community uses/centre (Classes D1/D2; new roundabout junction to A327 Reading Road; junction improvements to Langley Common Road, Baird Road and Biggs Lane; junction improvements and new access at Biggs Lane/Princess Marina Drive; re-use and improvements to existing site accesses from Biggs Lane.

1.4 The outline planning application was supported by a Flood Risk Assessment Report dated March 2015 which was prepared by AECOM. A separate Foul and Surface Water Drainage Strategy document was prepared by AECOM also dated March 2015.

1.5 Whilst the Outline Planning Permission applies to the entire Arborfield Green development this report specifically pertains to Parcel N and Linear Park Ph3A, located within the central area of the wider site to the south of the existing development.

1.6 The development proposals for Parcel N comprise 67 residential dwellings plus associated infrastructure. A Site Layout Plan is included in Appendix A.

1.7 This document has been prepared to demonstrate that the proposed drainage strategy for Parcel N complies with the approved documents and to allow discharge of Conditions 19 and 34 of the Outline Planning Consent (14/02121/OUT), which are as follows:

43. The development hereby permitted shall be carried out in accordance with the approved Foul and Surface Water Drainage Strategy Revision 3 Updated drainage strategy plan and phasing plan included dated 03/03/15 Job No 60312043 Reference DS/001 including the mitigation measures detailed in this strategy unless otherwise agreed in writing by the Local Planning Authority. In addition, an off-site drainage strategy will be submitted to and approved in writing by the Local Planning Authority (in consultation with the Sewage Undertaker) prior to the commencement of development and in any relevant phase. No discharge of foul water from the site shall be accepted into the public system until the drainage works relevant to that phase have been completed in accordance with the approved Foul and Surface Water Drainage Strategy Revision 3 Updated drainage strategy plan and phasing plan included dated 03/03/15 Job No 60312043 Reference DS/001 and the approved off-site drainage strategy. Application No: O/2014/2280 - 22 –

Reason: To ensure that the development does not increase flood risk and to ensure that sufficient capacity is made available to cope with the new development in order to avoid adverse environmental impact upon the community. Relevant policy: NPPF, Wokingham Borough Core Strategy Policy CP1 and CP18 and the Managing Development Delivery Local Plan Policy CC10 and the Arborfield Strategic Development Location Supplementary Planning Document (2011).

44. No part of the development within a phase shall take place until a surface water drainage scheme for the phase, based on sustainable drainage principles outlined in the agreed FRA (Foul and Surface Water Drainage Strategy Revision 3 Updated drainage strategy plan and phasing plan included dated 03/03/15 Job No 60312043 Reference DS/001) and an assessment of the hydrological and hydrogeological context of the development, has been submitted to and approved in writing by the local planning authority. The scheme shall subsequently be implemented in accordance with the approved details before the development is completed. The scheme shall also include:

a. Detailed surface water drainage calculations for all rainfall events (1 in 1, 1 in 30 and 1 in 100) up to and including the 1 in 100 plus climate change storm event.
b. Demonstration that there will be no flooding on the site up to the 1 in 30 storm event and that and flooding up to the 1 in 100 plus climate change storm event can be safely stored within the site without increasing flood risk to the surrounding area.
c. SuDS features shall be located outside of the 1 in 100 year plus 20% allowance for climate change flood level.
d. Limiting the discharge rate from the entire site to Greenfield rates
e. Details of the feasiblity of the use of soakaways in line with BRE 365 to demonstrate whether they are technically feasible and confirmation that there will be a minimum of 1 metre between the base of the infiltration device and the water table.
f. Information on the hierarchy of options to explain the choice of any proposed SuDS technique.
g. Details of how the scheme shall be maintained and managed after completion.

Reason: To prevent the increased risk of flooding, to improve and protect water quality, improve habitat and amenity, and ensure future maintenance of the surface water drainage system.

45. No development shall take place within each phase until full details of the Drainage System(s) have been submitted to and approved in writing by the Local Planning Authority. These shall include:

a. Wherever practical, measures to manage surface water at the surface through incorporation of SuDS that integrate with wider landscape proposals and provide a range of benefits in terms of amenity provision, ecological enhancements and water quality;
b. Demonstration of where and how surface water attenuation shall be provided across the site and that attenuation features are adequately sized to serve the development for all events up to and including the 1 in 100 year plus Application No: O/2014/2280 - 23 - allowances for climate change taking into consideration detailed intrusive site investigations at the site;
c. Details of the phased implementation of the drainage system(s) and demonstration that flood risk will not be exacerbated at any time during installation;
d. Details of the implementation of the drainage system(s)and demonstration that water quality will not be impacted at any time during installation;
e. Details of the implementation and final state of the drainage system(s) and demonstration that the structural integrity of receiving watercourses will not be impacted at any time;

f. Clear definition of where surface water outfalls will discharge and demonstration that discharges and attenuation volumes have accounted for the effect of flood levels on receiving water bodies;
g. Demonstration that any seasonal variation in groundwater levels has been considered in the sizing and location of SuDS features;
h. Details of the freeboard allowance for any structures required to cross ditches and/or watercourses requiring demonstration that structures do not increase flood risk in all areas upstream and downstream of the proposed development;
i. Detailed hydraulic modelling of the drainage system(s) incorporating the watercourses, SuDS features both online and offline and demonstration that SuDS storage is not compromised by fluvial flood flows / levels;
j. Full details of the maintenance and/or adoption proposals /agreements for the development covering all aspects of the proposed drainage system(s), with provision for annual inspection reports to be submitted to the Local Authority for any SUDS that will be retained by private management companies. Development should be implemented in accordance with the approved details and thereafter retained unless otherwise agreed in writing by the Local Planning Authority.

Reason: To prevent the increased risk of flooding, to improve and protect water quality, improve habitat and amenity, and ensure future maintenance of the surface water drainage system in accordance with NPPF, Wokingham Borough Core Strategy Policy CP1 and CP18 and the Managing Development Delivery Local Plan Policy CC10 and the Arborfield Strategic Development Location Supplementary Planning Document (2011).

1.8 The purpose of this report is to demonstrate that the proposed drainage design complies with the principles of the approved Surface Water Drainage Strategy prepared by AECOM.

1.9 This report confirms that the strategy is compliant with the approved FRA and meets the necessary requirements to discharge Condition 43, 44 and 45 of the Outline Planning Consent.

Review of Approved Documents

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Review of Approved Documents

This section reviews the FRA and Drainage Statement (Ref 3723.FRA.03) and Drainage Strategy Report (Ref: 5348/DS.05) to ensure that proposals at this stage are in accordance with the approved principles.

Surface Water Drainage Strategy

2.1 The site-wide approved surface water drainage strategy is contained within the approved Foul and Surface Water Drainage Strategy document prepared by AECOM dated March 2015.

2.2 The approved surface water drainage strategy split the site into sub-catchments to mimic the natural drainage regime. A copy of Surface Water Drainage Strategy that was included within the approved document is included as Appendix B of this report.

2.3 The runoff rate for each catchment was based upon the Qbar rate of 4.3l/s per impermeable hectare. The agreed rates for each catchment were calcaulted based upon an assumed impermeable area for each catchment. For residential parcels the calculations were based upon 60% impermeable surfacing.

2.4 Parcel N was included within Catchment 11 which also include Parcels L and M. The combined allowable discharge rate of the three parcels is 34.7l/s.

2.5 Attenuation for all three pacels was proposed within two attenuation basins within the proposed linear park located to the south of Parcel N.

2.6 The eastern attenuation basin will have a discharge rate of 9.7l/s and the western basin will have a discharge rate of 25l/s. Both basins discharge into the existing watercourse located to the immediate south of the proposed basins.

2.7 The eastern basin would accommodate flows from Parcel N only while the western basis is designed to accommodate the remainder of Parcel N as well as Parcels L and M.

2.8 The total attenuation volume calculated for the parcels to attenuate storms up to the 1 in 100 year event with 40% climate change allowance was 1580m^3.

Foul Water Drainage Strategy

2.9 In terms of foul drainage, the approved (outline) Foul and Surface Water Drainage Strategy proposed to construct a gravity foul sewer network within each of the development parcels that would generally follow the existing topography and discharge into the existing combined sewer that crosses the site.

2.10 The strategy proposed 12 connections from the site into the existing sewer network with existing connections being utilised where possible. The proposed outfall from Parcel N was to the Thames water sewer that runs slightly beyond the eastern boundary of the parcel. A copy of the outline sitewide Foul Water drainage strategy is included within Appendix B.

2.11 Through discussions with Thames Water it was confirmed that there would be capacity at the treatment works to serve the development at such time as discharge from the site is required.

Proposed Drainage Strategy

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Proposed Drainage Strategy

The following paragraphs provide detail on the proposed drainage strategy which follows the general principles of the approved FRA and DS with some amendments as necessary.

Proposed Surface Water Drainage Strategy

3.1 The proposed drainage strategy for Parcel N has been prepared by Woods Hardwick and is shown on the Drainage Strategy Drawing included in Appendix D.

3.2 In order to ensure that the proposals follow the hierarchy for surface water discharge the applicant commissioned Wilson and Bailey Geotechnical & Environmental (WB) to undertake a Desk Study and Phase 1 Ground Investigation Report.

3.3 Within their report WB confirm that soakaways are not considered to present a viable option for disposal of surface water due to the predominantly clayey nature of the near surface soils. It is therefore recommended that discharge to the local surface water drainage network of ditches, swales and basins should be explored by the civil engineers as part of the detailed drainage design.

3.4 The WB investigations also included groundwater monitoring which confirmed that groundwater seepages and inflows were encountered in a number of exploratory boreholes at depths of between about 2.00 m and 4.00 m below ground level. Limited monitoring of the standpipes installed into the small diameter boreholes indicates boreholes to be generally dry but where groundwater has been detected it is present at inconsistent depths that are indicative of localised pockets of groundwater perched within the sandier layers, rather than being indicative of a single body of laterally consistent and hydraulic continuous groundwater. Relevant extracts from the WB report can be found in Appendix C.

3.5 In light of the above and in accordance with the hierarchy it is proposed to discharge to the existing watercourses as per the approved outline strategy.

3.6 The strategy comprises two separate drainage networks, each serving a portion of the site. Both networks convey surface water unrestricted into the attenuation basins located within the proposed linear park to the south.

3.7 The basins were designed to accommodate flows from Parcel L, M and N. The eastern basin accommodates Parcel N only while the western basin accommodates the remainder of Parcel N as well as Parcels L and M.

3.8 The proposed discharge rates from the eastern and western basins are 9.7l/s and 24.4l/s respectively. The discharge rate of 9.7l/s is equal to the rate approved at the outline planning stage while the rate of 24.4 l/s represents slight betterment on the approved rate of 25l/s from the western basin.

3.9 The surface water drainage calculations, included in Appendix E, demonstrate that the proposed onsite attenuation features are capable of accepting flows from the 1 in 100-year rainfall event including 40% climate change plus 10% urban creep.

Proposed Foul Water Drainage Strategy

3.10 The proposed foul water drainage strategy is also shown on the Drainage Strategy Drawing included in Appendix D.

3.11 The drawing confirms that foul water flows from the site will be discharged via gravity into the existing foul water that crosses the site.

Maintenance and Management

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Maintenance and Management

The following paragraphs provide detail on the likely maintenance and management measures that will need to be undertaken across the lifetime of the development.

4.1 The arrangements for further maintenance of the surface water drainage system needs to be fully considered to ensure long-term functionality of the drainage system.

4.2 It is proposed that the piped surface water network including flow controls and headwalls and will be offered to Thames Water for adoption under S104 of the Water Industry Act. These systems will be subject to the maintenance regime of Thames Water which is subject to regulatory approval.

4.3 The maintenance regime defines the scope of inspections and maintenance that is to be carried out on the pipes and flow control device during and following construction, the stormwater drains will need to be regularly inspected in order to assess their performance and to schedule any required maintenance.

4.4 Items that are subjected to routine inspections for maintenance may comprise but are not limited to those listed in the table below, the party that will potentially be responsible for the various components are listed in the fourth column.

Item	Routine Inspections for Maintenance	Minimum Frequency	Responsibility
Pipes / Manholes / Catchpits	Inspect surface access points to manholes and catchpits as well as the surrounding area. Particular attention should be paid to damage or blockage. To be visually inspected after heavy rainfall events to ensure that they are free of debris and litter.	6 monthly As required	Thames Water
Flow Control Device	Inspect flow control device for blockages, damage and general condition. To be visually inspected after heavy rainfall events to ensure that they are free of debris and litter.	6 monthly As required	Thames Water

4.5 In addition, personnel completing the routine inspections for maintenance should be generally observant of items such as equipment failures, leaking water, scouring and/or signs of blockages of water flow. If such items are observed, an immediate inspection for engineering maintenance may be necessary.

4.6 Engineering inspections will generally comprise a walk over survey of the site, along with additional investigation activities as considered necessary. These inspections are primarily concerned with checking engineering aspects of the drainage that are not likely to be picked up during a routine inspection such as manhole damage and concrete deterioration.

4.7 During inspections for engineering maintenance, care is needed to look for signs of pipe blockages. This can only be checked at the inlet and outlet of manholes at the base. Items that are to be subject to Engineering Inspections for Maintenance will comprise of those listed in the table below:

Item	Engineering Inspections for Maintenance
Manholes / Catchpits	All manholes/Catchpits will require to be inspected externally and internally. External inspections will determine the overall condition of the access points, and should record deterioration of exposed concrete, access lids, restricted access due to overgrown vegetation/debris.
Flow Control Device	Inspections will determine the overall condition of the flow control device to ensure it is working efficiently and effectively.

4.8 As a result of the routine inspections, a schedule of maintenance activities shall be drawn up to address those issues identified during the inspection. Examples of possible maintenance activities may comprise, but not be limited to those listed in the table below:

Item	Scheduled Maintenance Activities	Minimum Frequency
Manholes / Catchpits	Clear accumulated sedimentation Repair/replace damaged pit covers and grates	6 monthly As required
Pipes / Flow Control Device	Clear accumulated sediment and debris	6 monthly

4.9 The table below highlights the likely renewal and replacement works that will be required and how this work will be funded.

Item	Renewal & Replacement Works	Undertaken / Financed by
Flow Control Device	Flow control to be replaced by a competent Contractor to the manufacturer's specification	Thames Water

FRA Compliance

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FRA Compliance

Presented below is a summary of how the proposed drainage strategy complies with the requirements of Planning Conditions 6, 8 and 11 and where the relevant information can be found.

5.1 On the basis of the information presented below it can be concluded that sufficient information has been provided to allow the discharge of Planning Conditions 43, 44 and 45.

Requirement	Compliance
43. The development hereby permitted shall be carried out in accordance with the approved Foul and Surface Water Drainage Strategy Revision 3 Updated drainage strategy plan and phasing plan included dated 03/03/15 Job No 60312043 Reference DS/001 including the mitigation measures detailed in this strategy unless otherwise agreed in writing by the Local Planning Authority. In addition, an off-site drainage strategy will be submitted to and approved in writing by the Local Planning Authority (in consultation with the Sewage Undertaker) prior to the commencement of development and in any relevant phase. No discharge of foul water from the site shall be accepted into the public system until the drainage works relevant to that phase have been completed in accordance with the approved Foul and Surface Water Drainage Strategy Revision 3 Updated drainage strategy plan and phasing plan included dated 03/03/15 Job No 60312043 Reference DS/001 and the approved off-site drainage strategy. Application No: O/2014/2280 – 22 •	The proposed Surface and Foul Water drainage strategies for parcel N have been designed in accordance with the plans and strategies that were approved at the outline planning stage. The Strategy for parcel N is described in Section 3 of this report and shown on the plans included within Appendix D. The calculations are included within Appendix E.

Requirement	Compliance
44. No part of the development within a phase shall take place until a surface water drainage scheme for the phase, based on sustainable drainage principles outlined in the agreed FRA (Foul and Surface Water Drainage Strategy Revision 3 Updated drainage strategy plan and phasing plan included dated 03/03/15 Job No 60312043 Reference DS/001) and an assessment of the hydrological and hydrogeological context of the development, has been submitted to and approved in writing by the local planning authority. The scheme shall subsequently be implemented in accordance with the approved details before the development is completed. The scheme shall also include: a. Detailed surface water drainage calculations for all rainfall events (1 in 1, 1 in 30 and 1 in 100) up to and including the 1 in 100 plus climate change storm event. b. Demonstration that there will be no flooding on the site up to the 1 in 30 storm event and that and flooding up to the 1 in 100 plus climate change storm event can be safely stored within the site without increasing flood risk to the surrounding area. c. SuDS features shall be located outside of the 1 in 100 year plus 20% allowance for climate change flood level. d. Limiting the discharge rate from the entire site to Greenfield rates e. Details of the feasiblity of the use of soakaways in line with BRE 365 to demonstrate whether they are technically feasible and confirmation that there will be a minimum of 1 metre between the base of the infiltration device and the water table. f. Information on the hierarchy of options to explain the choice of any proposed SuDS technique. g. Details of how the scheme shall be maintained and managed after completion.	a. Calculations for all storm events up to the 1 in 100 year + CC event are included within Appendix E. b. The calaculations in Appendix E confirm this requirement. c. All SuDS features are located outside of the Flood Zone. d. The discharge rate from Parcel N is restricted downstream of the basins to the Qbar rate. e. Based upon the underlying ground conditions infiltration is not feasible. This is confirmed in Section 3 and Appendix D. f. The hierarchy of options was reviewed and agreed at the outline stage and confirmed within Sections 2 and 3 of this report. g. A maintenance schedule is included as Section 4 of this report.

Requirement	Compliance
45. No development shall take place within each phase until full details of the Drainage System(s) have been submitted to and approved in writing by the Local Planning Authority. These shall include: a. Wherever practical, measures to manage surface water at the surface through incorporation of SuDS that integrate with wider landscape proposals and provide a range of benefits in terms of amenity provision, ecological enhancements and water quality; b. Demonstration of where and how surface water attenuation shall be provided across the site and that attenuation features are adequately sized to serve the development for all events up to and including the 1 in 100 year plus Application No: O/2014/2280 - 23 - allowances for climate change taking into consideration detailed intrusive site investigations at the site; c. Details of the phased implementation of the drainage system(s) and demonstration that flood risk will not be exacerbated at any time during installation; d. Details of the implementation of the drainage system(s)and demonstration that water quality will not be impacted at any time during installation; e. Details of the implementation and final state of the drainage system(s) and demonstration that the structural integrity of receiving watercourses will not be impacted at any time; f. Clear definition of where surface water outfalls will discharge and demonstration that discharges and attenuation volumes have accounted for the effect of flood levels on receiving water bodies; g. Demonstration that any seasonal variation in groundwater levels has been considered in the sizing and location of SuDS features; h. Details of the freeboard allowance for any structures required to cross ditches and/or watercourses requiring demonstration that structures do not increase flood risk in all areas upstream and downstream of the proposed development; i. Detailed hydraulic modelling of the drainage system(s) incorporating the watercourses, SuDS features both online and offline and demonstration that SuDS storage is not compromised by fluvial flood flows / levels; j. Full details of the maintenance and/or adoption proposals /agreements for the development covering all aspects of the proposed drainage system(s), with provision for annual inspection reports to be submitted to the Local Authority for any SUDS that will be retained by private management companies. Development should be implemented in accordance with the approved details and thereafter retained unless otherwise agreed in writing by the Local Planning Authority.	a. All of the proposed attenuation for Parcel N is above ground in accordance with the approved strategy. b. The attenuations features are shown on the Appended Drainage Strategy drawings. c. The attenuation basins required to attenuate Parcel N will be constructed in advance of connections being required from the parcel. d. Details of implementation will be provided at the detailed design stage. e. The required details will be provided at the detailed design stage. f. The required details are shown on the Drainage Strategy drawings. g. Groundwater seepages were encountered at depths between 2.0-4.0m below ground level. The inconsistent depths are inficative of localised pockets of groundwater perched on sandier layers rather thanbeing indicative of a single body of laterally consistent and hydraulic continuous groundwater. h. A minimum of 300mm of freeboard is provided in the basins i. The Calculations relevant for Parcel N are included within Appendix D. j. The maintenance strategy is included within Appendix 4 of this report.

Appendix A

Site Layout Plan

Issue:

N

0 25 50 m

KEY: SITE LAYOUT

- APPLICATION BOUNDARY

SURFACE MATERIALS:

- GARDEN/POS/HIGHWAY VERGE (SEE DETAILED LANDSCAPE PROPOSALS)
- TARMACADUM
- BLOCK PAVING

ENCLOSURE DETAILS:

- 1.8M HIGH BRICK WALL
- 1.8M HIGH CLOSE BOARDED FENCING
- 0.9M HIGH ESTATE RAILING

LANDSCAPING:

- INDICATIVE TREE PLANTING (SEE DETAILED LANDSCAPE PROPOSALS)
- RETAINED VEGETATION (SEE TREE RETENTION PLAN)
- ROOT PROTECTION AREA
- POTENTIAL ALLOTMENTS

OTHER:

- BIN COLLECTION POINT
- GATE/PERSONNEL DOOR
- CYCLE STORE
- SOCIAL RENT
- SHARED OWNERSHIP
- AFFORDABLE RENT

House Type Schedule - Parcel N, Arborfield Green

Open Mix Housetypes	No's	Sq.ft	Total Sq.ft	Beds	Storeys	Individual %
Dromer	1	755	755	2	2	2%
Redgrave	8	922	7,376	3	2	15%
Chelmsford M4(2)	4	997	3,988	3	2	7%
Seaton	5	1,043	5,215	3	2	9%
Filey	6	1,127	6,762	3	2.5	11%
Romsey	9	1,176	10,584	4	2	17%
Marlborough	2	1,347	2,694	4	2	4%
Burford V2	3	1,612	4,835	4	2	6%
Buckingham	9	1,517	13,653	5	2	17%
Walton	7	1,855	12,985	5	2.5	13%

Affordable Housetypes	No's	Sq.ft	Total Sq.ft	Beds	Storeys	Individual %
Social Rent						
1B Maisonette M4(2) GF	3	538	1,614	1	1	38%
1B Maisonette M4(2) FF	3	663	1,989	1	1	
AFR 2B3P M4(2)	1	767	767	2	2	
AFR 3B4P M4(2)	1	914	914	3	2	
AFR 4B5P M4(2)	1	1,056	1,056	3	2	
Shared Ownership						
AFR 2B3P M4(2)	1	767	767	2	2	23%
AFR 3B4P M4(2)	2	914	1,828	3	2	
Affordable Rent						
AFR 2B3P M4(2)	1	767	767	2	2	8%

Total Open Market Units	54		68,847
Total Affordable Units	13		9,702
Total Units	67	Total Sq.ft	78,549

PARCEL N, ARBORFIELD GREEN, WOKINGHAM – SITE LAYOUT

PEGASUS GROUP

| PEGASUSGROUP.CO.UK | TEAM/DRAWN BY: THA | APPROVED BY: STH | DATE: 22/09/2025 | SCALE: 1:500@AO | DRWG: P24-1739_DE_01_T_01 | CLIENT: CREST NICHOLSON (CHILTERN) |

Appendix B

Approved Outline Surface and Foul Water Drainage Strategy

Arborfield Garrison SDL, Foul and Surface Water Drainage Strategy

Prepared by: 

.....
Paul Petherick /Siobhan Murphy
Senior Engineer/Principal Engineer

Checked and Approved by: 

.....
Steve Martin
Regional Director

Verified by: 

.....
Chris Paterson
Director

Arborfield Garrison SDL,

Foul and Surface Water Drainage Strategy

Rev No	Comments	Checked by	Approved by	Date
1	Issue for comment	SLM	SLM	16.09.14
2	Issue for inclusion as ES appendix	SLM	SLM	19.09.14

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B4 6AT

Job No 60312043 Reference DS/001 Date Created September 2014

Table of Contents

Appendices

1 Project Overview

Purpose of the Assessment

1.1 AECOM Ltd has been appointed by Arborfield Garrison Landowners Consortium to undertake a preliminary assessment of the foul and surface water drainage requirements for the proposed redevelopment of the Arborfield Garrison SDL.

1.2 This report is intended as an initial assessment and will need to be reviewed, refined and updated as the masterplan develops. The report will in due course also incorporate the requirements of the relevant regulators and stakeholders following further consultation.

Scope of the Assessment

1.3 The scope of the assessment is as follows:-

Surface Water

- Obtain details of existing surface water sewers, ditch courses, watercourses and any other water bodies within and adjacent to the site.
- Liaise with the Environment Agency regarding points and rates of discharge and drainage constraints.
- Calculate expected surface water discharge flows based on likely development proposals.
- Obtain copies of available borehole records and geological maps to consider the feasibility of utilisation of sustainable drainage systems (SuDS) for the development site.
- Develop a surface water drainage strategy for the site using the principles of Sustainable Drainage Systems. The surface water drainage strategy will be in accordance with the Environment Agency's and Wokingham Borough Council requirements.

Foul Water

- Hold initial meeting with Thames Water to understand current position and actions for going forward.
- Obtain details of existing foul public water sewers from Thames Water.
- Obtain details from the MoD of existing private drains, flow information and condition.
- Assess existing foul water network and review current off site discharge points.
- Calculate expected foul water discharge flows based on development proposals including an assessment of existing flows that will remain.
- Instruct Thames Water on behalf of Crest to undertake a scoping exercise of assessment work required.
- Receive scoping study and instruct Thames Water on behalf of Crest to undertake Drainage Impact Assessment of Sewage Treatment Works and network capacity.
- Develop a Foul Water Drainage Strategy for the site including consideration of how the MFT site will drain.

2 Development Site

Site Location and Description

2.1 The proposed development site is located within the Borough of Wokingham, south-west of Wokingham, and south of Arborfield Cross, as shown in Figure 2.1

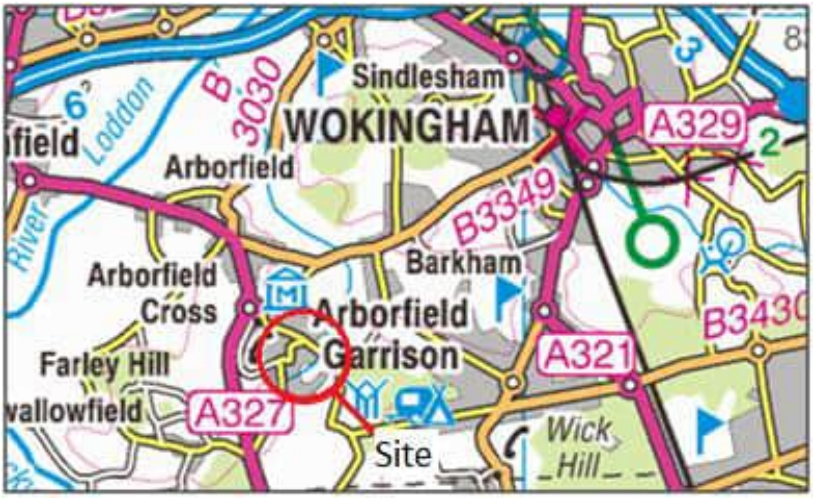


Figure 2.1 – Site location

2.2 The Arborfield Garrison site forms part of a wider Strategic Development Location (SDL), identified through the WBC Core Strategy which was adopted on the 29th January 2010, and capable of delivering approximately 3,500 homes. Figure 2.2. shows the Arborfield Garrison site in the context of the SDL and Suitable Alternative Natural Green Space (SANG) - the red shaded area to the north is the proposed development site, whilst the red shaded area to the south is a Suitable Alternative Natural Green Space (SANG) which forms part of the planning application.

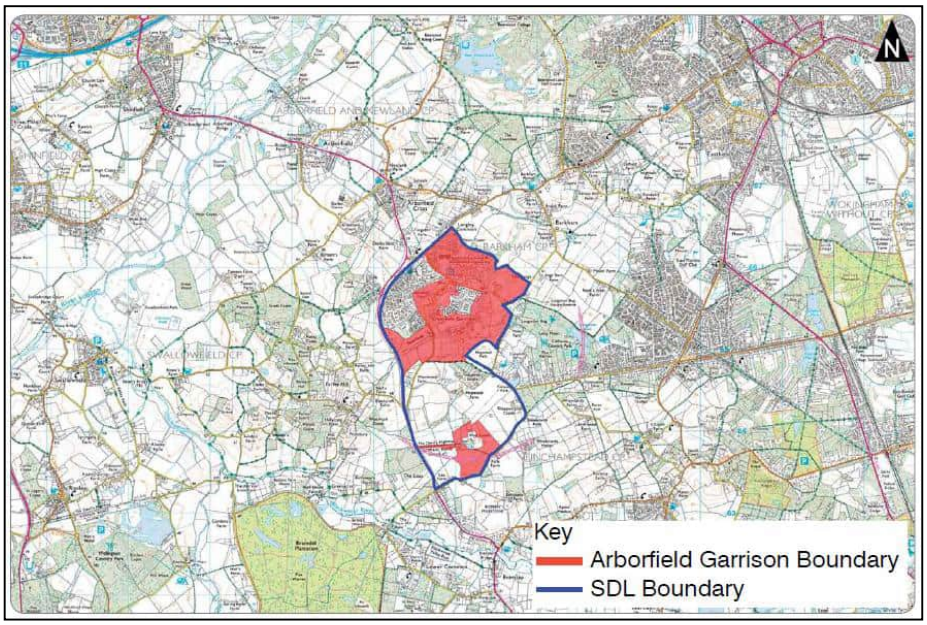


Figure 2.2 – Development Area and SANG

Site Proposals

2.3 The Arborfield Garrison site is planned to provide 2,000 homes, whilst the Marino Family Trust (MFT) proposed development (south of the Arborfield Garrison site) is planned to provide 1,500 homes.

2.4 A copy of the IDP masterplan dated September 2014 reference AR-23 is provided as Appendix A an extract is shown as Figure 2.3 below.

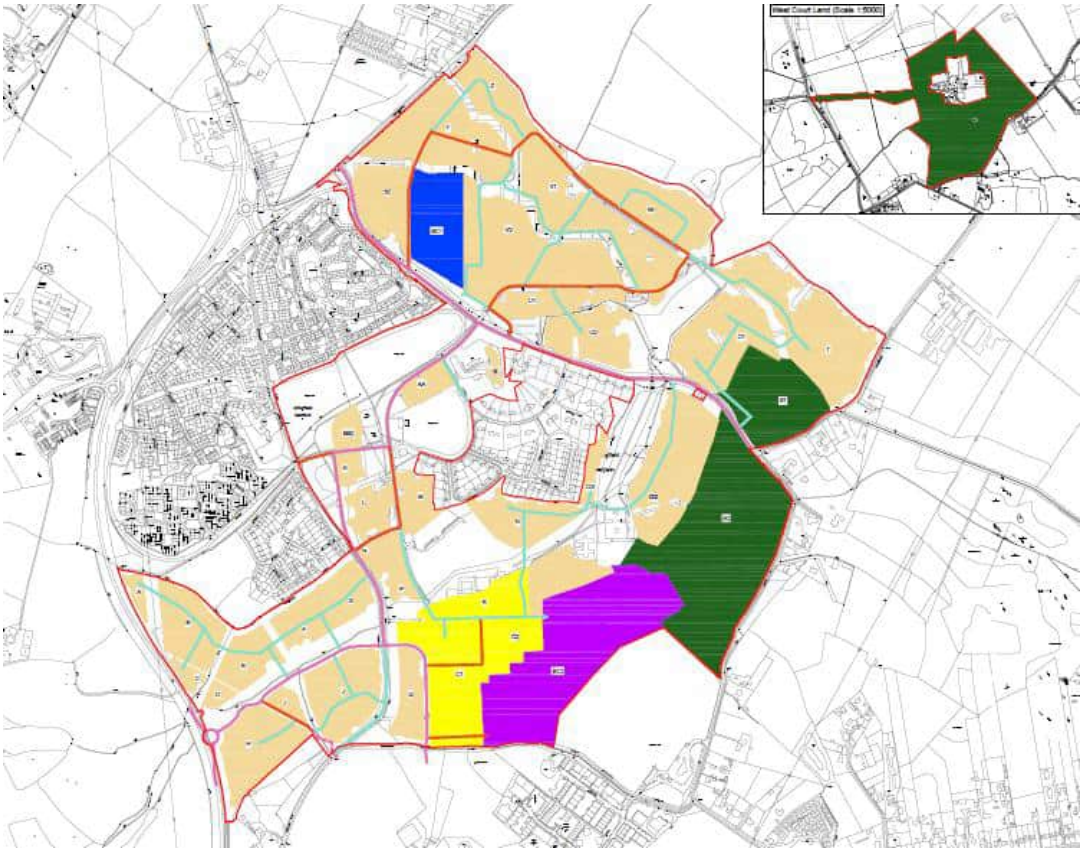


Figure 2.3 –Site Masterplan

2.5 The total site area is approximately 208 ha with approximately 79 ha attributed to developable area, which is provisionally divided into parcels by the internal road network and likely phasing. The site is proposed to include residential, employment, retail/leisure and a primary and secondary school.

3 Existing Site

Site Information

3.1 The proposed development site is within the Wokingham Borough Council boundary and Thames Water (TW) is the sewerage undertaker.

3.2 The land is both a “brownfield” site, or “previously developed land”, and “greenfield”.

3.3 The north and centre of the site consists of military buildings, housing, infrastructure, formal and informal open spaces, hardstandings, car parks and security fencing, and is generally typical of a functioning military Site. The military buildings include Hazebrouck Barracks to the north of the site and Rowcroft Barracks located centrally.

3.4 The eastern, southern and western edges are less developed and form a more open landscape of agricultural fields, playing fields, grassed areas and natural vegetation.

Topography

3.5 Topographical surveys of the site were undertaken in 2008 (Brunel Surveys Ltd) and in 2014 (K.A.Rylance Ltd). In addition to these, LiDAR ground level data was purchased in January 2014 from Mapshop (emapsite) with a resolution of 1m.

3.6 The site topography ranges typically from around 50m AOD to 65m AOD, and is located within one watershed, with the area predominately draining to the north-east, as shown in Figure 3.1.

Geology

3.7 A geo-environmental interpretive report has been prepared by AECOM in August 2014, and notes the following:

“ With reference to the British Geological Survey (BGS); Geology of Britain Viewer and the 1:50,000 scale survey sheet 268, the Site is primarily underlain by London Clay comprising of clays, silts and sands.

3.8 The Bagshot Formation, comprising fine sands, overlies the London Clay to the eastern boundary of the Site.

3.9 Shallow alluvium deposits are also identified within the eastern areas of the barracks, associated with Barkham Brook.

Hydrogeology

3.10 The London Clay Formation is classified as unproductive strata. The Environment Agency defines Unproductive Strata as: ‘.... *layers or drift deposits with low permeability that have negligible significance for water supply or river base flow’*.

3.11 The areas compromising of Alluvium and the Bagshot Formation are classified as Secondary Aquifers. The Environment Agency defines Secondary Aquifers as *‘.... rock layers or drift deposits with an equally wide range of water permeability and storage.’*

3.12 The soils are classified as Soils of a High Leaching Potential (H) which are ‘*soils which have little ability to attenuate diffuse source pollutants and in which non-absorbed diffuse source pollutants and liquid discharges have the potential to move more rapidly to underling strata or to shallow groundwater’*.

3.13 There is one licensed groundwater abstraction 546m south east from the Site at Banisters Farm, for general farming and domestic usage. Two groundwater abstractions are located approximately 1.5km north of the Site.

3.14 Previous reporting indicates anecdotal evidence of an on-site groundwater abstraction for emergency water supply in Hazebrouck Barracks along with four historical water wells present in the north of Hazebrouck Barracks.

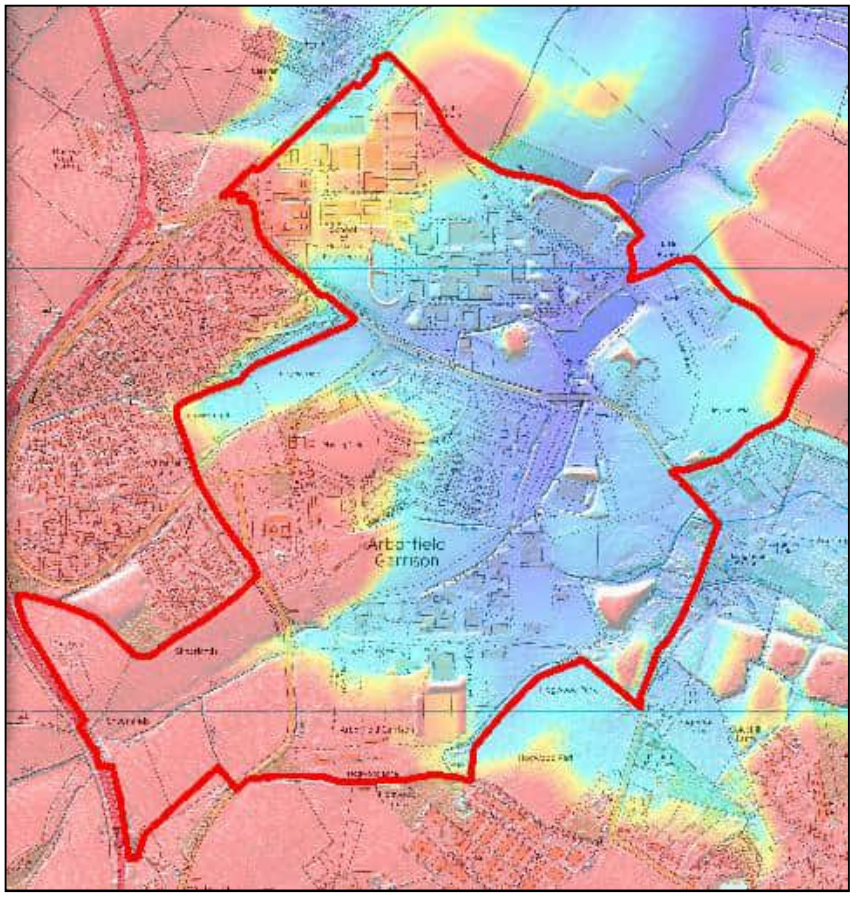


Figure 3. 1 - Arborfield Garrison LiDAR Topography Summary (Areas of high ground shaded red, falling to lower ground areas shown as blue)

Groundwater Source Protection Zones

3.15 The EA defines Source Protection Zones (SPZ) to help monitor the risk of contamination from any activities that might cause pollution in the area.

3.16 The site is not within a Groundwater Source Protection Zone.

Watercourses

3.17 The Arborfield Garrison site is located within the River Loddon Catchment, which lies within the Thames river basin district. The site drains in a general north-easterly direction, and comprises a number of drainage and small fluvial channels that flow through the site, into a balancing pond, before exiting the site and continuing in an north-easterly direction to the confluence with the Barkham Brook at OS NGR SU 77764 66586.

Infiltration to Groundwater

3.18 As discussed in above, the site is primarily Clay so infiltration to groundwater is limited.

Public Sewers

3.19 Thames Water (TW) sewer records, provided as Appendix B, identify the following public sewers in the vicinity of the site:

Surface Water Sewers

3.20 There are no public surface water sewers within the site boundary.

Foul Water Sewers

3.21 A 225mm diameter foul water sewer (FWS) enters the site at its western boundary and runs across the site in a north-easterly direction. A 225mm diameter FWS also enters the site along its southern boundary, where it runs in a northerly direction until it joins with the 225mm diameter from the west as mentioned. The sewer then upsizes to a 300mm diameter and then a 375mm diameter and exits the site along its north-east boundary and falls towards Arborfield Cross Sewage Treatment Works which is located approximately 1.2km away. The location of the treatment works is shown in Figure 3.2 below. These foul water sewers currently serve the residential areas to the west and south of the site boundary.

A 300mm diameter FWS runs along the eastern boundary of a site and falls in a northerly direction adjacent to Park Lane and then Princess Marina Drive, before exiting the site at the north-east boundary. The sewer then runs parallel to the 375mm diameter as mentioned in 4.7 with eventual discharge at Arborfield STW. This FWS currently serves residential areas to the south of the site.

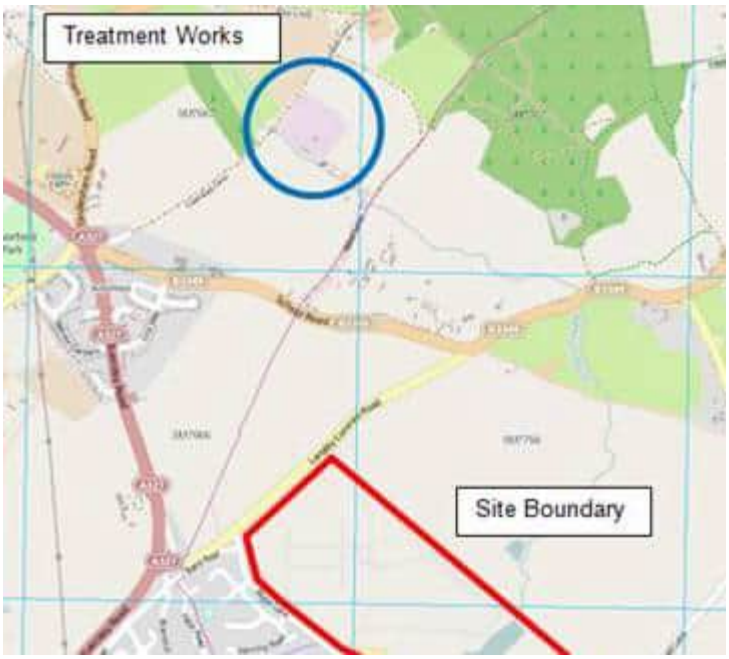


Figure 3. 2 - Arborfield Cross Waste Treatment Works

Other drainage

3.22 The topographical survey of the site identifies a number of other foul and surface water drainage systems within the site, which are likely to be private systems that serve the existing or previous developments.

3.23 The existing site is served by private foul and surface water drainage which is privately maintained by Severn Trent Services (previously Costain). The existing drainage records provided by Severn Trent Services are included as Appendix C.

3.24 Hazebrouck Barracks is served by a separate system. The surface water drains collect water from the many buildings and paved areas and fall in a southerly direction and discharge into the watercourse running across the site. The

surface water drainage size range from DN150 to DN600. Drainage records also show a small portion of the barracks at the north west boundary draining into the ditchcourse adjacent to Langley Common Road.

3.25 A number of surface water outfalls were observed on the bank of the watercourse running across the site.

3.26 The foul water drains serving the Hazebrouck Barracks generally fall in a south westerly direction and discharge into the DN225 public sewer running across the site. A sub-catchment to the north west boundary of the Barracks falls in the opposite direction to a public sewer outside of the site boundary adjacent to Langley Common Road.

3.27 No details are available for the existing drainage from Rowcroft Barracks and the existing houses to be retained in the centre of the site, however it is understood that the sewerage system is separate with surface water discharge into the watercourse running through the site and foul water discharge in the public FWS.

3.28 The drainage records and flow information provided by Severn Trent Services and Thames Water are shown on AECOM Existing Drainage drawing dated March 2014 reference 60312403/CIV/004 included as Appendix D. The drawing identifies the existing catchments and outfall points (some have been assumed) based on the records provided.

4 Sources of Potential Flooding and Information on Flood Extents

Flood Risk from Rivers

4.1 AECOM have undertaken a Flood Risk Assessment (FRA) and modelling study (AECOM report dated August 2014 reference 60312043/FRA/002).

4.2 The Environment Agency's (EA) Flood Map shows that the site comprises areas of Flood Zone 1 and 2. A copy of the EA Flood Map is shown in Figure 4.1 below.

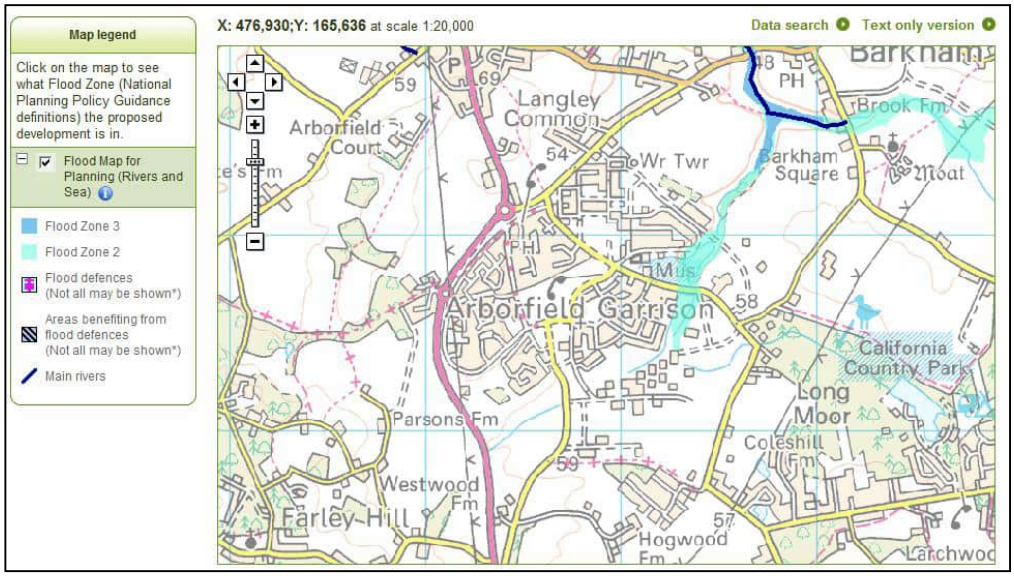


Figure 4. 1 – Environment Agency Flood Zone Map (Image taken from Environment Agency Website)

4.3 The Environment Agency Flood Zones do not reflect the true fluvial flood risk associated with the tributaries that flow through the Arborfield Garrison site. Therefore a key objective of the FRA report is to understand and quantify the risk associated with the smaller open channel network of tributaries through the site. In order to achieve this and to assess the flood risk the FRA report includes the following:

- a summary of the hydrological and hydraulic modelling study undertaken to understand and quantify fluvial flood risk to the site;
- an assessment of existing flood risk to the site (from all sources);
- mitigation options undertaken to reduce the flood risk to the site;
- information detailing how the FRA process has informed and led the spatial planning of the site to steer development to areas of least flood risk; and
- a proposed Masterplan design scenario flood risk assessment.

4.4 The flood modelling has simulated a range of options which have included the:

- removal of redundant channel structures that increase flood risk;
- opening up culverted sections of the watercourses; and
- re-profiling of ground levels – increasing on site flood storage capacity.

4.5 The modelling results have shown that the Masterplan concept design scenario:

- reduces the flood extent on site for the 1 in 20, 1 in100 and 100 year + CC flood events;
- includes a SuDS scheme that delivers a reduction in surface water flows (reducing runoff rates to calculated Greenfield);

- includes a SuDS scheme that has reduced fluvial flooding; and
- has no increase in flood risk downstream off site.

4.6 A copy of the modelling results is shown in Figure 4.2 below.

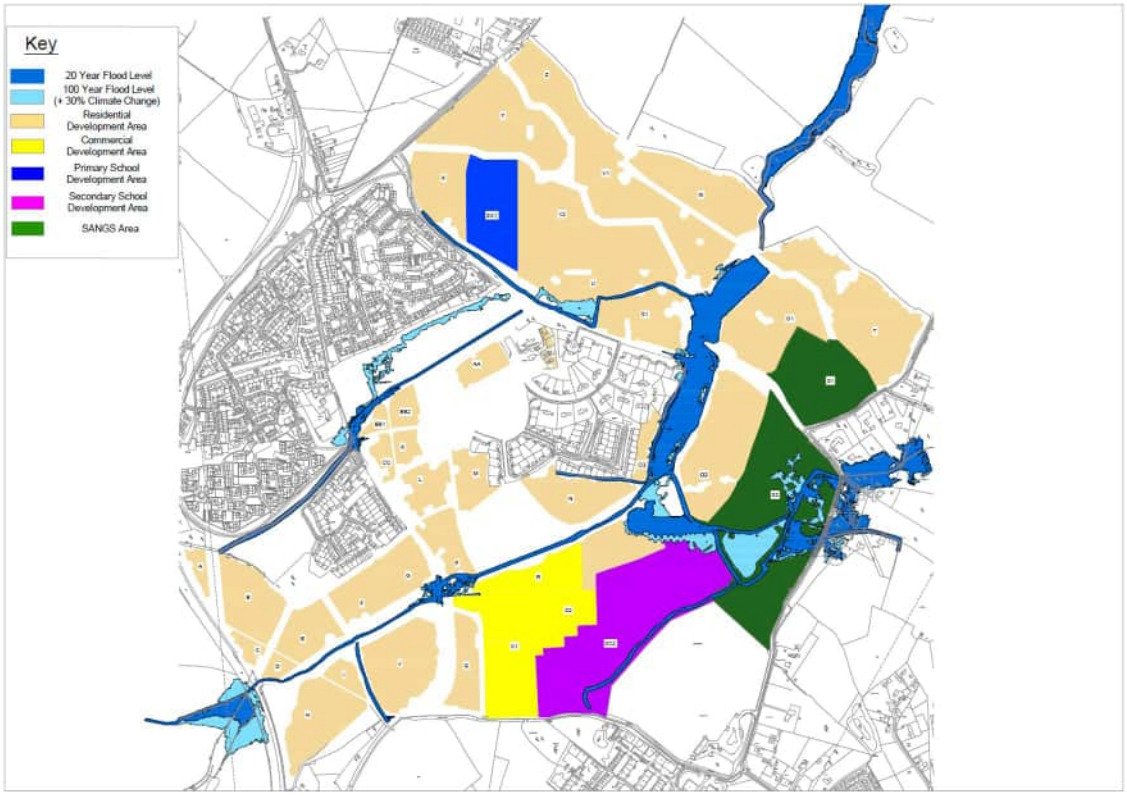


Figure 4.2 – Flood Extent for 1 in 20 year event and 1 in 100 year event plus climate change.

5 Sustainable Drainage Systems (SuDS)

SuDS Objectives

5.1 Surface water drainage systems developed in line with the ideals of sustainable development are collectively referred to as Sustainable Drainage System (SuDS). These systems are designed both to manage the environmental risks resulting from urban runoff and to contribute wherever possible to environmental enhancement. It is proposed that SuDS techniques are utilised wherever possible to manage surface water runoff from the development. The following paragraphs describe how SuDS could be incorporated into the development proposals.

5.2 SuDS objectives are to minimise the adverse effects from the development on the quantity and quality of the runoff, and maximise amenity and biodiversity opportunities." (CIRIA C697, 2007).

5.3 A strong design theme is essential if the maximum aesthetic benefits are to be gained from the SuDS approach. At a more local scale the SuDS should link with the individual plots' structure, planting, public open space requirements and amenity areas, gaining multiple benefits from a limited area of land. Multi-user green corridors could provide a linking theme through the area.

5.4 Sufficient space must be allowed for the SuDS features to appear as natural features and not be constrained by the development into inadequate, unattractive areas. Working with nature can ensure that SuDS are in keeping with their setting, minimising management requirements and costs.

5.5 The following reference guides will be reviewed and utilised, as appropriate, during the SuDS features design procedure;

- Planning for SuDS – making it happen (CIRIA C687)
- Site handbook for the construction of SUDS (CIRIA C698, 2007)
- Designing for exceedance in urban drainage: Good practice (CIRIA C635, 2006)
- Flood Risks to People, Defra /Environment Agency 2006
- Culvert design and operation guide (CIRIA C689, 2010)
- The GRO Green Roof Guide

The SuDS Management Train

5.6 The 'management train approach' should be central to the surface water drainage strategy of for the proposed site. The main objective is treatment and control of runoff as near to the source as possible protecting downstream habitats and further enhancing the amenity value of the site. This concept uses a hierarchy of drainage techniques to incrementally reduce pollution, flow rates and volumes of stormwater discharge from the site, and is as follows:

- Prevention - the use of good site design and housekeeping measures to prevent runoff and pollution and includes the use of rainwater reuse/harvesting
- Source Controls - control of runoff at source or as close to source as possible (e.g. soakaways, green roofs, pervious pavements)
- Site Control - management of water in a local area and can include; below ground storage/attenuation, detention basins, large infiltration devices
- Regional Control - management of water from a site or various sites and can include wetlands and balancing ponds

SuDS Site Constraints

5.7 Not all SuDS techniques are suitable for all sites; therefore an assessment of the existing site is required, so that the SuDS limitations can be determined. This assessment considers the following;

- **Land Use Characteristics**: The proposed density and land use of the development will influence the SUDS selection.
- **Site Characteristics**: Geological, groundwater and contamination characteristics could all affect the suitability of infiltration SUDS techniques.
- **Catchment Characteristics**: The site is currently brownfield and the discharge rate from the redeveloped site will need to be limited. This is discussed in more detail in paragraph 6.6 below.
- **Environmental and Amenity Performance**: Factors including maintenance regime, cost, safety and habitat creation need to be considered to influence the SUDS selection for the site.

SuDS Design Philosophy

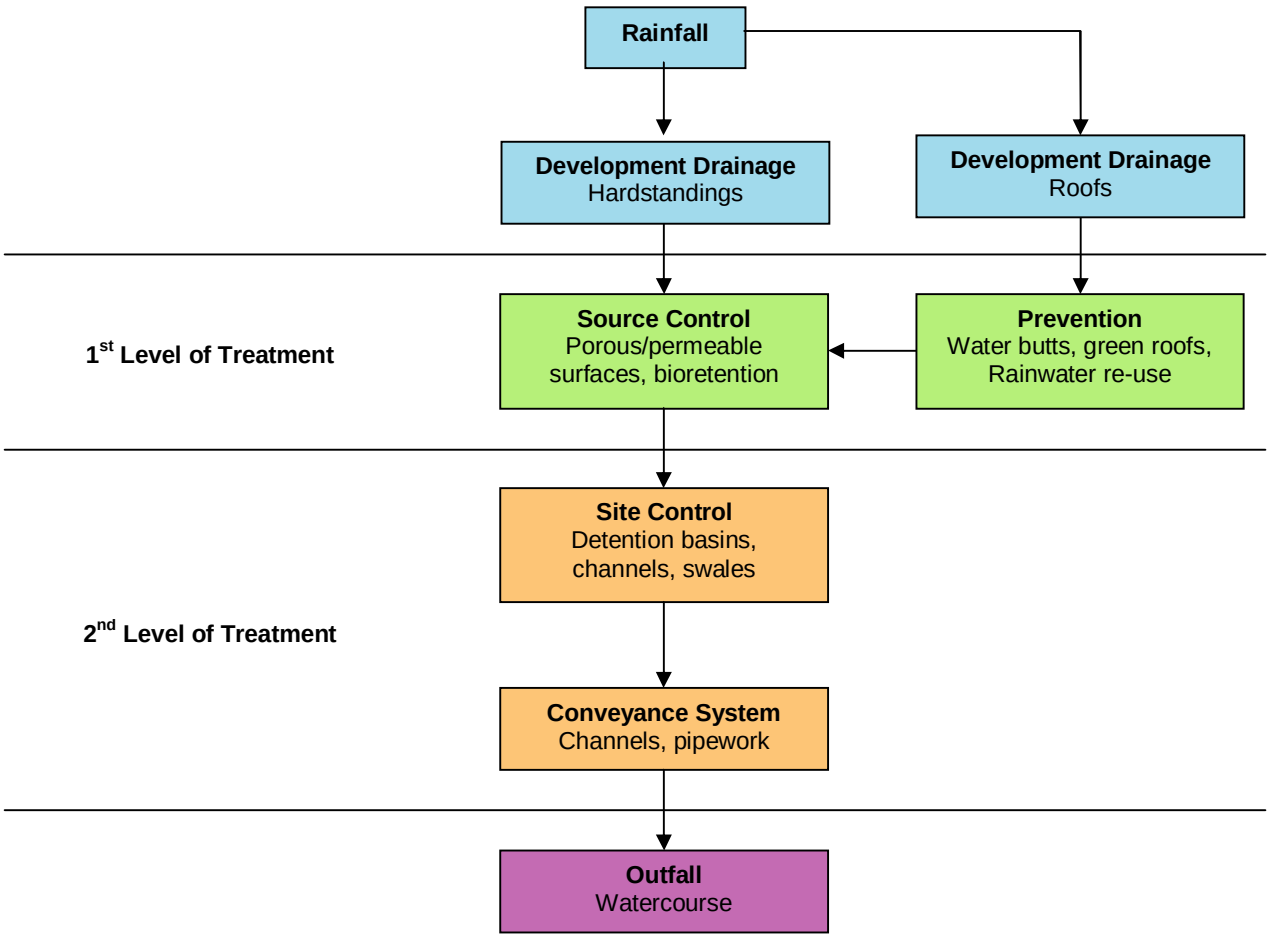
5.8 The SuDS philosophy for the development site is adding value to engineering design through habitat enhancement, landscape design, provision of an amenity resource and promotion of source control techniques. Landscape and ecological issues, where appropriate, should be given equal priority to the engineering issues and at times may have higher priority in the sizing and detailing options.

5.9 The following design philosophy is proposed:-

- Surface Water Treatment using the ‘Management Train’ approach to remove and isolate contamination at source and site control facilities prior to conveyance from the site.
- A minimum of two levels of treatment are provided.
- Integrate SuDS with landscape, habitat and amenity.
- Restrict development runoff peak flow rates to equivalent pre-development rates.
- Site control treatment using attenuation of storm runoff and providing conditions for settlement of suspended solids (detention).
- Use ‘soft engineering' techniques to limit the visual impact of the facilities.
- Use of swales and open channels in lieu of pipelines wherever acceptable and practical.
- Aim to limit, where possible, the impermeable fraction of development.
- Provide overland flood routes for extreme events where possible.
- Maintain existing hedge lines where possible (proposed ‘green corridor’).
- Use native species.
- Create and maintain buffer strips of shrubs, herbs and grasses next to SuDS features such as ponds.
- Promote community involvement and education.

5.10 The drainage techniques proposed for this site include prevention, source controls and site controls. The following SuDS strategy is proposed for the Arborfield Garrison Site. The techniques are discussed in further detail in Section 6.

Schematic of SuDS Strategy



First Level of Treatment – Source Control

5.11 The main objective of source control is the treatment and control of runoff as near to source as possible.

5.12 Prevention in the form of good housekeeping measures can help minimise the contaminants that may wash into the drainage system and extend the life of the system. Permeable surfaces utilising infiltration to groundwater are prime examples of source control. However, it is unlikely that infiltration will be a feasible method of drainage on this site due to the geology and the potential presence of contaminants. Permeable surfaces can still be used, but should be lined such that water is conveyed to a formal drainage system.

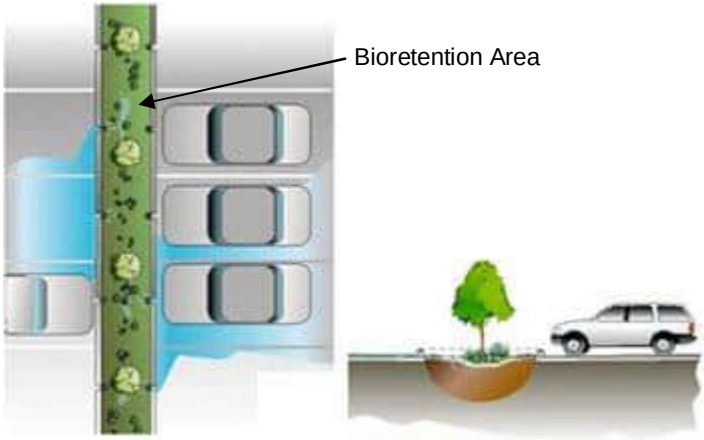
5.13 Other innovative source control solutions may be considered where possible as part of the overall approach to the Management Train, such as rainwater harvesting and greywater use. Water from roofs and hardstandings can be piped directly to a below ground tanks for water re-use, or 'rainwater harvesting'. Screens on downpipes and oil traps on gullies should be considered for filtering the roof debris and preventing oil entering the tank. The water could be used internally within the buildings for flushing toilets, or could be used for certain processes in the employment development.

5.14 Green roofs can act as prevention and source control features and provide good water quality treatment. They reduce the volume and rate of runoff as water is encouraged to remain on the roof. They have the benefit of requiring no land take, and also assist with thermal insulation and sound absorption in the building. They are intended primarily to be viewed rather than used as external space, and if planned properly, can require minimal maintenance. The inclusion of a green roof on a building must be taken into account in the structural design due to the increased imposed loading from the retained water.

Suggested Source Control Techniques

5.15 Source control techniques could include bioretention, permeable/porous surfaces and green roofs. These provide a means of slowing the runoff rate and treatment of the surface water by filtration, settlement and bio-degradation.

5.16 Typical examples of source control systems are given in The SuDS Manual and are briefly described below. The effectiveness of the various systems is inherently vulnerable to inadequate design. Hence particular care should be taken during detailed design.



Bioretention

5.17 Bioretention areas, also referred to as bioretention filters or rain gardens, are surface runoff controls that capture and treat stormwater runoff from frequent rainfall events. Excess runoff from extreme events is passed forward to other drainage facilities. The surface runoff is treated using soils and vegetation in shallow basins or landscaped areas to remove pollutants. The filtered runoff is then collected and returned to the conveyance system. Part of the runoff volume will be removed through evaporation and plant transpiration. Suitable flow routes or overflows are required to convey water in excess of the design volumes to appropriate receiving drainage systems safely.

5.18 Due to their nature, bioretention areas can be integrated into external areas within the site, and are suited to fitting around parking bays without excessive land-take, as illustrated in the images above. They allow small areas of landscaping to be incorporated into what could otherwise be a hard landscaped site.

Pervious pavements

5.19 Pervious pavements provide a pavement suitable for pedestrian and/or vehicular traffic that allow rainwater to infiltrate through the surface and into the underlying layers, where water is temporarily stored before infiltration to the ground, reuse or release to a drainage system. If the permeability of the soil is insufficient to allow infiltration, or if there are contamination or shallow groundwater issues, a lined system would be required with eventual connection onto the drainage system.

5.20 Pervious pavements can be made of porous material or constructed as a permeable surface as described below:

- Porous pavements infiltrate water across their entire surface material, e.g. reinforced grass or gravel surfaces, porous concrete and porous asphalt.
- Permeable pavements are formed of material that is itself impervious. However, the materials are laid to allow surface water to infiltrate through the joints or voids between the blocks into the underlying pavement structure, intercepting surface water runoff and providing a pollutant treatment medium prior to discharge to the downstream system. Treatment processes that occur within the surface structure, the subsurface matrix and the geotextile layers include; filtration, adsorption, biodegradation and sedimentation.

5.21 For this site, it is considered that permeable pavements, constructed using interlocking block paving over some or all of the surfacing, would be the most appropriate method within the private parking areas. The use of different surfacing can help, for example, to distinguish between the parking areas and the roadways within the site.

5.22 In addition, a positive strategy is required to promote SUDS and raise awareness. The site owners should be made aware of the purpose and importance of SUDS drainage and the maintenance requirements if the system is to remain private.

Green Roofs

5.23 Where there is limited space on the site, the option of providing green roofs on some of the buildings may be considered to increase the biodiversity on the site and also assist in reducing the volume of runoff and attenuating peak flows.

5.24 There are three main type of green roof, as follows:

- Extensive Green Roofs – the whole roof is covered in low growing, low maintenance plants, such as mosses, succulents, herbs and grasses. The growing medium is 25-125mm thick and the roof is intended to be largely self sustaining, with access required only for occasional maintenance. This type of green roof can be used on flat or sloping roofs and are lightweight and cost effective.
- Intensive Green Roofs (roof gardens) – these roofs are intended to be accessed and provide high amenity benefits. They can include planters, trees and even water features. The loads imposed by these green roofs are much greater than extensive green roofs and they require significant ongoing maintenance.
- Simple Intensive Green Roofs – as with the intensive green roofs, these can be assessed, but are generally vegetated with lawns or ground covering plants, which do require regular maintenance. The structural loading associated with these green roofs is lower, so they are less expensive than standard roof gardens.

5.25 On this site, extensive or simple intensive green roofs are more likely to be the favoured solutions due to the relative low costs. It is recommended that the design of these features is considered at an early stage, with the input of a horticulturalist and structural engineer to ensure the most effective and successful solution is provided.

Second Level of treatment – Site Control

5.26 Site control features such as ponds and detention basins can be designed to attenuate storm runoff and provide conditions for settlement of suspended solids. The use of these types of attenuation within the development is proposed for some areas of the site where there is sufficient land available to provide these large features.

Detention Basins

5.27 Detention basins collect surface water runoff from a site. They are generally dry features which are allowed to fill during significant storm events and then empty over time. Basins can also be mixed, including both a permanently wet area for wildlife or treatment of the runoff and an area that is usually dry to cater for flood attenuation.

5.28 Detention Basins offer opportunities for the landscape design. Basins should not be built on, but can be used for sports and recreation and can form part of public open space.

5.29 Detention basins will attenuate flows from site by use of complex flow controls situated downstream of the basin.

Channels and Swales

5.30 The site control measures also include landscaped channels and swales. The vegetated channels will drain water evenly off impermeable areas. Rainwater runs through the vegetation alongside of the channel which slows and filters the flow. They are designed to convey water, but can also provide the benefits of detention and treatment of runoff. Incorporation of check dams or pools can slow flows, increase attenuation and promote deposition of suspended solids.

5.31 Channels and swales can be incorporated into road verges and areas of public open space to provide an amenity as well as the SuDS function. In such locations they are likely to be dominated by fine-grass species and regularly mown.

5.32 The use of SuDS as part of the Site-Wide drainage strategy is described further in Section 6.

Pollution Control

5.33 Runoff quality control for the proposed development site may include some or all of the control features detailed above, swales, channels, ponds or basins. In addition, where gullies are used to collect surface water from external areas, these should be trapped as a matter of course.

6 Surface Water Drainage Strategy

Surface Water Drainage and Flood Risk Mitigation Parameters

6.1 The proposed surface water drainage strategy has been developed in consultation with the Environment Agency (EA) and Wokingham Borough Council (WBC). The principles of the strategy were agreed at Flood Risk Assessment Scoping meeting held on 28th November 2013. The minutes of the meeting are included as Appendix E.

6.2 The proposed drainage strategy drawings are included in Appendix F.

6.3 The SuDS philosophy has been outlined in Section 5. By virtue of the SuDS philosophy the surface water drainage strategy is as set out in the bullet points listed below:

- The runoff from the proposed development will discharge to the existing water courses within the site.
- Drainage will be by gravity and will mimic the existing situation.
- Surface water run off rates will be restricted to the equivalent greenfield rate of runoff by the use of complex flow controls.
- A SuDS management train approach will be used to treat and attenuate runoff.
- Existing culverted watercourses will be opened up and an on line permanent pond is proposed (included in the AECOM Flood Modelling Study Report dated August 2014 ref: 60312043/FRA/002).
- Flood exceedence pathways have been identified.
- A further level of detail of drainage design will be required at each reserved matters application to accurately determine the internal plot layout including a hydraulic model which will be simulated for an extreme storm event to determine flood flow pathways.

6.4 The following paragraphs expand the principles of the strategy outlined above.

Catchment Areas

6.5 The AECOM Surface Water Drainage Strategy drawing dated September 2014 ref 60312043/CIV/001 shows the site has been divided into sub catchment areas to mimic the existing situation. It has been assumed that existing levels will be retained and that drainage will be by gravity.

Surface Water Discharge Options for the Proposed Development

Option 1 – Infiltration to Groundwater

6.6 AECOM have prepared a geo-environmental interpretive report dated August 2014, and notes that the site is primarily underlain by clay therefore infiltration is unlikely.

Option 2 – Discharge into Watercourse

6.7 As the ground conditions are unsuitable for infiltration, discharge into the watercourses that cross the site is considered to be the only viable option for surface water discharge.

It is therefore proposed that surface water flows are discharged into these watercourses at equivalent greenfield rates of runoff.

Option 3 – Discharge into Public Sewer(s)

6.8 This option has been discounted due to there being no separate public surface water sewers within the development.

Limiting Piped Outflow from Development

6.9 The proposed development site is part brownfield and part greenfield. In consultation with the Environment Agency and Wokingham Borough Council it is proposed that the surface water discharge from the site will be restricted to the equivalent greenfield rate of runoff.

6.10 It is proposed that the outflow restriction to the equivalent greenfield rates will be achieved by making use of complex controls located strategically within the new drainage system. These complex flow restrictions could be in the form of a combination of vortex flow controls and/or orifice plates and/or weirs.

6.11 The outfall complex flow controls will be designed so that the catchments they serve only discharge into the receiving watercourse at the calculated rates of greenfield runoff for various storm events including Q_{BAR} and Q_{100} return periods.

Greenfield Runoff Calculation Method

6.12 Greenfield runoff rates are calculated to determine the level of acceptable rate of discharge from the site to the receiving watercourse and are likely to be used by the environmental regulator to set site-specific drainage constraints. The Institute of Hydrology (IoH) Report 124, Flood Estimation from Small Catchments, has been used to determine peak greenfield runoff rates.

$$Qbar_{rural} = 0.00108 \times AREA^{0.89} \times SAAR^{1.17} \times SPR^{2.17}$$

where:
AREA is the area of the catchment in ha.
SAAR is the long term average rainfall = 657mm.
SPR is Standard Percentage Runoff coefficient for the SOIL category = 0.47.

To calculate the equivalent greenfield runoff rate for the 1yr, 30yr and 100yr return period, the growth curve for FSR Region 6 is then applied.

Assumed Percentage Impermeability

6.13 The site can effectively be split into discrete drainage catchments, with differing land uses. Based on the parcel areas in taken from the Masterplan included as Appendix A the following assumptions have been made as to the likely impermeable areas on the site post-development. It should be noted that these assumptions are based on the masterplan and will be subject to review with each reserved matters application.

- Residential – 65%
- Commercial – 80%
- Primary and Secondary School – 50%

6.14 A catchment area plan drawing dated September 2014 reference 60312043/CIV/010 is included as Appendix F. The plan identifies the developable areas as set out in the Masterplan within each of the drainage subcatchments.

Return Period

6.15 It is a requirement of the sewerage undertaker that a new adoptable drainage system be designed not to flood any part of the site in a 1 in 30 year return period design storm. New drainage systems should be designed to adoptable standards.

6.16 The National Planning Policy Framework identifies that flooding can occur on a local scale due to runoff exceeding the capacity of the minor system during extreme events and it can only be addressed on a site specific basis. Sewers for Adoption 7th Edition (WRc, 2012) states that properties should be protected against flooding from extreme events and that flood pathways are identified when the drainage system is exceeded.

6.17 All attenuation features should be designed to store a 1 in 100 year rainfall event plus an allowance for climate change.

Surface Water Discharge Rates for the Proposed Development

6.18 It is proposed that the surface water runoff for all storm events, including the 1 in 100 year plus climate change, from the site is to be limited to equivalent greenfield rates of runoff without climate change. The greenfield runoff rates have been calculated using the methods identified in Section 6.13. using Microdrainage software. The output from the Microdrainage software is included as Appendix G and is summarised in table 6.1 below..

Rainfall Return Period	Proposed Discharge Rate (l/s/ha)
Q_{BAR}	4.3
Q_1	3.7
Q_{30}	10.0
Q_{100}	13.8

Table 6.1 – Existing Greenfield Rates of Runoff

Note: Q_{BAR} is defined as the Mean Annual Flood flow rate for a river. This approximates to a return period of 2.3 years. Q_{30} and Q_{100} are the runoff rates from a 1 in 30 and 1 in 100 year storm.

6.19 The existing greenfield rates of run off have been used to calculate pro-rata discharge rates in Table 6.2 for the individual catchments identified on drawing 60312043/CIV/001 included as Appendix F.

Catchment (Refer to dwg **Surface Water Drainage Strategy drawing dated September 2014 reference** 60312043/CIV/001)	**Developable Area (ha)**	**Impermeable Area (ha)**	**QBAR Discharge Rate (l/s)**	**Q1 Discharge Rate (l/s)**	**Q30 Discharge Rate (l/s)**	**Q100 Discharge Rate (l/s)**
1	2.1	1.38	5.94	5.11	13.81	19.1
2	0.3	0.19	0.83	0.72	1.93	2.7
3	2.1	1.36	5.85	5.04	13.62	18.8
4	2.9	1.86	7.99	6.87	18.57	25.6
5	0.5	0.35	1.48	1.28	3.45	4.8
6	2.3	1.48	6.38	5.49	14.84	20.5
7	2.4	1.57	6.76	5.82	15.72	21.7
8	11.8	7.67	32.97	28.37	76.68	105.9
9	7.0	4.55	19.54	16.82	45.45	62.8
10	1.1	0.71	3.07	2.64	7.14	9.9
11	3.9	2.51	10.81	9.30	25.14	34.7
12	1.0	0.63	2.73	2.35	6.34	8.8
13	0.7	0.45	1.95	1.68	4.54	6.3
14	1.9	1.26	5.42	4.66	12.60	17.4
15	3.9	2.53	10.88	9.36	25.31	35.0
16	1.8	1.19	5.12	4.40	11.90	16.4
17	2.1	1.37	5.89	5.07	13.70	18.9
18	4.8	3.14	13.50	11.62	31.40	43.4
19	7.0	4.58	19.69	16.95	45.80	63.2
20	2.1	1.37	5.87	5.05	13.65	18.8
21	2.9	1.90	8.16	7.02	18.97	26.2
22	6.4	4.15	17.86	15.37	41.53	57.4
23	2.1	1.37	5.87	5.05	13.65	18.8
24	4.0	2.63	11.30	9.73	26.29	36.3
25	0.6	0.38	1.65	1.42	3.83	5.3
26	0.5	0.32	1.40	1.20	3.25	4.5
TOTAL	**78.3**	**50.91**	**218.92**	**188.38**	**509.12**	**703.05**

Table 6.2 – Pro-Rata Limiting Discharge Rates for Individual Development Catchments

6.20 As a comparison a theoretical baseline rate of runoff from the existing Garrison site can be estimated using the Modified Rational Method. The existing positively drained roof area has been calculated at 10.86 ha and there is also up to 11.53 ha of external area including roads and paved areas around buildings which is positively drained.

Baseline rate of runoff from roofs only $Q = 3.61CvIA$

where $Cv = 0.77$

I = Rainfall Intensity = 50mm

and A = Impermeable Area (ha)

Therefore, $Q = 3.61 \times 0.77 \times 50 \times 10.86 =$ **1510 l/s**

6.21 Reducing the rate of run off to the equivalent greenfield rate of runoff, can be achieved through on site attenuation which will store surface water from the impermeable areas and release it gradually to the outfall. The options for this are discussed below.

Attenuation and Storage of Surface Water

6.22 Attenuation is required before discharge into the local watercourse and is proposed to be undertaken in above ground features, such as ponds and detention basins.

6.23 The use of channels and swales to convey the surface water gives the added advantage of providing attenuation volume within the site.

6.24 The Source Control program within the Microdrainage computer modelling suite has been used to estimate the storage requirements for each parcel based on the percentage impermeability assumptions and limiting discharge rates detailed above. The results are provided in Table 6.3.

Storm Events up to and Including 1 in 30 year Return Period

6.25 The below ground drainage system is to be designed to adoptable standards; therefore it is proposed that all surface water sewers will be designed to convey a design storm of a 1 in 30 year return period.

Storm Events up to and Including 1 in 100 year Return Period + 30% Climate Change

6.26 Attenuation storage will also be required to limit the discharge from the site for up to the 1 in 100 return period design storm plus 30% climate change to greenfield rate of runoff.

6.27 The estimated volume of attenuation storage required at this site for this return period is shown in Table 6.3. The volumes of storage have been generated using Flood Estimation Handbook (FEH) rainfall data and the source control function within the Microdrainage software. The output from the Quick Storage Estimate (QSE) function within the source control function of MicroDrainage is included in Appendix G.

6.28 The table also contains the estimated volume of attenuation storage generated using Flood Studies Report (FSR) data in QSE. By comparison the volumes generated using FEH are more conservative therefore these values have been used in the Masterplan design.

Catchment	Developable Area (ha)	Impermeable Area (ha)	Q100 Discharge Rate (l/s)	QSE (Microdrainage). Storage Volume for 100yr Storm Event + 30% cc FSR rainfall Data (m3)	QSE (Microdrainage). Storage Volume for 100yr Storm Event + 30% cc FEH rainfall Data (m3)	Outfall
1	2.1	1.38	19.1	777	885	A
2	0.3	0.19	2.7	106	117	B
3	2.1	1.36	18.8	766	810	D
4	2.9	2.02	27.9	1049	1200	C
5	0.5	0.35	4.8	198	225	C1
6	2.3	1.48	20.5	833	950	E
7	2.4	1.57	21.7	885	991	D
8	11.8	7.67	105.9	4323	5000	G
9	7.0	4.55	62.8	2565	2900	H
10	1.1	0.71	9.9	399	460	F
11	3.9	2.51	34.7	1414	1580	I
12	1.0	0.63	8.8	507	580	J
13	0.7	0.45	6.3	253	290	J
14	1.9	1.26	17.4	710	832	N
15	3.9	2.53	35.0	1414	1625	T
16	1.8	1.19	16.4	670	760	O
17	2.1	1.37	18.9	772	880	O
18	4.8	3.14	43.4	1769	2010	S
19	7.0	4.58	63.2	2565	2950	O
20	2.1	1.37	18.8	773	880	P
21	2.9	1.90	26.2	1071	1250	R
22	6.4	4.15	57.4	2338	2600	Q
23	2.1	1.37	18.8	773	880	M
24	4.0	2.63	36.3	1482	1700	L
25	0.6	0.38	5.3	214	253	U
26	0.5	0.32	4.5	200	225	K
Total	**78.3**	**50.91**	**705**	**28825**	**32833**	

Table 6.3 – Attenuation Storage Volumes

On-Site Attenuation Features

6.29 The range of attenuation features described below outline the details of the SuDS features incorporated into the site masterplan. The type and location of attenuation features are identified on the Surface Water Strategy drawing ref 60312043/CIV/001.

6.30 The proposed SuDS sections drawing ref 60312043/CIV/009 included in Appendix F illustrate cross sections through proposed SuDS features situated within the site.

Detention basin/pond

6.31 Basins can provide both attenuation of surface water and provide water quality treatment. Runoff entering the basin is detained and treated by settling out sediments and biological uptake until it is displaced by runoff from the next storm. A basin should preferably be divided into a multiple basin system that provides water quality and quantity volume storage in several independent cells. These can create increased attenuation, flood control, longer pollutant removal pathways an easier maintenance regime and more varied ecology.

6.32 The proposed basins will be between 1m and 1.5m deep with slopes at 1 in 3. Low flow channels will be provided through basins to cater for more frequent storm events. Some basins may incorporate some permanent ponds in accordance with landscaping proposals.

6.33 It is proposed that each development zone drains to a detention basin where possible.

Swales and Landscaped Channels

6.34 Swales and channels are linear vegetated drainage features in which surface water can be stored and/or conveyed. Swales should be designed at shallow gradients to promote lower flow velocities which will provide effective pollutant removal. Channels are deeper features again with shallow gradients but with steeper side slopes to reduce land take.

6.35 The proposed channel depths are 1m, the widths of the channels vary between 3m and 6m with a 0.5m to 1m wide base. Channel slopes will be between 1 in 3 and 1 in 1. The channels will also incorporate low flow channels along the base to cater for the more frequent rainfall events.

6.36 Underdrained swales are also proposed within development parcels. A perforated pipe and sand or gravel can be installed below the bottom (under drain). A particular type of under drained swale can be constructed with enhanced vegetation and filtration; these are known as rain gardens, bioswales or bioretention areas.

6.37 The proposed development introduces new swales and channels throughout the site which aid conveyance and pollutant removal.

Other means of attenuation

6.38 Methods of source control discussed in Section 5 such as permeable paving and green roofs may also be considered at detailed design stage. The use of such features will be reviewed against and in parallel with a site wide design code that will consider the broader sustainability objectives for the development as well as adopting any new best practices that may come online over time.

6.39 As infiltration drainage is not a viable option and as such any permeable paving will need to be lined to act as a pollutant removal device. Given the fact that the proposed strategy provides a number of levels of treatment within each catchment in the form of cascading conveyance and attenuation features, it is considered that an additional level of treatment in the form of permeable paving will not be required. If permeable paving were to be used in any part of the site, the storage capacity within this feature will not be used to reduce the overall storage volume as estimated within this strategy.

6.40 It is likely that the overall development timescale will exceed twenty years. It is acknowledged that during this period the take up of SuDS will advance resulting in new innovations . Any future SuDS innovations will be considered for use where appropriate, suitable and feasible.

Surface water outfalls

6.41 It is proposed that Aborfield Garrison site has multiple surface water outfalls to the existing watercourses within the red line boundary. The outfalls are shown on Surface Water Strategy Drawing ref 60312043/CIV/001.

Adoption

6.42 In 2010 the Flood and Water Management Act set out a policy to make the use of SuDS compulsory and that the systems would become the responsibility of the local authority. The government have not yet published guidance for the SuDS Approving Bodies (SABS) and some authorities have chosen to develop an interim approach.

6.43 Wokingham Borough Council (WBC) has an interim SuDS policy dated 28th March 2013 available on the internet included as Appendix E. The document sets out a mechanism for adopting SuDS located within public open space and adopted highway which involves agreement by both parties and commuted sums.

6.44 In a telephone conversation with Julia Greene of WBC on 28th August 2014 it was confirmed that WBC were in the process of setting up a SAB. WBC is currently drafting a checklist of SuDS principles and it is recommended that the detailed SuDS design is developed in line with this checklist when available.

6.45 The alternative arrangement would be for the SuDS to remain unadopted and to be maintained by an estate management company.

Maintenance and Management of SuDS

6.46 Management of SuDS will be undertaken in an ecologically sensitive manner to promote biodiversity across the site. The series of ditches, swales and ponds being introduced across the site will provide a number of wetland habitats, as well as retaining stormwater and releasing it back into the environment.

6.47 For below-ground SuDS such as permeable paving the manufacturer or designer should provide maintenance advice. This should include routine and long-term actions that can be incorporated into a maintenance plan.

6.48 Marginal vegetation should be monitored to ensure it does not engulf the open water. At least 50% of the water should be managed as open and free from marginal vegetation.

6.49 Channels will be monitored annually to ensure that aquatic vegetation does not block the channel and impede water flow and removed as necessary. If cut annually, on a rotational basis, marginal vegetation will ensure a year round supply of vegetative cover and food sources.

6.50 Ponds should be kept free from predatory fish. Occasional drying up can be good as it prevents fish from becoming established. Ponds however, need to retain open water for the majority of the amphibian breeding and larval development seasons to ensure adequate numbers of new recruits into the local population.

6.51 Silt or water plants should not excessively choke ponds. Areas of open water should be retained.

6.52 Management of ponds will be undertaken in late autumn and winter only when amphibians are less likely to be present. Only a small percentage of the pond area will be managed in any one year to leave sections as refuges.

6.53 Detailed ecological management plans for water bodies, SuDS features and wetland areas will be developed in conjunction with the overall phased development programme, and included within the Landscape Management Plan for each phase of construction.

6.54 The SuDS features on the site will be designed to reflect the landscape proposals and the various maintenance requirements.

Reserved Matters Application

6.55 For each phase of the works a detailed drainage strategy will be submitted as part of the reserved matters application. Each submission will reflect the surface water strategy (in particular Table 7.3) detailed in this document and will include the detailed surface water design and supporting calculations. The proposed storage features will be included in detail to reflect the fixed site layout. The proposed discharge rates for each phase will reflect the impermeable area

contributing to the outfall which may include some temporary control measures until the additional contributing areas are constructed.

Exceedance Flows

6.56 Sewers for Adoption 7th Edition (WRc, 2012) states that properties should be protected against flooding from extreme events and that flood pathways are identified when the drainage system is exceeded.

6.57 Flood pathways for the conveyance of exceedance flows should be built into the proposals for the site by the design of the external layout, with the exceedance flow then being conveyed back into the surface water network. At reserved matters application stage, when a detailed hydraulic model has been built for the surface water network, the amount of storage volume that be accommodated by the external areas can be accurately determined.

6.58 Flood Exceedence Route Plan dated September 2014 reference 60312043/CIV/011 included in Appendix E demonstrates the flood exceedence routes based on the proposed Masterplan. The flood flow pathways have been determined based on the indicative internal road layout and existing levels.

Flood Risks to People

6.59 "*People are at risk of suffering death or serious injury when flooding occurs. People are unable to stand in deep of fast flowing floodwater. Once they are unable to stand, there is a high risk of death or serious injury*

Adults are unable to stand in still floodwater with a depth of about 1.5m or greater, although this is obviously affected by the height of a person. The depth of flowing floodwater where people are unable to stand is much less. For example, some people will be at risk when the water depth is only 0.5m if the velocity is 1m/s (about 2 mph). If the velocity increases to 2m/s (about 4 mph), some people will be unable to stand in a depth of water of only 0.3m. Most people will be unable to stand when the velocity is 2m/s and the depth is 0.6m." (Defra / Environment Agency, Flood Risks to People dated March 2006 reference FD2321/TR2)

6.60 During detailed design a hydraulic model will be built for the surface water networks. When simulated for an extreme storm event, the flooding locations will become evident and the flood flow pathways can be determined based on the layout and levels of the road network.

6.61 The depth of the flood water can be determined from the layout and the velocity of the water can be calculated using the Manning's equation. Reference will then need to be made to Figure 2.1 – Combinations of flood depth and velocity that cause danger to people, in the Defra / EA Flood Risks to People publication dated March 2006 reference FD2321/TR2. The velocity and depth as described above would then give a category of flood hazard and the corresponding risk to people. If the risk is deemed to be too high then the design would require reassessing.

7 Foul Drainage Strategy

Foul Drainage Principles

7.1 *"When drawing up sewerage proposals for any development, the first presumption must always be to provide a system of foul drainage discharging into a public sewer. This should be done in consultation with the Sewerage Undertaker of the area.*

If, by taking into account the cost and/or practicability, it can be shown to the satisfaction of the local planning authority that connection to a public sewer is not feasible, a package sewage treatment plant incorporating a combination of treatment processes should be considered.

Only if it can be clearly demonstrated by the developer that the sewerage and sewage disposal methods are not feasible, taking into account cost and/or practicability, should a system incorporating septic tank(s) be considered and proposed if appropriate." (DETR Circular 03/99).

Public Sewers

7.2 The Sewer records obtained from Thames Water indicate there are public foul / combined water sewers within the site boundary. Foul flows in the development area gravitate in a north-easterly direction towards Barkham Road. From here, flows gravitate in a north-westerly direction towards Arborfield Sewage Treatment Works. Arborfield STW is located approximately 2.8km downstream of the development site.

Existing Site Dry Weather Flow Discharge Rate

7.3 The existing discharge from the site has been estimated using the water consumption figures provided by the Severn Trent Services. The average water usage rate is 6.8 l/s. Assuming that 95% of this water is then returned to the foul water system as waste water, then the total discharge from the site is 6.46 l/s. An allowance of 10% for infiltration into the site foul water sewers has been made, therefore the total site dry weather flow (DWF) is estimated at 7.1 l/s.

7.4 The site wide foul water drainage records are incomplete; therefore assumptions have been made on the route and points of discharge.

Proposed Site Dry Weather Flow Discharge Rate

7.5 For the purposes of this assessment, the following discharge criteria has been used to calculate the proposed dry weather flow:

- Residential - 4000 litres / dwelling / day (based on Sewers for Adoption 7th Edition)
- District centre - 0.0594 l/s/1000m2 internal floor space
- Neighbourhood centre - 0.1056 l/s/1000m2 internal floor space
- Primary School – 0.099 l/s
- Secondary School – 0.5278 l/s

7.6 Based on the above criteria the total proposed site dry weather flow has been calculated at **16.4 l/s**, therefore an increase of 9.3 l/s over existing DWF.

7.7 To estimate dry weather peak flow which takes into account diurnal peaks and seasonal fluctuations in water consumption a multiple of 6 is applied to the DWF. The proposed peak DWF is therefore **99.8 l/**s and when compared to the existing site peak DWF of **42.6 l/s**, this results in an increased discharge of **53.6 l/s**.

Foul Drainage Proposals

7.8 Indicative foul drainage proposals for the site are detailed in Proposed Foul Strategy Drawing ref 60312043/CIV/002 included in Appendix H.

7.9 It is proposed to construct a gravity foul water drainage network within each of the development plots which will generally follow the topography of the land and fall towards the existing combined sewer within the development site.

7.10 The indicative foul water design allows for 12 connections from the proposed development onto the existing public sewer. Where possible existing connections onto the public sewer will be utilised for the new development.

Development Impact Assessment

7.11 There has been ongoing liaison with Thames Water regarding the capacity of both their sewerage network and sewage treatment works to cope with the additional flows generated by the new development site.

7.12 To determine the available capacity within the sewerage network and the likelihood of network upgrade, Thames Water are carrying out a Development Impact Assessment. This includes building an InfoWorks hydraulic model of the sewerage network and verifying the model against recorded flows in the actual sewer network using recorded rainfall data. The model can then be assessed using pre and post development flow rates and the performance of the sewerage system known for the critical storm duration of a 1 in 20 year rainfall return period. Any detriment in performance (i.e. increase in surcharge/flooding) will be advised by Thames Water and solutions given which may involve the upgrading of the existing public sewerage system.

7.13 Thames Water has carried out a pre and post development assessment using an unverified hydraulic model.

7.14 In the email dated 2nd September 2014 Thames Water has confirmed that the initial assessment shows that the network may cause detriment and therefore some network enhancement may be required. The capacity and extent of detriment will be reassessed once the verification of the assessment has been completed. The final assessment has not been provided at the time of writing this report. A copy of the correspondence is included in Appendix B.

Arborfield Cross Sewage Treatment Works

7.15 Under Section 94 of the Water Industry Act 1991 sewerage undertakers have an obligation to provide treatment capacity for domestic flows from future development. There is also a requirement to ensure that their assets have no adverse effect on the environment. Thames Water are therefore responsible for assessing and providing future capacity at the STW and this is in line with the Core Strategy Development Plan.

7.16 The current upgrade at Arborfield STW, which will be completed in 2015, will increase the capacity from a 2008 base population equivalent (pe) of 18,700 to 26,253 (increase of 7553 pe). The population of Arborfield Garrison is circa. 1000. Therefore once the barracks is decommissioned in 2015, an additional 1000 pe capacity will be provided. The current upgrade with therefore accommodate a pe increase of 8553.

7.17 Assuming an average of 3 persons per dwelling, this upgrade would therefore provide capacity for approximately 2851 dwellings for both the Arborfield Garrison Site and the Marino Family Trust Site. Based on the latest build profile (excluding the relatively small loads (10%) from the commercial and school development) there will be capacity at Arborfield STW until approximately 2025. When this capacity is reached, Thames Water will provide further capacity as detailed in Section 8.16.

7.18 AECOM wrote to Thames Water on 11th June 2014 asking for confirmation of the points set out above. Thames Water confirmed that the letter was acceptable in their email response on 19th June 2014. A copy of the correspondence is included in Appendix B.

Greywater

7.19 For all foul catchments it is recommended that the use of a grey water system is considered. This is the term for water which has been used for washing and can potentially be reused rather than sent straight down the drains. It is recommended to be considered for certain houses in the new development. Greywater includes water from laundry, dishwashers, baths, showers, hand washing etc, but does not include toilet waste (black water). It is recommended not to use kitchen sink waste water as this often contains traces of grease, fats, meat, fish, and oils.

7.20 This recycled water can be used for toilet flushing and for watering the garden. It reduces the load on valuable ground water reserves, and also reduces the drainage burden of the foul water system.

7.21 The Greywater system involves diverting the water into a container by the use of a valve. This allows normal discharge into the drainage system when required by the owner. Treating greywater typically involves passing it through a filter to remove any solids, disinfection by the addition of a small amount of a chlorine bleach, and then a period of sitting in a

settling tank to cool. Solid particles sink to the bottom, oils and fats rise to the top, and the water in the middle is the treated greywater. More complex systems are possible involving sand and gravel.

8 Conclusions and Recommendations

8.1 This report has been undertaken to develop a foul and surface water drainage strategy for the Aborfield Garrison Site, and to inform the development of a Masterplan.

Surface Water

8.2 Details of existing surface water sewers, ditch courses, watercourses and any other water bodies have been obtained.

8.3 A surface water drainage strategy has been developed in consultation with the Environment Agency and Wokingham Borough council.

8.4 The surface water drainage strategy is shown on AECOM Surface Water Drainage Strategy drawing dated September 2014 reference 603012043/CIV/001.

8.5 Surface water discharge flows have been calculated based on the development proposals.

8.6 Discharge flows have been calculated to restrict the rate of runoff to the equivalent greenfield rate of run off by the use of complex flow controls.

8.7 The strategy includes a SuDS management train approach including swales, channels, basins and online ponds.

8.8 Flood flow pathways will generally be defined by the road network. Flood waters will be conveyed to the attenuation features by means of these pathways.

Foul Water

8.9 An initial meeting was held with Thames Water on 22nd January 2014.

8.10 Details of existing foul public water sewers and private drains have been obtained from Thames Water and the MoD.

8.11 The expected foul water discharge flows have been calculated based on the development proposals including an assessment of existing flows that will remain.

8.12 Thames Water have been instructed on behalf of Crest Nicholson to undertake a scoping exercise of assessment work required. The initial assessment shows that the network may cause detriment and therefore some network enhancement may be required. The capacity and extent of detriment will be reassessed once the verification of the assessment has been completed. The final assessment has not been provided at the time of writing this report.

8.13 AECOM has received written confirmation that Thames Water will provide any additional capacity in the sewerage network under Section 94 of the Water Industry Act 1991.

8.14 The foul water drainage strategy is shown on AECOM Foul Water Drainage Strategy drawing dated September 2014 reference 603012043/CIV/002.

Recommendations

8.15 It is recommended that when the site is developed the steps outlined below are taken in the drainage design process.

8.16 A detailed Ground Investigation should be carried out to inform geological, hydrological and ground conditions on the site.

8.17 Surface water discharge from the site should be limited to equivalent greenfield rates of runoff.

8.18 The layout of the proposed development and the design of the new on-site surface water drainage system should allow for the excess runoff from an exceptionally intense local rainstorm to be confined for the duration of the storm within the site.

8.19 The detailed design of the on-site surface water drainage system should take into account the possible effects of climate change on storm runoff over the next one hundred years.

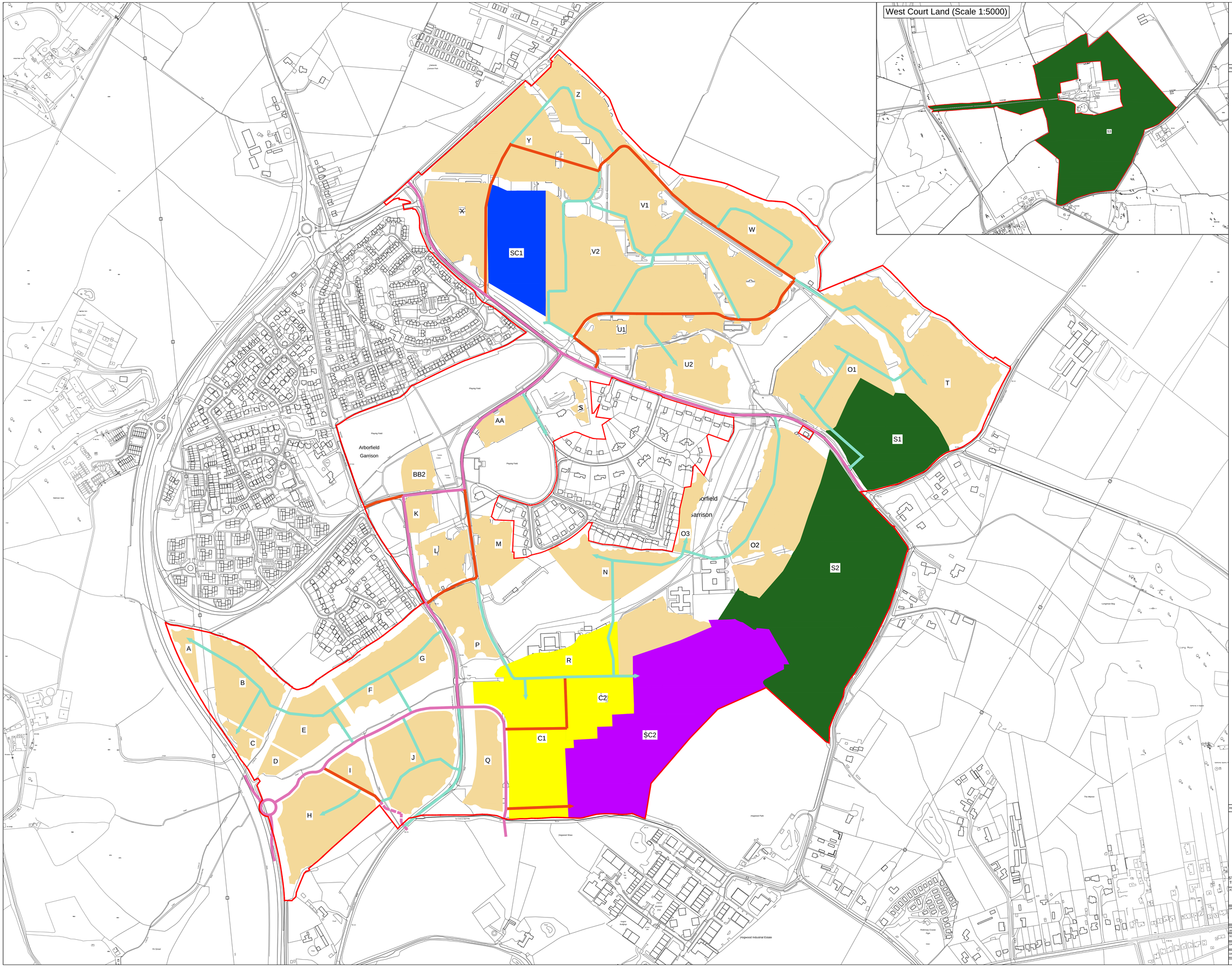
8.20 The detailed design of the proposed SuDS features should be carried out in consultation with Wokingham Borough Council and Thames Water to ensure that there are no issues with the future adoption of the features.

8.21 The foul water design should be refined and reviewed as the site layout develops.

8.22 Where possible existing connections onto the public foul sewer should be utilised for the new development.

Appendix A

Development Masterplan



DO NOT SCALE
All dimensions to be checked on site and Architect to be notified of any discrepancies prior to commencement

DESIGNERS RISK ASSESSMENT
under section 13 - Construction (Design and Management) Regulations 1994

RESIDUAL RISKS

REF.	DESCRIPTION	DATE:

KEY

- SANGS Area- 38.41Ha/ 86.81Acres
- Residential Developable Area- 61.3Ha / 151.4Acres
  2000 units = density of 32.66DPH/ 13.21DPA
- District Centre (Mixed Use) - 5.78Ha/ 14.28Acres
- Primary School Land - 2.88Ha/ 7.11Acres
- Secondary School Land - 9.10Ha/ 22.49Acres
- Primary Street Network
- Secondary Street Network
- Tertiary Street Network

REVISION	DATE	DESCRIPTION	CHECKED
I	190914	Relocated A327 junction. Trees to be retained layer updated.Revised alignment of the Nine Mile Ride extension. Revised cells H,J,Q and C1. Red line boundary amended.	
H	100914	Cells CC and BB1 omitted. Street layout amended to take on board SJA comments. Updated SJA trees to be retained layout.	
G	140814	Road layout updated. SANGS cells S1 and S2 revised to accommodate bridleway link.	
F	040814	Revised Flood line option 3B shown. Development cells amended accordingly. SANGS area reduced to now allow for 2000 units. Revised district centre and primary and secondary school sites cells shown.	
E	220714	Access off A372 roundabout relocated due to third party land, development cells amended accordingly.	
D	160714	Cells and roads updated and SUDS basins/swales locations added.	
C	070714	Cells and roads amended to accommodate green links and SUDS basins/swales.	
B	200614	Cells, SANGS and roads amended. Trees and flood line shown.	
A	110614	Cells and roads amended. Trees and flood line shown	

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JOB / CLIENT
Arborfield Garrison
for Crest Nicholson

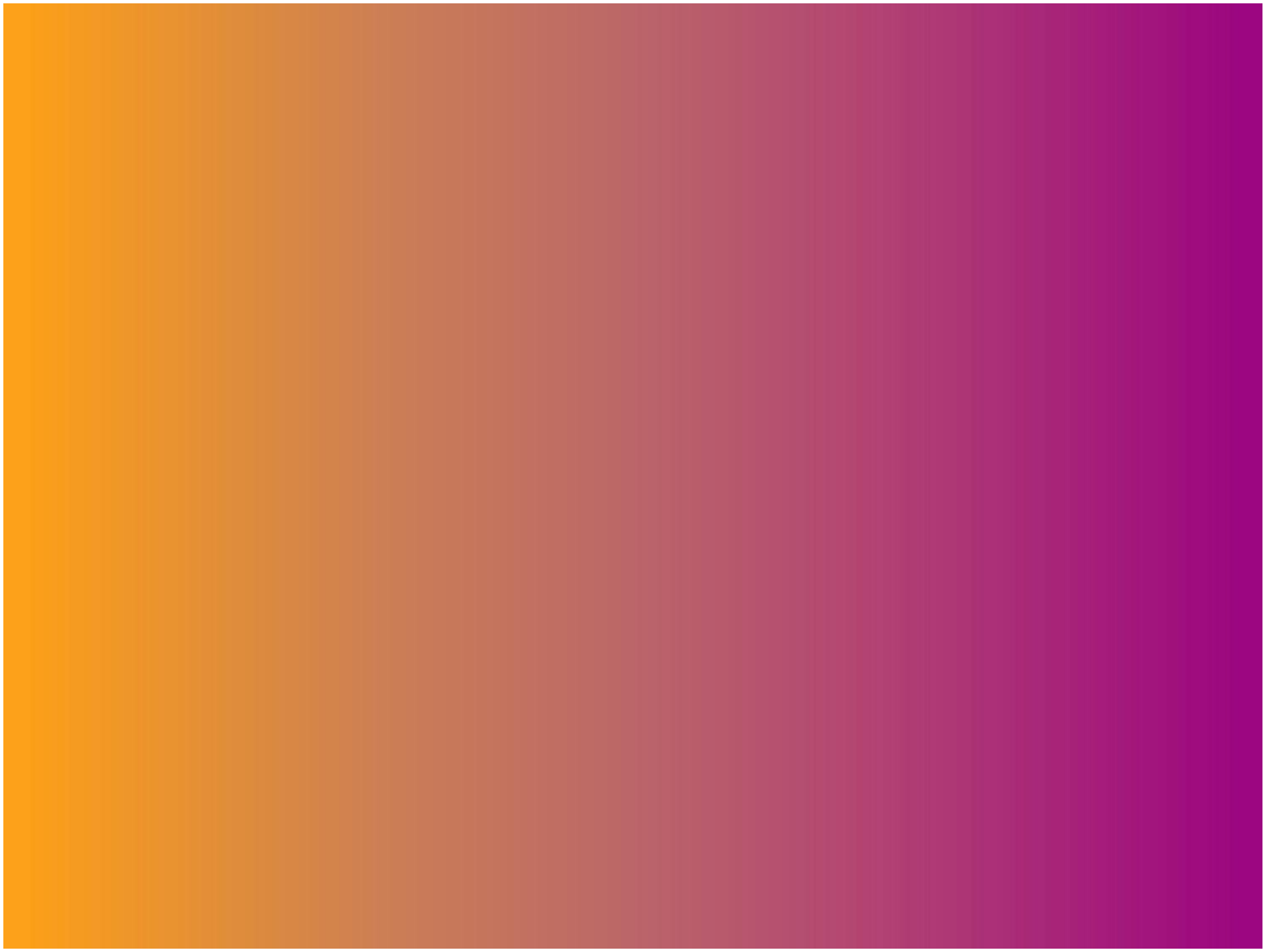
DRAWING TITLE
Masterplan Diagram
(with constraints)

PROJECT ARCHITECT	DRAWN BY	CHECKED
MM	DJ	
SCALE 1:2500@A0	PROJECT NO. N81:2240	DRAWING NO Rev I AR-23
DATE 16/05/2014		

DRWG. STATUS: DRAFT | CONSULTATION | TENDER | CONSTRUCTION | RECORD

Appendix B

Thames Water Correspondence



Murphy, Siobhan

From: Martin, Steve L
Sent: 03 September 2014 17:20
To: Murphy, Siobhan
Subject: FW: Arborfield Garrison SDL DIA (SMG1522 X4503/669) - Initial Detriment Results

fyi

From: Geoff Nokes [mailto:geoff.nokes@thameswater.co.uk]
Sent: 03 September 2014 15:39
To: Martin, Steve L
Subject: FW: Arborfield Garrison SDL DIA (SMG1522 X4503/669) - Initial Detriment Results

fyi

From: Tyrone Parkinson [mailto:Tyrone.Parkinson@mwhglobal.com]
Sent: 02 September 2014 15:36
To: Geoff Nokes
Cc: Manuel Dasilva; Simone Rast; Carl Smith
Subject: Arborfield Garrison SDL DIA (SMG1522 X4503/669) - Initial Detriment Results

Dear Geoff

The model build for the Arborfield study is now complete. The scope for the study requires us to provide an initial assessment to the Developer in advance of the completing the flow survey and model verification. An initial assessment of the proposed development has been completed with the newly built but unverified model. This shows that the development may cause detriment and therefore some form of network enhancement may be required. The flow survey is almost complete and so model verification will start shortly. The capacity of the existing network and extend of any detriment caused by the proposed development will be re-assessed once the verification is complete.

Would you like to pass this information on to the Developer?

Regards

Tyrone

Tyrone Parkinson
Principal Engineer
MWH Global
Terriers House Tel: +44 (0) 1494 557692
201 Amersham Road Mobile: +44 (0) 7710 944339
High Wycombe HP13 5AJ
United Kingdom

tyrone.parkinson@mwhglobal.com
www.mwhglobal.com

From: Graham Moralee
Sent: 02 September 2014 14:36

To: Simone Rast
Cc: Tyrone Parkinson; Pugazh Thayumanavan; Kishor Patil; Carl Smith
Subject: RE: Arborfield Garrison SDL DIA - Initial Detriment Results

Hi Simone,

As we don't normally provide actual detriment figures externally, we could provide a themed plan showing the locations of flooding and surcharge detriment?

Kind regards,
Graham

Graham Moralee MCIWEM
Senior Wastewater Networks Modeller
Urban Drainage Group

MWH.
BUILDING A BETTER WORLD

From: Simone Rast [mailto:simone.rast@thameswater.co.uk]
Sent: 02 September 2014 13:45
To: Graham Moralee
Cc: Tyrone Parkinson; Pugazh Thayumanavan; Kishor Patil; Carl Smith
Subject: RE: Arborfield Garrison SDL DIA - Initial Detriment Results

Hi Graham,

I'm looking at this now.
We agreed to provide results from an initial run without flow survey data in the scope, so we ought to provide a response, although we'd like to avoid this really.

What did you have in mind to send?

Kind regards,
Simone

Simone Rast
Wastewater Network Modeller
Thames Water Utilities Ltd,
Reading STW, Island Road,
Reading, RG2 0RP

☎ 020 3577 9299 (89299)

Simone.Rast@thameswater.co.uk

From: Graham Moralee [mailto:Graham.Moralee@mwhglobal.com]
Sent: 28 August 2014 12:00
To: Simone Rast
Cc: Tyrone Parkinson; Pugazh Thayumanavan; Kishor Patil; Carl Smith
Subject: RE: Arborfield Garrison SDL DIA - Initial Detriment Results

Hi Simone,

The model was calibrated using the full SFHD dataset from 1990 to February 2014. The dataset was filtered to remove any XE and XI properties, and only those with a Hydraulic Flood Category Code were considered. In total, there were 90 instances of reported flooding at 48 separate properties that were considered.

Figure 4 in the MBV Report shows the predicted vs. reported flooding locations with the results of an M30 event shown.

Please find an IWC containing the current model files for the Arborfield Garrison study uploaded to the SMFT, as shown.

Please let me know any further queries.

Thanks,
Graham

Graham Moralee MCIWEM
Senior Wastewater Networks Modeller
Urban Drainage Group

MWH.
BUILDING A BETTER WORLD

From: Simone Rast [mailto:simone.rast@thameswater.co.uk]
Sent: 28 August 2014 11:25
To: Graham Moralee
Cc: Tyrone Parkinson; Pugazh Thayumanavan; Kishor Patil; Carl Smith
Subject: RE: Arborfield Garrison SDL DIA - Initial Detriment Results

Hi Graham,

I am currently in the process of reviewing the Arborfield DAP report.
It seems that for the historic verification of the Arborfield model you have taken into account properties that flooded only in the extreme event of 20th July 2007.

If this is correct, then it is likely that the model over predicts in some areas.

Could you send me your current model please, to have a look?

Kind regards,

Simone

Simone Rast
Wastewater Network Modeller
Thames Water Utilities Ltd,
Reading STW, Island Road,
Reading, RG2 0RP

☎ 020 3577 9299 (89299)

Simone.Rast@thameswater.co.uk

Asset Management

Driving Intelligent Investment

From: Graham Moralee [mailto:Graham.Moralee@mwhglobal.com]
Sent: 28 August 2014 10:50
To: Simone Rast
Cc: Tyrone Parkinson; Pugazh Thayumanavan; Kishor Patil; Carl Smith
Subject: Arborfield Garrison SDL DIA - Initial Detriment Results

Good Morning Simone,

We've completed our initial assessment of the predicted detriment caused by the Arborfield Garrison SDL site, using the unverified Arborfield model. The consultant acting on behalf of the Developer, URS, requested this initial run as part of the assessment so they could provide an indication to their client of the potential impact.

We must obviously stress that the attached results have been produced using the model that has only been calibrated using historical flooding records, and has not had any verification against measured flow survey data carried out. Therefore, the attached results are subject, and likely to, change.

The attached results spreadsheet indicate a minimum amount of flooding detriment to be caused by the re-development of the Garrison site; however, there is surcharge detriment caused.

Please let me know if you would like to review the model set-up before we look to issuing these initial results to Developer Services and the Developer.

Kind Regards,
Graham

Graham Moralee MCIWEM
Senior Wastewater Networks Modeller
Urban Drainage Group
MWH Global
Terrier's House, 201 Amersham Road
High Wycombe, Buckinghamshire, HP13 5AJ
United Kingdom
T: +44 (0)1494 557 695 (Ext:7695)
M: +44 (0)79211 72303
graham.moralee@mwhglobal.com
www.mwhglobal.com

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BUILDING A BETTER WORLD

Asset Location Search

Thames Water Property Searches
12Vastern Road
READING
RG1 8DB

Search address supplied Biggs Lane
Arborfield
Reading
RG2 9LL

Your reference 60312043 - Arborfield Garrison

Our reference ALS/ALS Standard/2014_2677085

Search date 8 February 2014

You are now able to order your Asset Location Search requests online by visiting
www.thameswater-propertysearches.co.uk

searchcode

Asset Location Search

Search address supplied: Biggs Lane, Arborfield, Reading, RG2 9LL

Dear Sir / Madam

An Asset Location Search is recommended when undertaking a site development. It is essential to obtain information on the size and location of clean water and sewerage assets to safeguard against expensive damage and allow cost-effective service design.

The following records were searched in compiling this report: - the map of public sewers & the map of waterworks. Thames Water Utilities Ltd (TWUL) holds all of these.

This searchprovides maps showing the position, size of Thames Water assets close to the proposed development and also manhole cover and invert levels, where available.

Please note that none of the charges made for this report relate to the provision of Ordnance Survey mapping information. The replies contained in this letter are given following inspection of the public service records available to this company. No responsibility can be accepted for any error or omission in the replies.

You should be aware that the information contained on these plans is current only on the day that the plans are issued. The plans should only be used for the duration of the work that is being carried out at the present time. Under no circumstances should this data be copied or transmitted to parties other than those for whom the current work is being carried out.

Thames Water do update these service plans on a regular basis and failure to observe the above conditions could lead to damage arising to new or diverted services at a later date.

Contact Us

If you have any further queries regarding this enquiry please feel free to contact a member of the team on 0845 070 9148, or use the address below:

Thames Water Utilities Ltd
Property Searches
PO Box 3189
Slough
SL1 4WW

Email: searches@thameswater.co.uk
Web: www.thameswater-propertysearches.co.uk

Asset Location Search

Waste Water Services

Please provide a copy extract from the public sewer map.

The following quartiles have not been printed as they contain no assets:

The following quartiles have been printed as they fall within Thames' sewerage area:

SU7665SW
SU7665NW
SU7665SE
SU7665NE
SU7666SE
SU7764NW
SU7765SW
SU7765NW
SU7766SW
SU7765SE
SU7765NE
SU7766SE
SU7664NW
SU7664NE

Enclosed is a map showing the approximate lines of our sewers. Our plans do not show sewer connections from individual properties or any sewers not owned by Thames Water unless specifically annotated otherwise. Records such as "private" pipework are in some cases available from the Building Control Department of the relevant Local Authority.

Where the Local Authority does not hold such plans it might be advisable to consult the property deeds for the site or contact neighbouring landowners.

This report relates only to sewerage apparatus of Thames Water Utilities Ltd, it does not disclose details of cables and or communications equipment that may be running through or around such apparatus.

The sewer level information contained in this response represents all of the level data available in our existing records. Should you require any further Information, please refer to the relevant section within the 'Further Contacts' page found later in this document.

For your guidance:

- The Company is not generally responsible for rivers, watercourses, ponds, culverts or highway drains. If any of these are shown on the copy extract they are shown for information only.
- Any private sewers or lateral drains which are indicated on the extract of the public

sewer map as being subject to an agreement under Section 104 of the Water Industry Act 1991 are not an 'as constructed' record. It is recommended these details be checked with the developer.

Clean Water Services

Please provide a copy extract from the public water main map.

The following quartiles have not been printed as they contain no assets:

The following quartiles have been printed as they fall within Thames' water area:

SU7765SW
SU7765NW
SU7766SW
SU7765SE
SU7765NE
SU7766SE
SU7664NW
SU7665SW
SU7665NW
SU7665SE
SU7665NE
SU7666SE
SU7664NE South East
SU7764NW South East

The following quartiles have not been printed as they are out of Thames' water catchment area. For details of the assets requested please contact the water company indicated below:

Enclosed is a map showing the approximate positions of our water mains and associated apparatus. Please note that records are not kept of the positions of individual domestic supplies.

For your information, there will be a pressure of at least 10m head at the outside stop valve. If you would like to know the static pressure, please contact our Customer Centre on 0845 920 0800. The Customer Centre can also arrange for a full flow and pressure test to be carried out for a fee.

South East Water Ltd
3 Church Road
Haywards Heath
West Sussex

Asset Location Search

RH16 3NY

Tel: 0845 301 0845
Website: www.southeastwater.co.uk.

For your guidance:

- Assets other than vested water mains may be shown on the plan, for information only.
- If an extract of the public water main record is enclosed, this will show known public water mains in the vicinity of the property. It should be possible to estimate the likely length and route of any private water supply pipe connecting the property to the public water network.

Payment for this Search

A charge will be added to your suppliers account.

Asset Location Search

Further contacts:

Waste Water queries

Should you require verification of the invert levels of public sewers, by site measurement, you will need to approach the relevant Thames Water Area Network Office for permission to lift the appropriate covers. This permission will usually involve you completing a TWOSA form. For further information please contact our Customer Centre on Tel: 0845 920 0800. Alternatively, a survey can be arranged, for a fee, through our Customer Centre on the above number.

If you have any questions regarding sewer connections, budget estimates, diversions, building over issues or any other questions regarding operational issues please direct them to our service desk. Which can be contacted by writing to:

Developer Services (Waste Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0845 850 2777
Email: developer.services@thameswater.co.uk

Clean Water queries

Should you require any advice concerning clean water operational issues or clean water connections, please contact:

Developer Services (Clean Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0845 850 2777
Email: developer.services@thameswater.co.uk

Asset Location Search Sewer Map - ALS/ALS Standard/2014_2677085

SU7665SW

The width of the displayed area is 500m and the centre of the map is located at OS coordinates 476250,165250

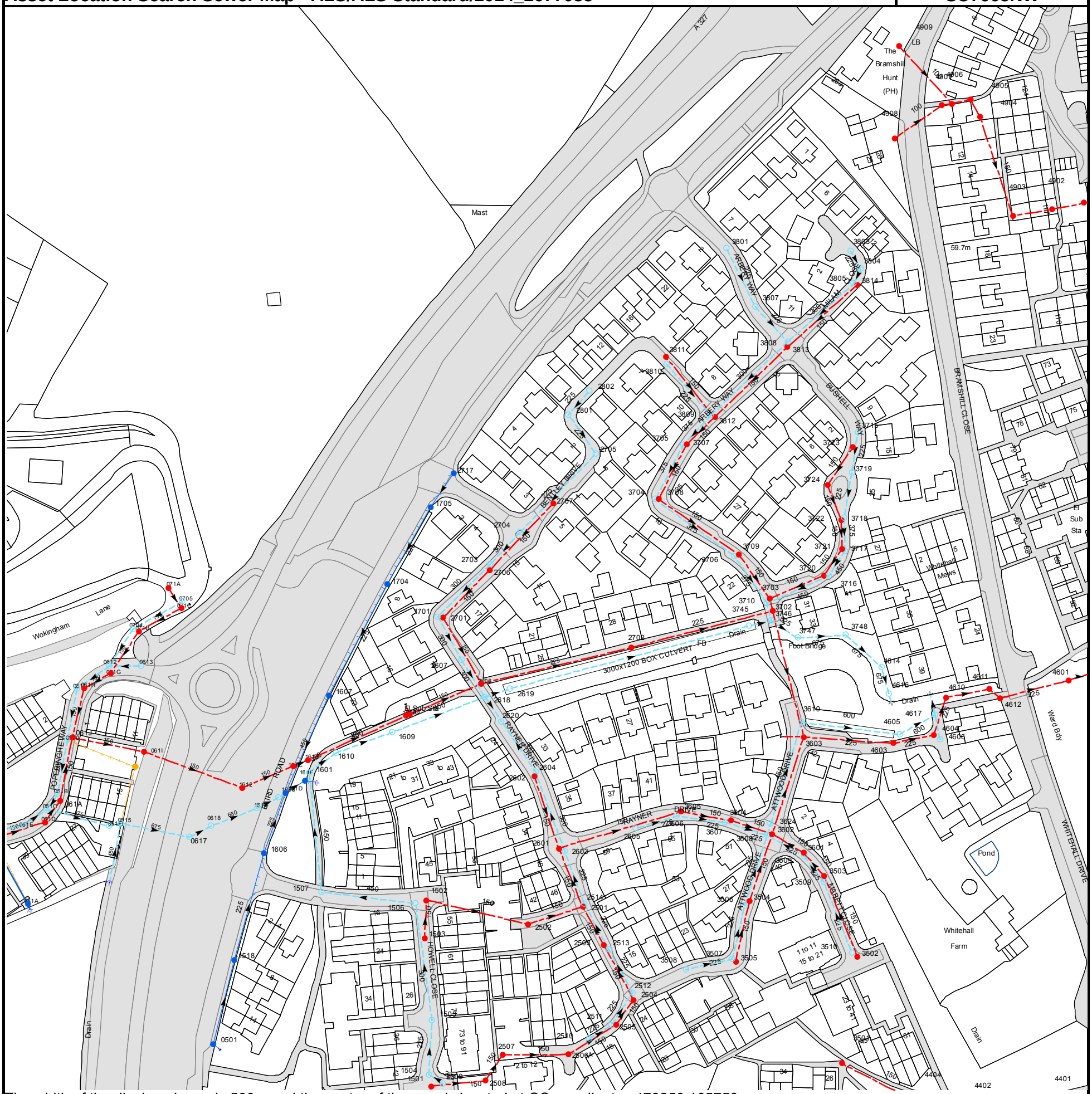
NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
4408	59.02	57.83
4415	58.34	56.24
4414	58.08	55.95
4407	59.18	57.62
4405	58.4	56
4406	58.32	56.92
4403	57.8	56.54
4402	57.95	56.38
4401	57.46	55.46
4404	58.79	57.62
4205	61.77	59.34
4201	61.75	58.69
4207	61.14	58.74
4203	61.14	58.16
4206	61.12	58.76
4202	61.11	58.28
4208	61.16	58.72
4204	61.07	58.06
4306	60.8	59.03
4305	60.81	58.5
4301	60.46	57.77
4307	61.41	58.66
4308	59.53	57.57
4304	59.51	57.38
4409	58.86	56.81
4416	n/a	n/a
4302	60.11	57.63
3305	60.06	58.53
4303	59.93	57.56
3302	59.65	57.61
3301	59.83	58.34
3406	60.32	58.6
3401	59.74	58.7
3404	60.58	59.15
3403	59.78	59.18
3402	59.83	58.92
3405	60.6	59.58
2201	61.49	58.73
3303	60.23	58.47
2307	61.96	59.1
2306	61.81	58.99
2302	61.62	60.07
2301	61.94	59.71
2303	61.24	60.03
2305	62.16	60.84
2304	61.88	60.36
3407	61.25	58.92
2401	61.34	59.55
2406	61.52	60.36
2402	61.26	59.71
2407	61.98	60.66
2410	62.38	60.66
2403	60.97	60.06
2404	61.09	60.46
2405	62.22	61.32
1306	62.97	60.68
1401	63.1	60.94
1402	63	61.39
1303	62.82	59.59
1302	62.84	59.48
1304	62.87	59.91
1305	62.67	60.08
1301	62.74	59.44
2408	62.44	60.28
2409	62.34	60.45

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

Asset Location Search Sewer Map - ALS/ALS Standard/2014_2677085

SU7665NW



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 476250,165750

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
4603	58.73	54.88
4606	56.25	55.15
4604	56.33	54.77
4605	56.83	55.14
4617	56.15	55.15
4612	55.95	54.52
4610	56.15	54.67
4616	56.56	54.97
4611	56	54.55
4601	55.73	54.17
4614	56.96	55.24
4903	n/a	n/a
4902	59	56.77
4901	58.82	56.56
4908	59.92	58.73
4904	59.41	57.87
4907	59.69	58.44
4906	59.74	58.38
4905	59.66	58.33
4909	60.68	59.35
3610	57.28	55.7
3747	57.73	55.46
3748	57.4	55.33
3745	57.65	55.75
3746	57.69	55.65
3702	57.72	55.29
3710	57.86	55.9
3703	57.84	55.37
3720	57.96	56.25
3716	58.05	55.99
3706	58.24	56.51
3709	58.49	55.98
3717	58.19	56.02
3721	58.18	56.45
3722	58.46	56.62
3718	58.46	56.2
3724	58.82	57.03
3719	59.14	57.39
3723	59.31	57.61
3715	59.62	57.73
3813	60.75	58.26
3808	60.74	58.45
3807	61.04	59.47
3814	60.54	58.26
3805	60.57	58.71
3804	60.46	58.88
3803	60.45	59.03
3501	60.06	58.48
3505	60.04	58.33
3507	59.98	58.52
3502	59.43	57.8
3510	59.55	57.98
3506	59.16	57.7
3504	59.11	57.32
3509	59.03	57.4
3503	58.96	56.99
3609	58.69	57.09
3601	58.63	56.63
3608	58.48	56.69
3602	58.47	56.26
3624	58.41	55.93
3604	58.48	56.49
3603	57.35	55.09
2604	58.81	57.12
2620	58.62	56.8
2618	58.94	56.59
2619	58.77	55.75
2606	58.98	57.68
2607	59.29	57.43
2702	58	56.02
2701	59.64	57.61
1701	59.71	58
2706	60.29	58
2703	60.37	58.37
2704	60.49	58.54
1705	62.25	60.9
2707	60.47	58.47
3704	59.47	57.75
3708	59.46	57.07
2717	n/a	n/a
2705	60.37	58.96
3705	60.14	58.05
3707	60.13	57.64
3812	60.55	57.93
3809	60.56	57.74
2801	61.62	59.43
2802	61.49	59.77
3810	61.35	59.05
3811	61.47	59.64
3801	61.15	59.7
1501	62.7	61

Manhole Reference	Manhole Cover Level	Manhole Invert Level
2509	62.61	61.31
2508	62.54	60.59
1504	62.56	61.02
2507	62.47	60.39
2506	61.88	59.99
2510	61.54	60.22
2511	61.35	59.94
2505	61.35	59.5
1505	62.22	60.82
2504	61.04	59.2
2512	60.96	59.48
3508	60.59	59.13
2513	60.28	58.83
2503	60.26	58.47
2502	60.4	58.35
2501	59.64	57.99
2514	59.57	58.16
2603	59.21	57.59
2601	59.17	57.01
2605	58.81	57.23
3607	58.44	56.89
3606	58.45	57.17
3605	58.46	56.63
2602	58.85	57.34
061I	60.67	59.07
071A	64.25	62.49
071C	63.93	61.99
0705	63.98	62.38
0617	62.71	58.27
0618	n/a	n/a
0501	62.32	60.83
1518	61.3	60.1
1612	60.43	58.72
161E	n/a	n/a
1606	60.1	58.9
161D	n/a	n/a
1608	n/a	n/a
161C	59.99	58.54
161F	n/a	n/a
161B	59.74	58.44
1601	59.7	57.66
1507	60.6	58.75
1607	n/a	n/a
1610	59.29	57.49
1704	61.5	60.2
1609	58.91	57.14
161A	59.04	58.04
1603	59.01	57.98
1506	60.75	59.09
1503	61.27	59.41
1502	68.68	58.78
061E	60.96	58.93
051A	n/a	n/a
061D	60.89	59.64
061C	60.82	58.87
061B	60.81	59.01
061A	60.79	59.51
0610	60.89	59.37
061J	60.85	59.31
0611	61.95	60.38
061H	61.95	60.16
061F	60.39	58.77
0612	62.86	61.39
061G	62.93	61.05
0615	60.27	58.75
0704	63.39	61.91
071B	63.48	61.75
0613	63.73	62.3

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

Asset Location Search Sewer Map - ALS/ALS Standard/2014_2677085

SU7665SE

The width of the displayed area is 500m and the centre of the map is located at OS coordinates 476750,165250

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
6201	59.34	58.57
5302	59.49	58.12
5408	n/a	n/a
5426	n/a	n/a
5410	n/a	n/a
5409	n/a	n/a
5402	58.47	56.85
5411	n/a	n/a
5412	n/a	n/a
5413	n/a	n/a
5405	57.6	56.15
5403	57.55	55.67
5421	n/a	n/a
5422	n/a	n/a
5401	58.1	56.39
5404	57.2	55.56
5424	57.41	56.26
5423	n/a	n/a
5203	61.35	59.46
5201	61.3	58.92
5202	60.67	59.44
5304	60.51	59.23
5305	60.68	59.03
5307	60.59	59.19
5306	60.55	58.73
5301	n/a	n/a
531A	n/a	n/a
531B	n/a	n/a
5407	n/a	n/a

Asset Location Search Sewer Map - ALS/ALS Standard/2014_2677085

SU7665NE

The width of the displayed area is 500m and the centre of the map is located at OS coordinates 476750,165750

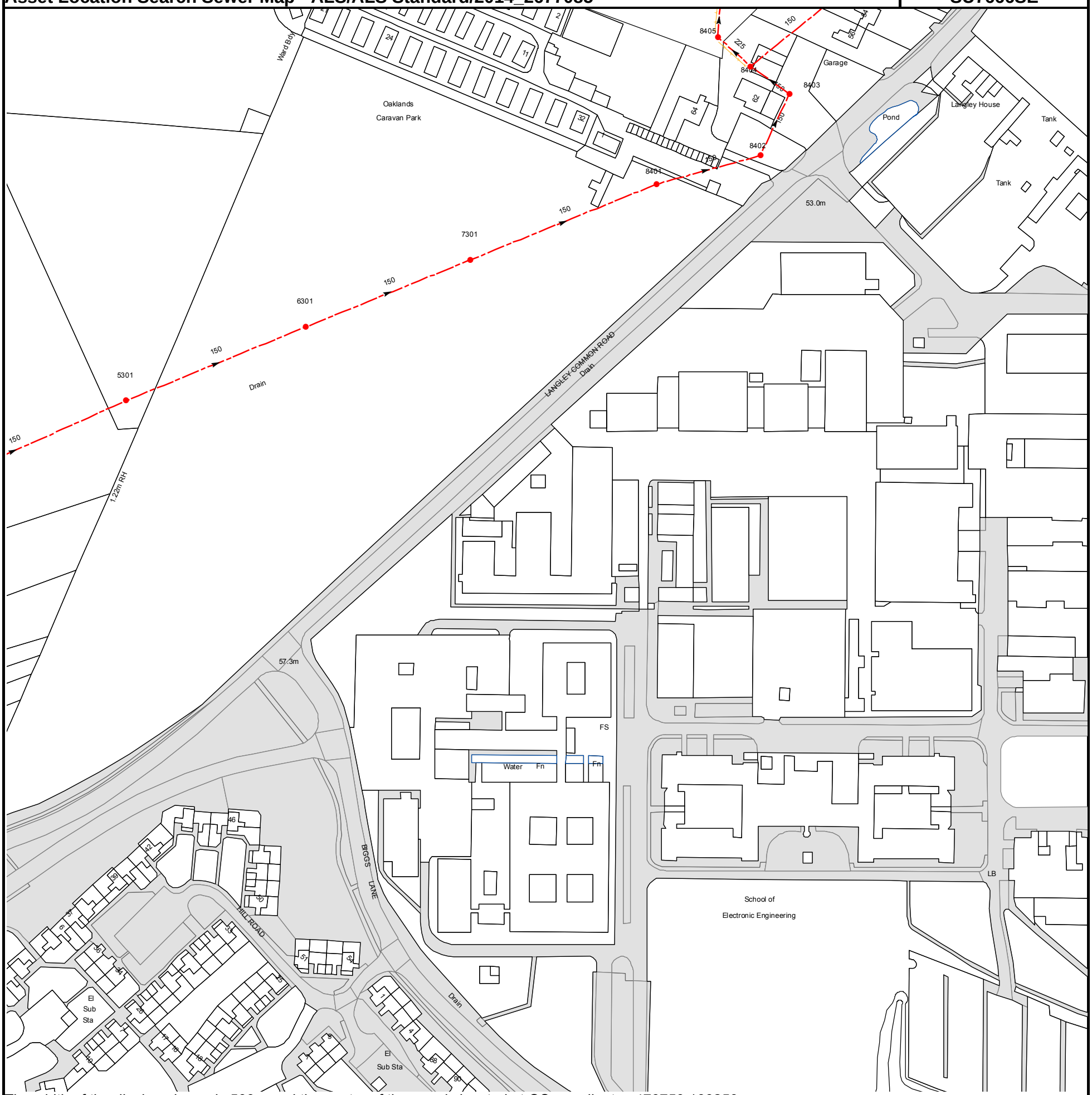
The width of the displayed area is 500m and the centre of the map is located at OS coordinates 476750,165750

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
5701	54.46	53.46
6703	54.22	53.09
6702	54.06	53.03
6701	53.68	53
7701	53.37	52.68
681A	n/a	n/a
8801	53.25	51.3
7803	52.96	52.14
681B	n/a	n/a
681C	n/a	n/a
681D	n/a	n/a
8802	n/a	n/a
6801	n/a	n/a
6803	56.12	55.02
6802	56.12	55.2
6806	56.13	54.63
6805	56.1	54.59
6807	56.22	54.94
6804	55.93	54.32
7801	55.05	53.76
9801	52.18	50.86
9803	52.4	50.92
9802	52.37	50.97
7802	55.09	53.35
5801	57.65	55.3
7901	55.18	51.8
8903	54.46	51.55
8902	53.3	51.22
8901	n/a	n/a
591A	n/a	n/a
691E	n/a	n/a
591B	n/a	n/a
691D	n/a	n/a
591C	n/a	n/a
691C	n/a	n/a
691B	n/a	n/a
691A	n/a	n/a
691F	n/a	n/a
591D	n/a	n/a
591E	n/a	n/a
5504	n/a	55.35
5502	57.06	54.97
5501	55.71	54.65
5601	n/a	n/a
5702	54.99	53.79
5802	58.12	55.59
5901	58.77	55.96

Asset Location Search Sewer Map - ALS/ALS Standard/2014_2677085

SU7666SE



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 476750,166250

The width of the displayed area is 500m and the centre of the map is located at OS coordinates 476750,166250

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
6301	55.19	53.86
7301	54.35	52.94
8401	n/a	n/a
8402	52.82	51.02
8403	52.11	50.58
8404	52.19	50.42
8405	51.9	50.29
5301	56.4	54.98

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Asset Location Search Sewer Map - ALS/ALS Standard/2014_2677085

SU7764NW

The width of the displayed area is 500m and the centre of the map is located at OS coordinates 477250,164750

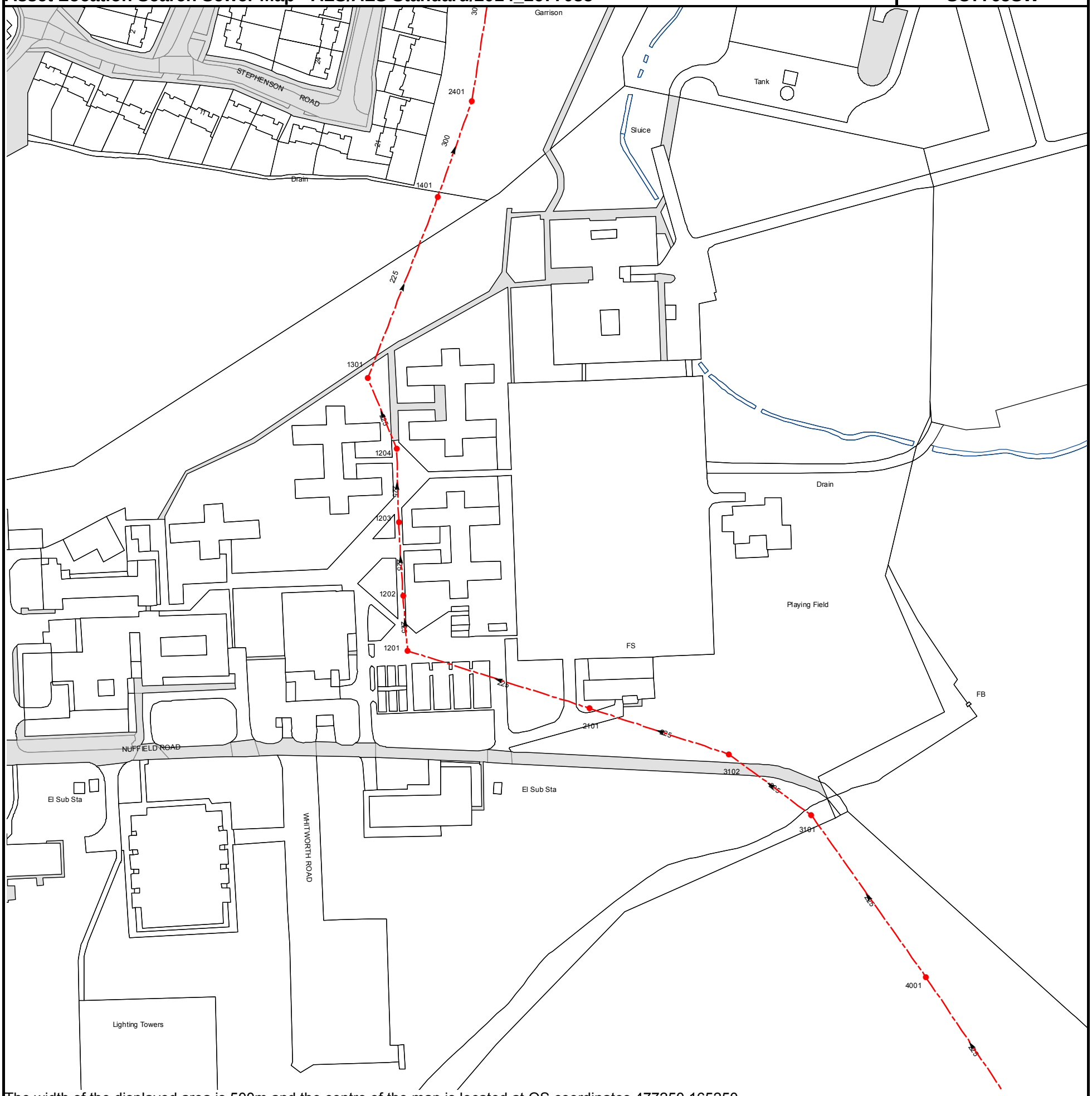
The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
2652	57.7	56.45
2651	57.74	56.61
2603	57.64	55.44
2602	57.75	55.72
3701	57.09	55.26
4601	56.46	54.62
4701	56.25	54.53
4704	56.35	53.32
4702	56.34	53.44
4703	55.65	52.92
4901	54.05	52.08
4803	55.17	53.2
4802	54.75	52.61
4705	56.4	53.6
4801	54.55	52.95
1550	58.29	56.9
1651	58.8	57.11
1702	57.81	56.85
1850	n/a	n/a
1602	58.91	56.87
1652	58.83	57.28
1751	58.21	55.68
1701	58.25	56.55
1750	57.62	n/a
1753	n/a	n/a
1754	n/a	n/a
2551	58.67	57.81
2502	58.65	56.67
2850	57.22	55.4
2753	58.04	55.91
2550	58.49	57.67
2501	58.53	56.44
2752	58.05	56.02
2703	58.06	56.06
2751	58.13	56.21
2702	58.09	55.68
2650	58.18	56.92
2750	57.97	56.2
2701	57.92	55.58
2601	58.16	56.07
2604	n/a	n/a
2653	57.79	56.38
0751	58.72	57.56
0701	58.71	56.97
0653	n/a	n/a
0750	58.81	57.38
0652	n/a	n/a
0702	58.67	56.68
0651	58.75	57.26
0602	58.67	56.64
0752	58.47	57.34
0650	58.58	57.23
0753	n/a	n/a
1851	55.93	54.93
1553	58.21	56.8
1650	58.6	57.19
1601	58.63	57.28

Asset Location Search Sewer Map - ALS/ALS Standard/2014_2677085

SU7765SW



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 477250,165250

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
2101	52.4	50.73
3102	52.82	51.07
3101	53.58	51.3
1201	52.36	50.41
1202	52.27	50.28
1203	51.92	50.21
1204	51.66	50.03
1301	52.26	49.87
1401	51.79	49.53
2401	51.34	49.38
4001	54.32	51.81

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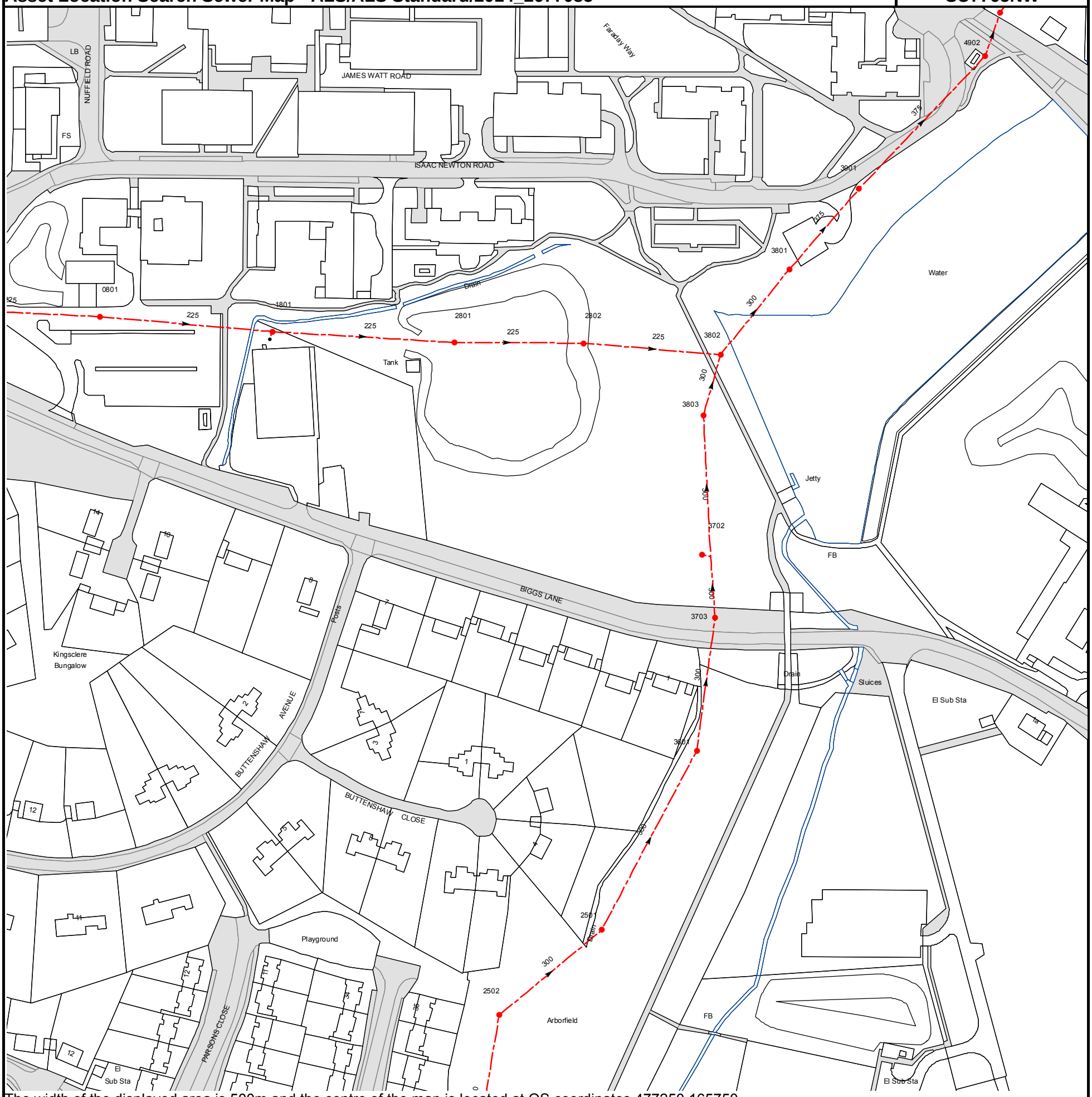
Asset Location Search Sewer Map - ALS/ALS Standard/2014_2677085

SU7765NW



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 477250,165750

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

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Manhole Reference	Manhole Cover Level	Manhole Invert Level
2501	n/a	n/a
3601	50.36	48.79
3702	50.47	49.16
3803	50.04	48.49
3703	50.29	48.64
3802	49.93	48.29
3801	50	48.23
3901	49.91	48.1
4902	n/a	n/a
4901	50.52	47.64
2502	51.24	49.2
2802	n/a	n/a
2801	54.68	49.25
1801	n/a	n/a
0801	51.61	50.31

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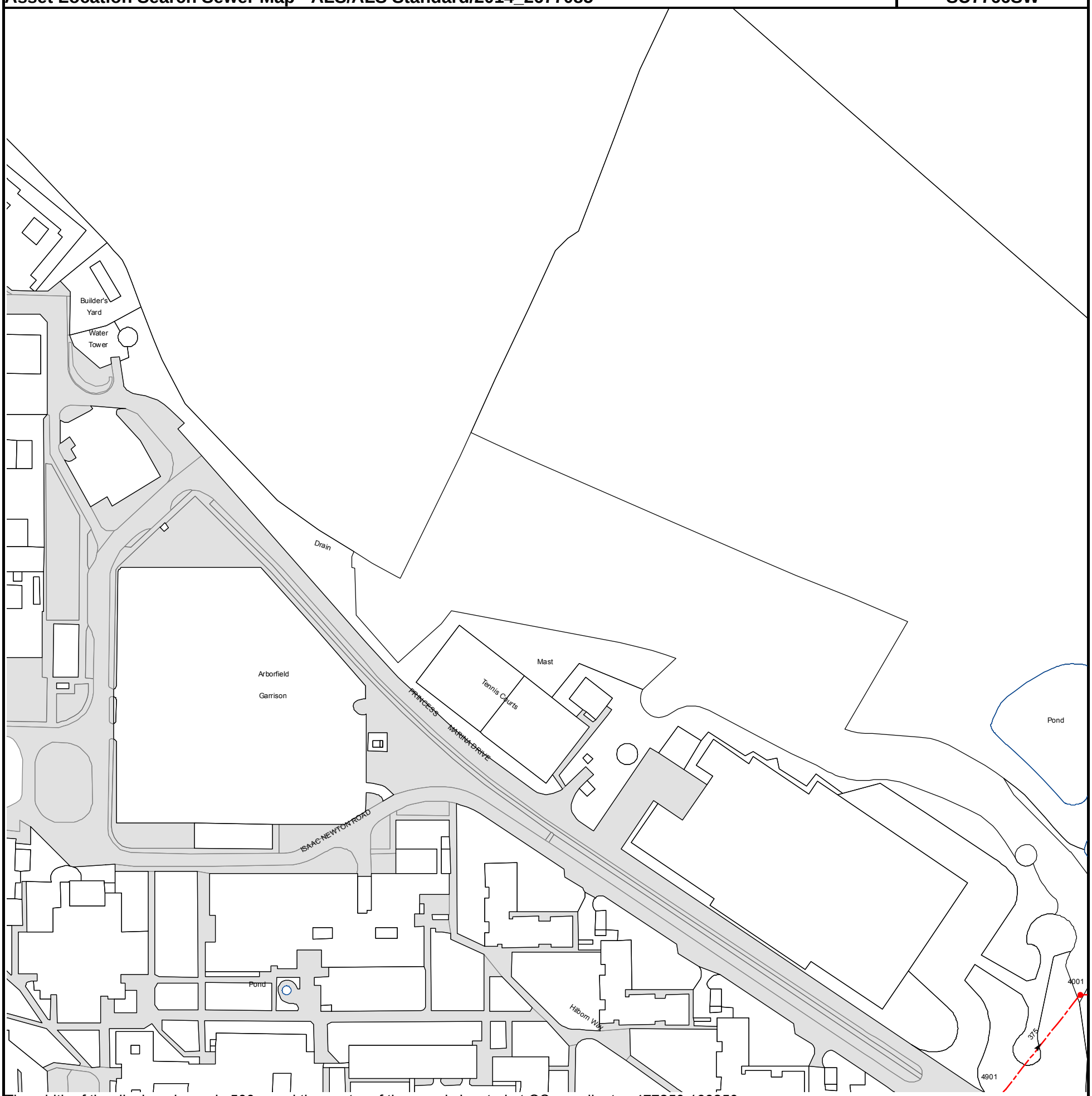
Asset Location Search Sewer Map - ALS/ALS Standard/2014_2677085	SU7766SW



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 477250,166250

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NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
4001	50	47.53

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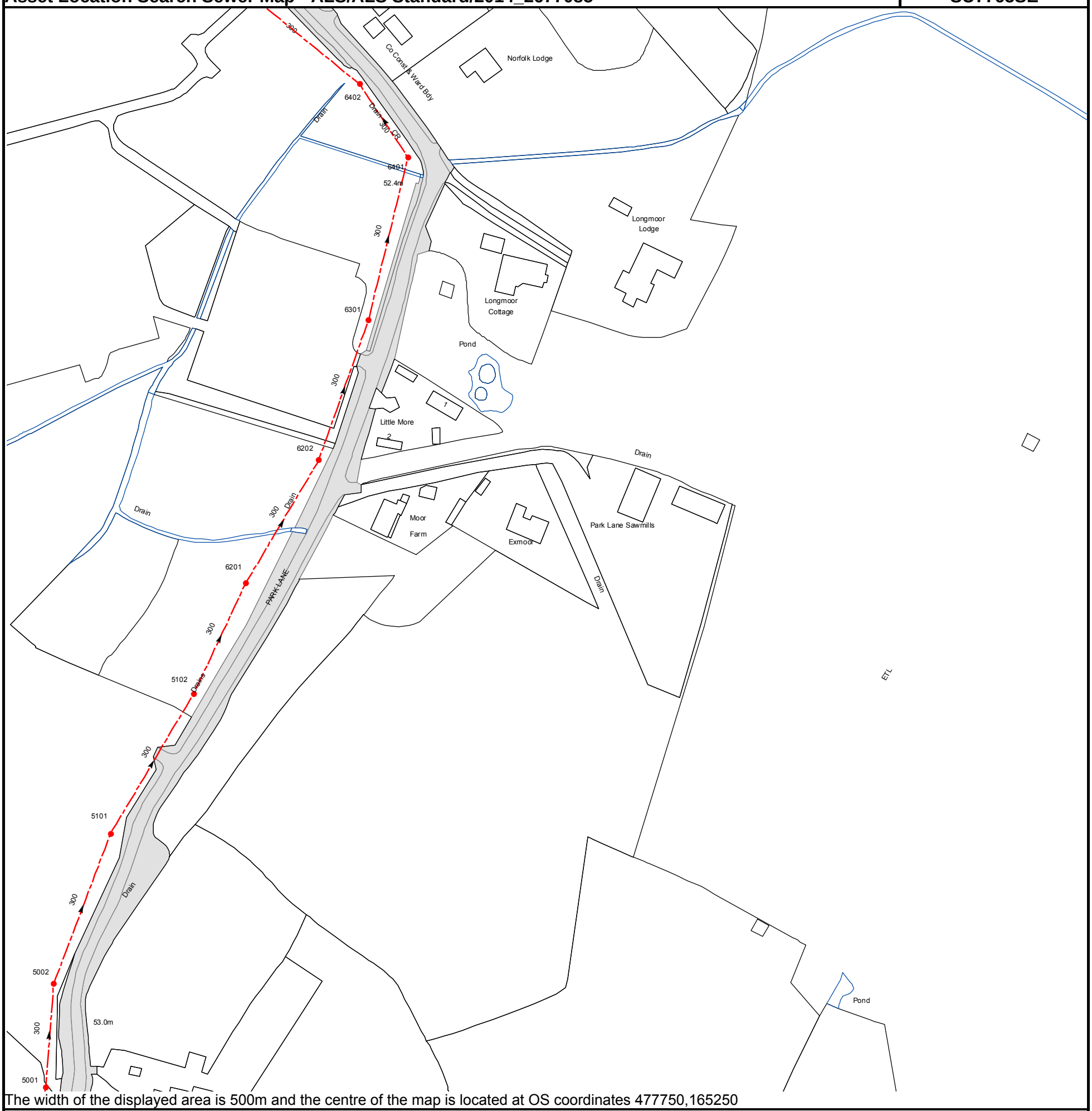
Asset Location Search Sewer Map - ALS/ALS Standard/2014_2677085

SU7765SE



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 477750,165250

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
6402	52.89	49.53
6301	n/a	n/a
6401	52.47	49.67
5101	53.85	51.18
5102	53.01	50.39
6201	52.43	50.22
6202	52	50.04
5001	53.7	51.6
5002	54.1	51.45

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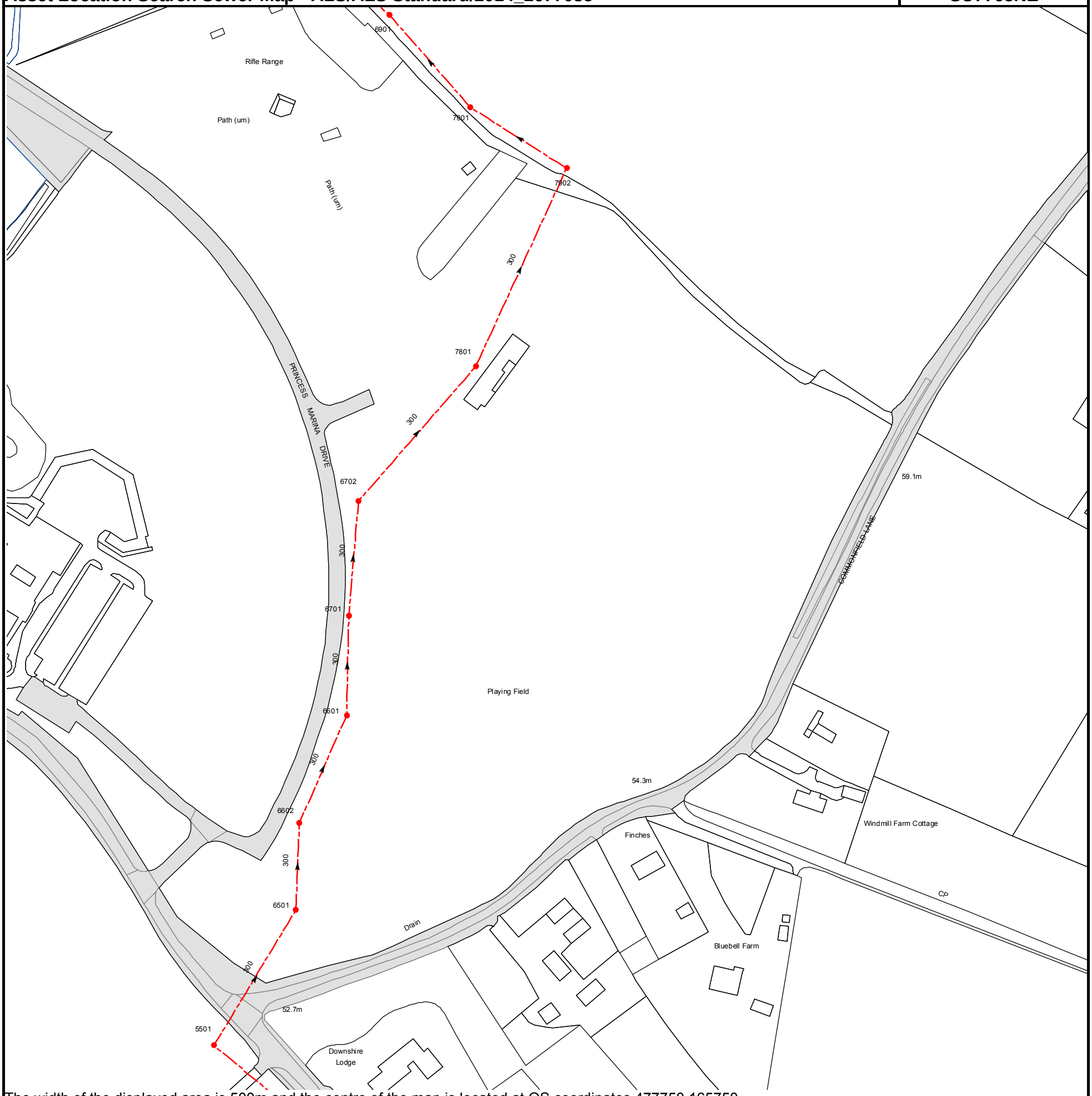
Asset Location Search Sewer Map - ALS/ALS Standard/2014_2677085 | SU7765NE



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 477750,165750

The width of the displayed area is 500m and the centre of the map is located at OS coordinates 477750,165750

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
6901	n/a	n/a
7901	n/a	n/a
7801	53.78	48.23
7902	n/a	n/a
6601	54.56	48.79
6701	54.68	48.64
6702	54.17	48.48
5501	52.91	49.32
6501	53.75	49.05
6602	54.2	48.89

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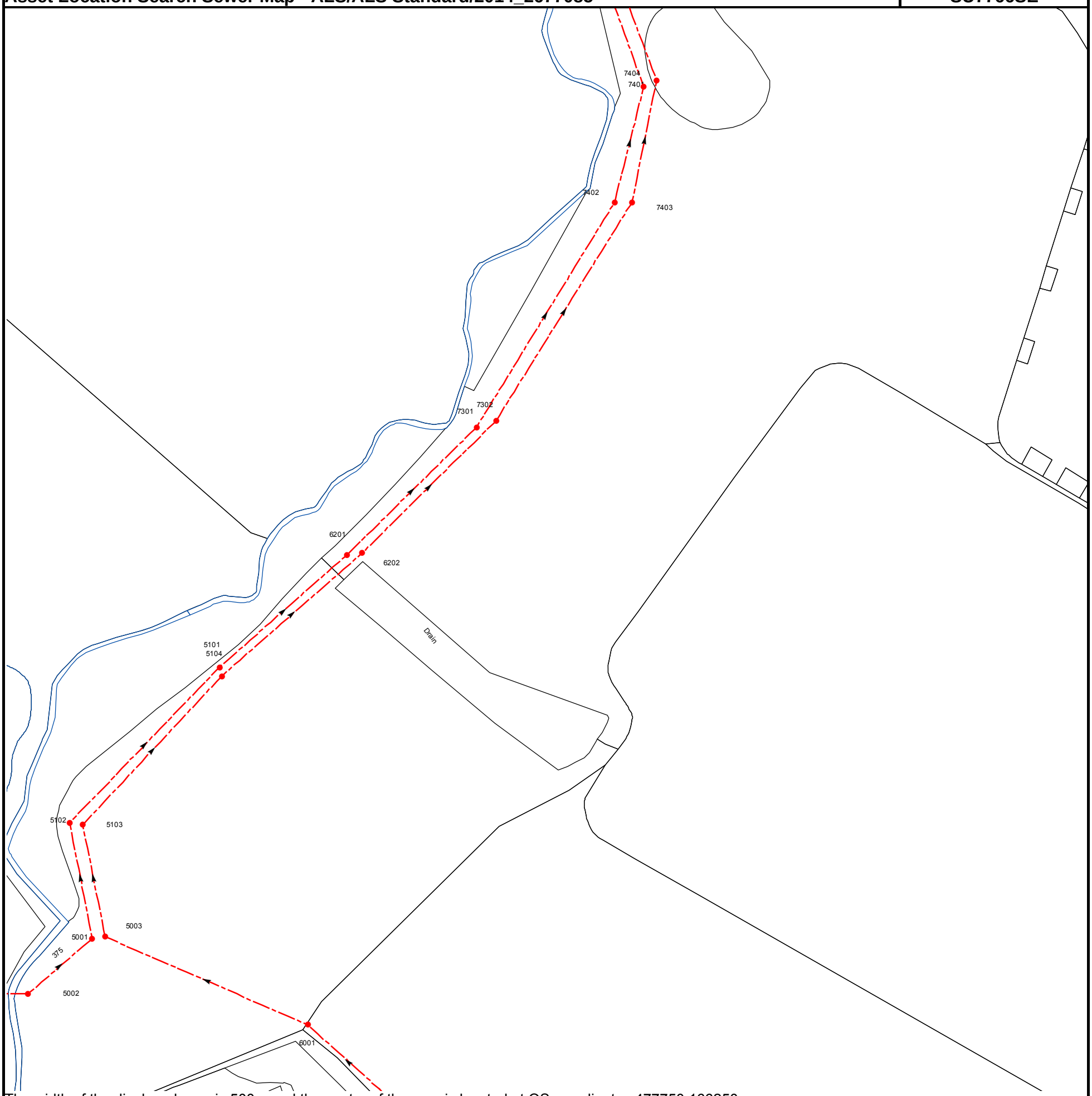
Asset Location Search Sewer Map - ALS/ALS Standard/2014_2677085	SU7766SE



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 477750,166250

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NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
6201	n/a	n/a
6202	n/a	n/a
7301	n/a	n/a
7302	n/a	n/a
7402	n/a	n/a
7403	n/a	n/a
7401	n/a	n/a
7404	n/a	n/a
5002	49.69	47.46
5102	n/a	n/a
5103	n/a	n/a
5001	n/a	n/a
5003	n/a	n/a
6001	n/a	n/a
5101	n/a	n/a
5104	n/a	n/a

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ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

Foul: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

Surface Water: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

Combined: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

Trunk Surface Water

Trunk Foul

Storm Relief

Trunk Combined

Vent Pipe

Bio-solids (Sludge)

Proposed Thames Surface Water Sewer

Proposed Thames Water Foul Sewer

Gallery

Foul Rising Main

Surface Water Rising Main

Combined Rising Main

Sludge Rising Main

Proposed Thames Water Rising Main

Vacuum

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

Air Valve

Dam Chase

Fitting

Meter

Vent Column

Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

Control Valve

Drop Pipe

Ancillary

Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol, Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

Outfall

Undefined End

Inlet

Other Symbols

Symbols used on maps which do not fall under other general categories

Public/Private Pumping Station

Change of characteristic indicator (C.O.C.I.)

Invert Level

Summit

Areas

Lines denoting areas of underground surveys, etc.

Agreement

Operational Site

Chamber

Tunnel

Conduit Bridge

Other Sewer Types (Not Operated or Maintained by Thames Water)

Foul Sewer

Surface Water Sewer

Combined Sewer

Gulley

Culverted Watercourse

Proposed

Abandoned Sewer

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.

2) All measurements on the plans are metric.

3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.

4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.

5) 'na' or '0' on a manhole level indicates that data is unavailable.

6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in milimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Insight on 0845 070 9148.

Asset Location Search Water Map - ALS/ALS Standard/2014_2677085	SU7664NW

The width of the displayed area is 500m and the centre of the map is located at OS coordinates 476250,164750

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Asset Location Search Water Map - ALS/ALS Standard/2014_2677085

SU7665SW

The width of the displayed area is 500m and the centre of the map is located at OS coordinates 476250,165250

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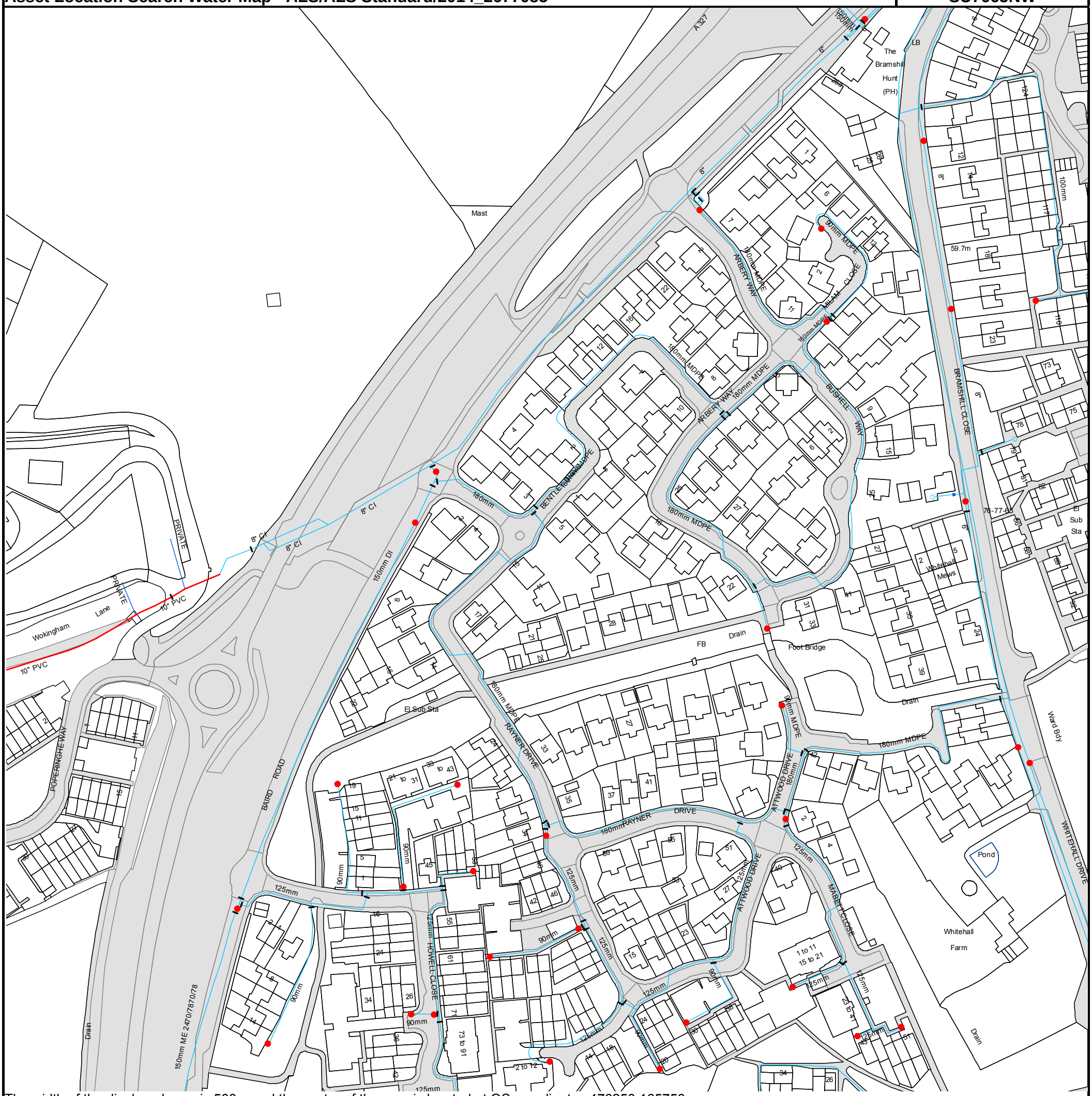
Asset Location Search Water Map - ALS/ALS Standard/2014_2677085

SU7665NW



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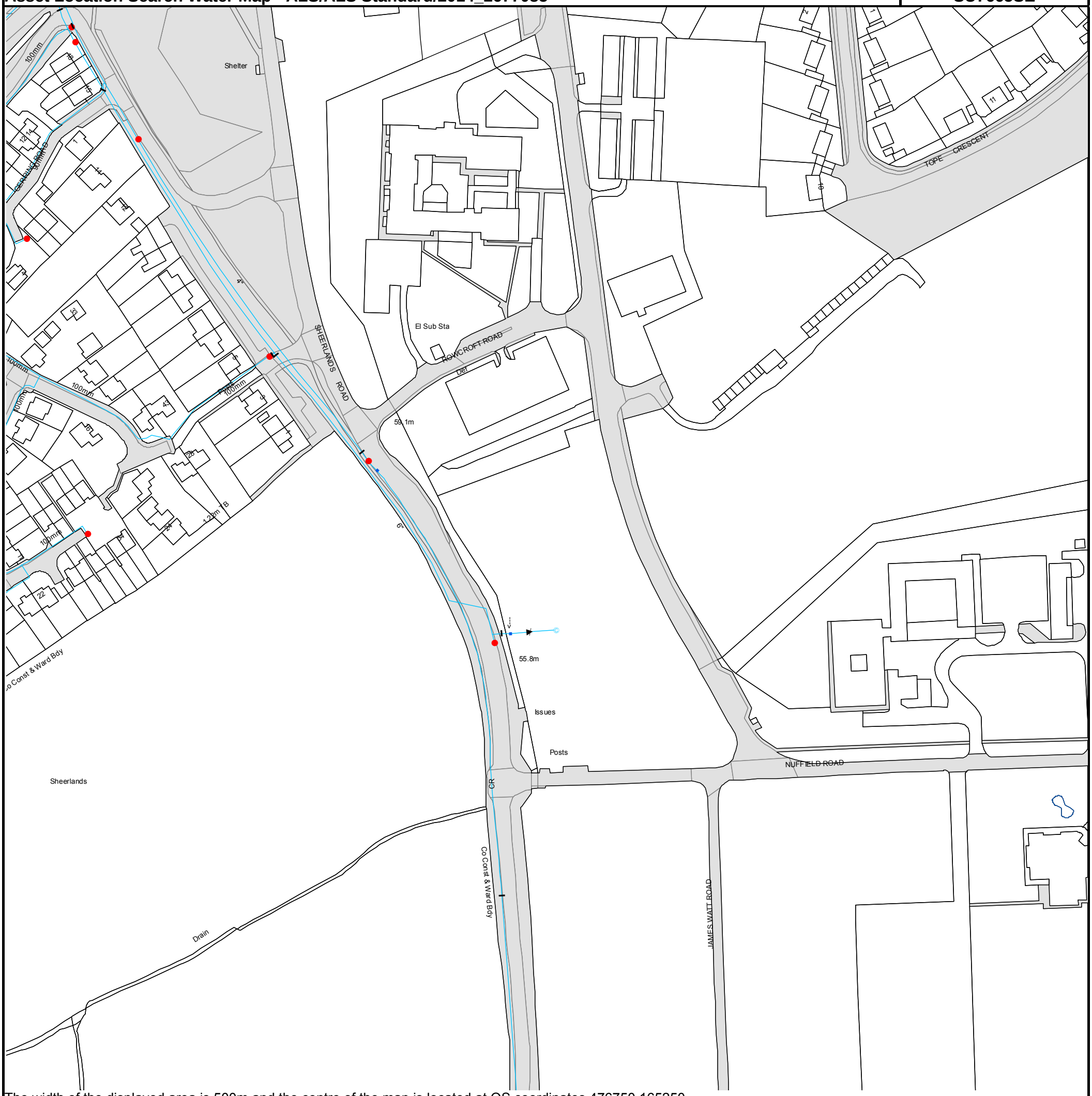
Asset Location Search Water Map - ALS/ALS Standard/2014_2677085 | SU7665SE



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 476750,165250

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Asset Location Search Water Map - ALS/ALS Standard/2014_2677085

SU7665NE

The width of the displayed area is 500m and the centre of the map is located at OS coordinates 476750,165750

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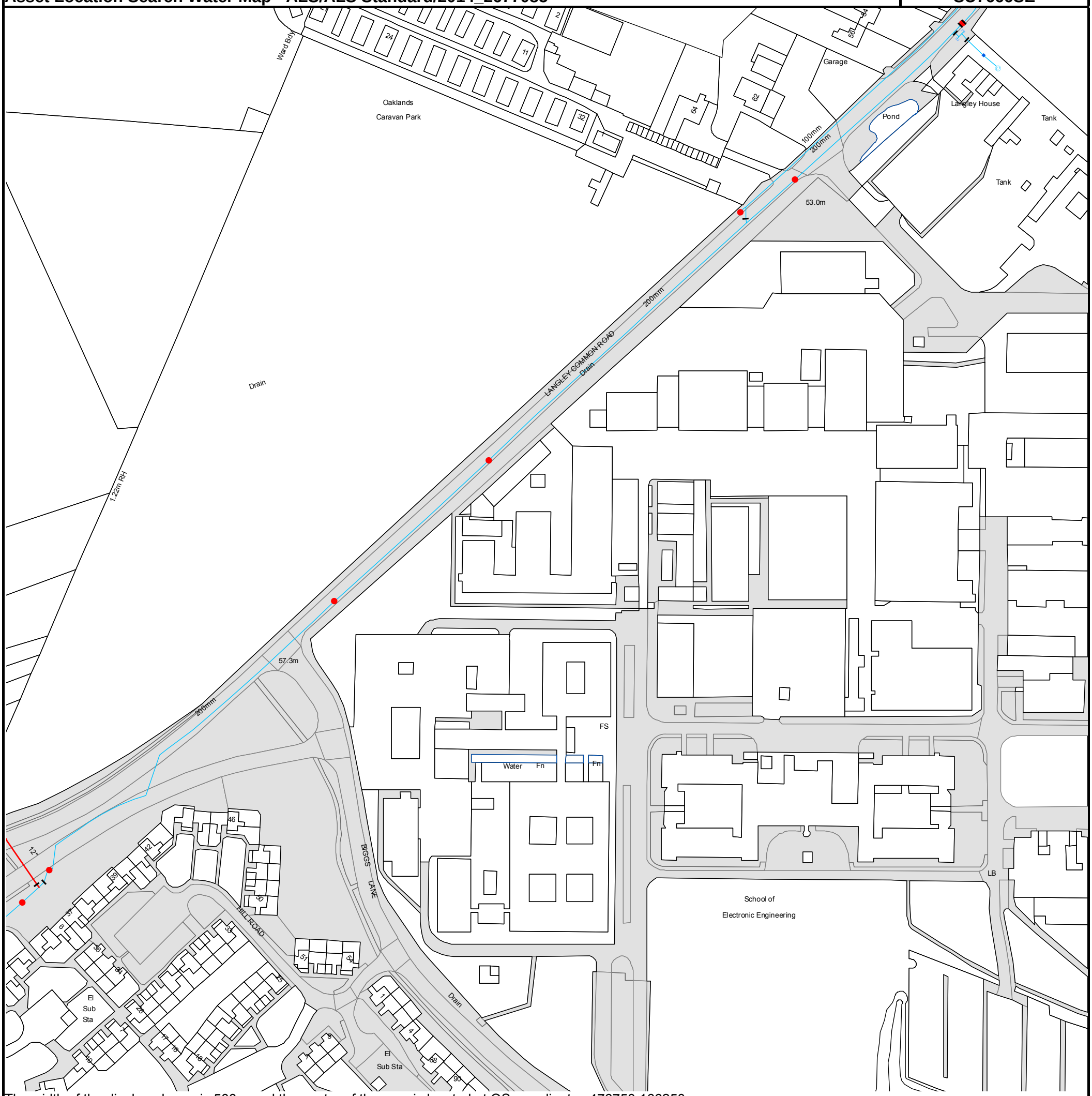
Asset Location Search Water Map - ALS/ALS Standard/2014_2677085

SU7666SE



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ALS Water Map Key

Water Pipes (Operated & Maintained by Thames Water)

4"

Distribution Main: The most common pipe shown on water maps. With few exceptions, domestic connections are only made to distribution mains.

16"

Trunk Main: A main carrying water from a source of supply to a treatment plant or reservoir, or from one treatment plant or reservoir to another. Also a main transferring water in bulk to smaller water mains used for supplying individual customers.

3" SUPPLY

Supply Main: A supply main indicates that the water main is used as a supply for a single property or group of properties.

3" FIRE

Fire Main: Where a pipe is used as a fire supply, the word FIRE will be displayed along the pipe.

3" METERED

Metered Pipe: A metered main indicates that the pipe in question supplies water for a single property or group of properties and that quantity of water passing through the pipe is metered even though there may be no meter symbol shown.

Transmission Tunnel: A very large diameter water pipe. Most tunnels are buried very deep underground. These pipes are not expected to affect the structural integrity of buildings shown on the map provided.

Proposed Main: A main that is still in the planning stages or in the process of being laid. More details of the proposed main and its reference number are generally included near the main.

Valves

- General Purpose Valve
- Air Valve
- Pressure Control Valve
- Customer Valve

Hydrants

- Single Hydrant

Meters

- Meter

End Items

Symbol indicating what happens at the end of a water main.

- Blank Flange
- Capped End
- Emptying Pit
- Undefined End
- Manifold
- Customer Supply
- Fire Supply

Operational Sites

- Booster Station
- Other
- Other (Proposed)
- Pumping Station
- Service Reservoir
- Shaft Inspection
- Treatment Works
- Unknown
- Water Tower

Other Symbols

- Data Logger

PIPE DIAMETER	DEPTH BELOW GROUND
Up to 300mm (12")	900mm (3')
300mm - 600mm (12" - 24")	1100mm (3' 8")
600mm and bigger (24" plus)	1200mm (4')

Other Water Pipes (Not Operated or Maintained by Thames Water)

Other Water Company Main: Occasionally other water company water pipes may overlap the border of our clean water coverage area. These mains are denoted in purple and in most cases have the owner of the pipe displayed along them.

Private Main: Indiates that the water main in question is not owned by Thames Water. These mains normally have text associated with them indicating the diameter and owner of the pipe.

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All sales are made in accordance with Thames Water Utilities Limited (TWUL) standard terms and conditions unless previously agreed in writing.

1. All goods remain in the property of Thames Water Utilities Ltd until full payment is received.
2. Provision of service will be in accordance with all legal requirements and published TWUL policies.
3. All invoices are strictly due for payment 14 days from due date of the invoice. Any other terms must be accepted/agreed in writing prior to provision of goods or service, or will be held to be invalid.
4. Thames Water does not accept post-dated cheques-any cheques received will be processed for payment on date of receipt.
5. In case of dispute TWUL`s terms and conditions shall apply.
6. Penalty interest may be invoked by TWUL in the event of unjustifiable payment delay. Interest charges will be in line with UK Statute Law 'The Late Payment of Commercial Debts (Interest) Act 1998'.
7. Interest will be charged in line with current Court Interest Charges, if legal action is taken.
8. A charge may be made at the discretion of the company for increased administration costs.

A copy of Thames Water's standard terms and conditions are available from the Commercial Billing Team (cashoperations@thameswater.co.uk).

We publish several Codes of Practice including a guaranteed standards scheme. You can obtain copies of these leaflets by calling us on 0845 9200 800.

If you are unhappy with our service you can speak to your original goods or customer service provider. If you are not satisfied with the response, your complaint will be reviewed by the Customer Services Director. You can write to him at: Thames Water Utilities Ltd. PO Box 492, Swindon, SN38 8TU.

If the Goods or Services covered by this invoice falls under the regulation of the 1991 Water Industry Act, and you remain dissatisfied you can refer your complaint to Consumer Council for Water on 0121 345 1000 or write to them at Consumer Council for Water, 1st Floor, Victoria Square House, Victoria Square, Birmingham, B2 4AJ.

Ways to pay your bill

Credit Card	**BACS Payment**	**Telephone Banking**	**Cheque**
Call **0845 070 9148** quoting your invoice number starting CBA or ADS.	Account number **90478703** Sort code **60-00-01** A remittance advice must be sent to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW.** or email **ps.billing@thameswater.co.uk**	By calling your bank and quoting: Account number **90478703** Sort code **60-00-01** and your invoice number	Made payable to '**Thames Water Utilities Ltd**' Write your Thames Water account number on the back. Send to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW** or by DX to **151280 Slough 13**

Thames Water Utilities Ltd Registered in England & Wales No. 2366661 Registered Office Clearwater Court, Vastern Rd, Reading, Berks, RG1 8DB.

Search Code

IMPORTANT CONSUMER PROTECTION INFORMATION

This search has been produced by Thames Water Property Searches, Clearwater Court, Vastern Road, Reading RG1 8DB, which is registered with the Property Codes Compliance Board (PCCB) as a subscriber to the Search Code. The PCCB independently monitors how registered search firms maintain compliance with the Code.

The Search Code:

- provides protection for homebuyers, sellers, estate agents, conveyancers and mortgage lenders who rely on the information included in property search reports undertaken by subscribers on residential and commercial property within the United Kingdom
- sets out minimum standards which firms compiling and selling search reports have to meet
- promotes the best practise and quality standards within the industry for the benefit of consumers and property professionals
- enables consumers and property professionals to have confidence in firms which subscribe to the code, their products and services.

By giving you this information, the search firm is confirming that they keep to the principles of the Code. This provides important protection for you.

The Code's core principles

Firms which subscribe to the Search Code will:

- display the Search Code logo prominently on their search reports
- act with integrity and carry out work with due skill, care and diligence
- at all times maintain adequate and appropriate insurance to protect consumers
- conduct business in an honest, fair and professional manner
- handle complaints speedily and fairly
- ensure that products and services comply with industry registration rules and standards and relevant laws
- monitor their compliance with the Code

Complaints

If you have a query or complaint about your search, you should raise it directly with the search firm, and if appropriate ask for any complaint to be considered under their formal internal complaints procedure. If you remain dissatisfied with the firm's final response, after your complaint has been formally considered, or if the firm has exceeded the response timescales, you may refer your complaint for consideration under The Property Ombudsman scheme (TPOs). The Ombudsman can award compensation of up to £5,000 to you if he finds that you have suffered actual loss as a result of your search provider failing to keep to the Code.

Please note that all queries or complaints regarding your search should be directed to your search provider in the first instance, not to TPOs or to the PCCB.

TPOs Contact Details

The Property Ombudsman scheme
Milford House
43-55 Milford Street
Salisbury
Wiltshire SP1 2BP
Tel: 01722 333306
Fax: 01722 332296
Email: admin@tpos.co.uk

You can get more information about the PCCB from www.propertycodes.org.uk

PLEASE ASK YOUR SEARCH PROVIDER IF YOU WOULD LIKE A COPY OF THE SEARCH CODE

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11 June 2014

Carl Smith
Thames Water Utilities Ltd
Reading STW
Island Road
Reading
RG2 0RP

Our Ref: 60312043/TW/003

Dear Carl

Arborfield Garrison SDL, Wokingham, Impact at Sewage Treatment Works

Thank you for providing details of the current capital scheme at Arborfield Sewage Treatment Works (STW) to accommodate known growth in the catchment. It is now our understanding that:

- Under Section 94 of the Water Industry Act 1991 sewerage undertakers have an obligation to provide treatment capacity for domestic flows from future development. There is also a requirement to ensure that your assets have no adverse effect on the environment.

- Thames Water are responsible for assessing and providing future capacity at the STW and this is in line with the core strategy development plan.

- The current upgrade at Arborfield STW, which will be completed in 2015, will increase the capacity from a 2008 base population equivalent (pe) of 18,700 to 26,253 (increase of 7553 pe).

- The population of Arborfield Garrison is circa. 1000. Therefore once the barracks is decommissioned in 2015, an additional 1000 pe capacity will be provided. The current upgrade with therefore accommodate a pe increase of 8553.

- Assuming an average of 3 persons per dwelling, this upgrade would therefore provide capacity for approximately 2851 dwellings for both the Arborfield Garrison Site and the Marino Family Trust Site.

- Based on the latest build profile (excluding the relatively small loads (10%) from the commercial and school development) there will be capacity at Arborfield STW until approximately 2025.

- When this capacity is reached, Thames Water will provide further capacity as detailed in the first point above.

Please can you confirm that our understanding as detailed above is correct. If you require any further information please do not hesitate to contact me.

Yours sincerely

Paul Petherick
Senior Engineer
D +44 (0)121 262 1930
E Paul.Petherick@aecom.com

Murphy, Siobhan

Subject: FW: Arborfield Garrison Development imapct Assessment

---

From: Carl Smith
Sent: 19 June 2014 09:53:44 (UTC) Dublin, Edinburgh, Lisbon, London
To: Petherick, Paul
Subject: RE: Arborfield Garrison Development imapct Assessment

Hi Paul,

I am happy with the wording of the letter.

Regards,

Carl Smith
Wastewater Asset Planner

Asset Management

Thames Water Utilities Ltd, Reading STW, Island Road, Reading, RG2 0RP
☎ 07747645534 (45534) carl.smith@thameswater.co.uk
Promoting intelligent investment in our wastewater assets

From: Petherick, Paul [mailto:paul.petherick@aecom.com]
Sent: 12 June 2014 08:58
To: Carl Smith
Cc: Martin, Steve L; Sammie Bryans; Stephen.Hollowood@gva.co.uk
Subject: RE: Arborfield Garrison Development imapct Assessment

Carl

We are nearing planning submission for this development and I would like to include a statement on the current capacity of Arborfield STW in the submission. With the previous planning submission for this site it wasn't clear on capacity and there were objections raised regarding this and the timescales for providing more capacity. Therefore I want to make it clear in the new submission that Thames are responsible for the required upgrading and with the ongoing capital scheme there will be capacity for many years to come.

Therefore I have attached a letter which details our understanding of the capacity at Arborfield STW. Please can you confirm in writing that our understanding as detailed in the letter is correct.

If you need any additional information or would like to discuss, please do not hesitate to give me a ring on the number below.

Regards

Paul Petherick
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From: Carl Smith [mailto:carl.smith@thameswater.co.uk]
Sent: 20 March 2014 12:46
To: Petherick, Paul
Subject: RE: Arborfield Garrison Development imapct Assessment

Paul,

The upgrade at Arborfield STW is increasing the capacity from a 2008 base population equivalent (pe) of 18,700 to 26,253. Within these calculations the majority of the pe increase is attributed to the Garrison development (3400 properties). It may be that a further upgrade is required at the treatment works after 2021. The scope of this upgrade is unknown, the site has a fair amount of spare land available however this land is not necessarily in the most appropriate area of the site to extend the existing the process.

Regards,

Carl Smith
Wastewater Asset Planner

Thames Water Utilities Ltd, Reading STW, Island Road, Reading, RG2 0RP
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From: Petherick, Paul [mailto:paul.petherick@aecom.com]
Sent: 17 March 2014 11:47
To: Carl Smith
Subject: FW: Arborfield Garrison Development imapct Assessment

Carl

Geoff Nokes has passed on your contact details. I am working on the redevelopment of the Arborfield Garrison site and I'm trying to understand the impact of the development at Arborfield Cross STW. Further to the information you supplied below, please can you confirm details of the upgrade of the works for known growth up to 2021, i.e how many houses this allows for. Also, can the further upgrade be done within the existing site, or is an extension/land purchase likely to be required?

Please can you ring me on 07734382242 to discuss further.

Regards

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From: Geoff Nokes [mailto:geoff.nokes@thameswater.co.uk]
Sent: 27 February 2014 13:41
To: Petherick, Paul
Subject: FW: Arborfield Garrison Development imapct Assessment

FYI

From: Carl Smith
Sent: 27 February 2014 12:04
To: Brendan Hegerty; Manuel Dasilva; Geoff Nokes
Subject: RE: Arborfield Garrison Development imapct Assessment

Geoff,

The upgrade at Arborfield STW is to cater for known growth upto 2021. The latest SOLAR form for the site does include the Arborfield Garrison development but the upgrade at the works will not cater for the whole development. A further upgrade is likely to be required in AMP6 or AMP7.

Regards,

Carl Smith
Wastewater Asset Planner

Asset Management

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From: Brendan Hegerty
Sent: 27 February 2014 11:20
To: Manuel Dasilva; Geoff Nokes; Carl Smith
Subject: RE: Arborfield Garrison Development imapct Assessment

Carl

Your area

Regards

Brendan Hegerty
Asset Planner
Thames Water Utilities Ltd, Oxford STW, Grenoble Rd, Oxford, OX4 4XU

È 07747 647327 (47327)
8 Brendan.Hegerty@thameswater.co.uk

From: Manuel Dasilva
Sent: 27 February 2014 10:00
To: Geoff Nokes; Brendan Hegerty
Subject: RE: Arborfield Garrison Development imapct Assessment

Geoff

My understanding is that Arborfield STW is being upgraded to cater for future growth in the catchment and the upgrades will be completed early in 2015. Brendan should be able to confirm if this site is being considered as part of the current upgrades.

Regards

Manuel da Silva
Principal Wastewater Modeller
Thames Water Utilities Ltd, Reading STW, Island Rd, Reading, RG2 0RP
Tel: 020 3577 9756 (89756)

Asset Management

From: Geoff Nokes
Sent: 27 February 2014 09:39
To: Manuel Dasilva; Tyrone Parkinson (Tyrone.Parkinson@mwhglobal.com); Brendan Hegerty
Subject: FW: Arborfield Garrison Development imapct Assessment

Guys

What is the response about the treatment works please?

Regards
Geoff
89228

From: Petherick, Paul [mailto:paul.petherick@aecom.com]
Sent: 26 February 2014 09:44
To: Geoff Nokes
Subject: RE: Arborfield Garrison Development imapct Assessment

Geoff

Further to our telephone conversation on Monday, please see attached letter requesting more information on the impact of Arborfield Cross STW due to the proposed development sites.

I look forward to hearing from you.

Regards

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From: Geoff Nokes [mailto:geoff.nokes@thameswater.co.uk]
Sent: 21 February 2014 15:59
To: Petherick, Paul
Subject: RE: Arborfield Garrison Development imapct Assessment

Paul

Please find the following impact study scope and cost;

SMG1522 Arborfield Garrison SDL, Wokingham (Project Ref: X4503-669)

Background

A foul water impact study has been requested for an area of Strategic Development Land site at Arborfield Garrison, Wokingham.

The proposed development will consist of 2,000 residential properties, a primary school, a secondary school, a supermarket, retail facilities and a district community centre.

The foul flow from the development site has been provided as a net increase of 4.2l/s.

A preferred connection manhole has not been identified.

Key Background Information

1. The proposed development is on a Brownfield site.
2. The study is to consider foul flows only. Surface water flows are assumed to drain to a nearby watercourse or soakaways.
3. The OS co-ordinates for the site are: 477238 164885.
4. DTS Reference: 12189.

Scope

The development site is located at Arborfield Garrison, Wokingham.

Foul flows in the development area gravitate in a north-easterly direction towards Barkham Road. From here, flows gravitate in a north-westerly direction towards Arborfield Sewage Treatment Works (STW). Arborfield STW is located approximately 2.8km downstream of the development site.

There is no existing hydraulic model of the Arborfield catchment. A new model will need to be constructed for this study. A manhole survey will be required to confirm pipe sizes and invert levels local to the development site.

A flow survey will be required to confirm the flows in the sewer network, and to undertake model verification.

The existing and proposed foul flows from the development area will need to be confirmed prior to the assessment taking place, as well as the method of connection to the existing public sewer network.

The Thames Water Sewer Flooding History Database (SFHD) indicates one historical flooding location at Park Lane in the vicinity of the development site.

The tasks required to understand the impact of this development on the sewerage system are:

1. Plan and manage the asset and flow surveys.
2. Build a hydraulic model of the Arborfield STW catchment.
3. Update the model with the asset survey results.
4. Verify model.
5. Confirm the development flows / net increases in flow, and the method of connection to the existing sewer networks.
6. Run the model for the 20 year design standard for the baseline condition.

7. Run the model for the 20 year design standard with the proposed development inflows.
8. Review the hydraulic impact and, if required, develop solutions to provide a 'no detriment' condition to the existing system with the proposed additional flow. This would include reviewing alternative connection points.
9. Prepare report.

Risks

a. A site visit is not envisaged as being necessary at this stage.
b. Allowance has been made for a discussion by telephone with Thames Water Operations to understand the existing catchment issues.
c. The solutions are subject to change following discussions with Thames Water's Operations and Asset Planning departments.
d. Thames Water Process team may wish to ensure the impact of any solution will be acceptable at the STW. Any implications on the STW will be assessed by Thames Water and a separate additional study may be appropriate, depending on the outcome of these investigations and assessments.

Resources

PM	5 day	Senior Consultant
Estimate	0.5 day	Senior Consultant
Archiving	0.5 day	Technician
Survey Management	1 day	Technician
Project Familiarisation	0.5 day	Modeller
Data Collection	1 day	Technician
Model Build	28 day	Modeller
Calibration	7 day	Modeller
Performance Testing	3 day	Modeller
Solution Development	3 day	Senior Modeller
Reporting	3 day	Senior Consultant

Alternatively the flow survey will be removed from the system at the end of 8 weeks and a conservative approach to the system response taken for modelling purposes.

Programme Comments

Estimated project completion is within 24 weeks of project commencement, to allow sufficient time for data retrieval. This assumes an eight week lead time for flow surveys and an eight week flow survey. Should the developer decide to extend the flow survey as previously discussed the programme will need to be extended.

Regards

Geoff Nokes
Development Engineer - Waste

Thames Water Utilities Ltd, Clearwater Court, Vastern Road, Reading, RG1 8DB
helpdesk 0845 850 2777 direct 02035779228
geoff.nokes@thameswater.co.uk

From: Petherick, Paul [mailto:paul.petherick@aecom.com]
Sent: 07 February 2014 08:55
To: Geoff Nokes
Subject: RE: Arborfield Garrison Development imapct Assessment

Geoff

I have attached the red line boundary plan for the Arborfield Garrison site and also the extracts of the Infrastructure and Utilities Report which was sent to you in the post, which details both sites. Please let me know if you need any additional information.

Regards

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From: Geoff Nokes [mailto:geoff.nokes@thameswater.co.uk]
Sent: 06 February 2014 14:12
To: Petherick, Paul
Subject: RE: Arborfield Garrison Development imapct Assessment

Paul

Do you have a site plan you could Email me please.

Regards
Geoff

From: Petherick, Paul [mailto:paul.petherick@aecom.com]
Sent: 29 January 2014 11:53
To: Geoff Nokes
Cc: Martin, Steve L
Subject: RE: Arborfield Garrison Development imapct Assessment

Geoff

Please find attached a letter requesting the FW Impact assessment for Arborfield Garrison SDL, Wokingham as requested. Also attached are the minutes from our meeting last week for your comments.

I have put a copy of the letter with the enclosed report in the post, addressed to yourself.

Regards

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From: Geoff Nokes [mailto:geoff.nokes@thameswater.co.uk]
Sent: 27 January 2014 10:22
To: Petherick, Paul
Subject: RE: Arborfield Garrison Development imapct Assessment

Paul

For an impact study Scope and Cost we require £400+vat cheque and covering letter with information on the site to have our external consultants instigate this.

Regards
Geoff Nokes
Development Engineer - Waste

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geoff.nokes@thameswater.co.uk

From: Petherick, Paul [mailto:paul.petherick@aecom.com]
Sent: 27 January 2014 09:45
To: Geoff Nokes
Cc: Martin, Steve L
Subject: Arborfield Garrison Development imapct Assessment

Geoff

Thanks for meeting us last Wednesday regarding the Arborfield Garrison development. We are keen to get things moving to understand the implications of the development on the sewerage network and the treatment works in particular.

As requested, I have sent you an email so that you can respond with details on the process for starting a development impact assessment, i.e costs and information you require from us.

I look forward to hearing from you.

Regards

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Appendix C

Severn Trent Service Records

Do not scale

Notes

N

SERVICES LEGEND

- FW DRAINAGE
- SW DRAINAGE
- WATER SUPPLY
- BUILDING OUTLINE
- ROAD OUTLINE
- MOD BOUNDARY
- DHE BOUNDARY

QA : ISSUED FOR INFORMATION ONLY AND SUBJECT TO VERIFICATION

Rev	Description	Date	Approved
B	UpdateCompany Information	Sep03	asm
A	ADD A59,A60. Dash A68.	Jan02	df

AMENDMENT RECORD

BABCOCK

Office Of Origin:
Project Management
Hazebrouck Barracks
Arborfield Garrison
Berkshire
READING RG2 9NH
Tel: 0118 9763510

FS 25612

Site/Project :

ARBORFIELD GARRISON

Drawing Title :

SITE PLAN

Scales :

Design Manager :

Architect/Engineer :

Drawn : Date :FEBRUARY 2000

Checked : Date :

Approved for Issue : Date :

Issue :

Project ID :

Drawing No : ©

Revision A

For Reprographic Purposes This Line Is To Equal 85 mm On The Original Drawing

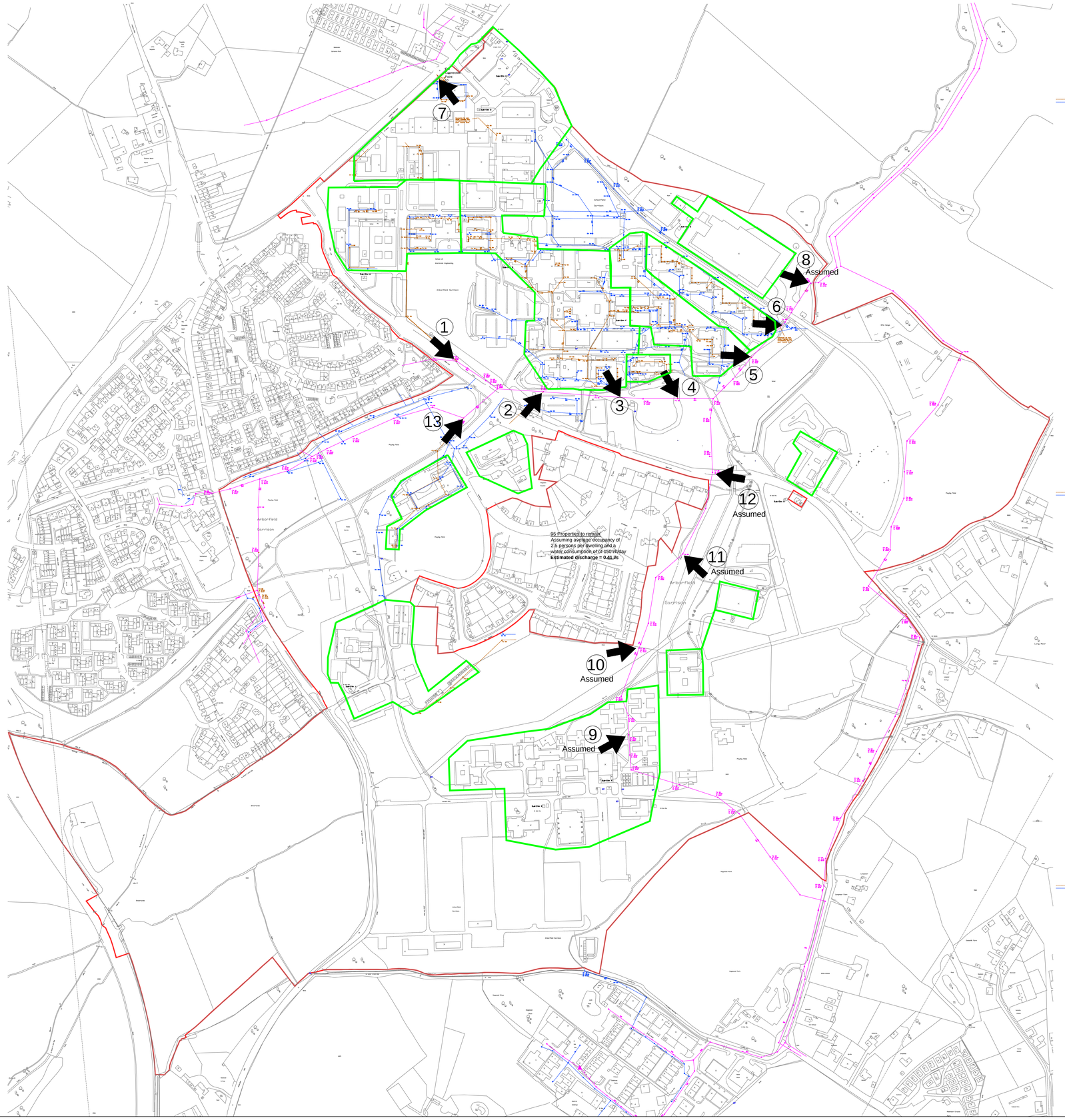
Appendix D

Existing Drainage

ISO A0 841mm x 1189mm Approved: Checked: Designer: Project Management Initials:

Catchment	Exisitng DWF (l/s)	Existing Peak DWF (l/s)
1	0.65	3.93
2	0.17	1.01
3	1.21	7.24
4	0.07	0.42
5	0.48	2.88
6	0.33	1.99
7	1.31	7.87
8	0.38	2.27
9	1.42	8.50
10	0.60	3.63
11	0.18	1.07
12	0.11	0.65
13	0.19	1.17
TOTAL	**7.11**	**42.64**

Existing Foul Water Discharge Rates
(see Note 3)



AECOM

PROJECT

Arborfield Garrison SDL

CLIENT

Crest Nicholson

CONSULTANT

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Key

- Existing Thames Water public foul water sewer
- Existing private foul water drainage
- Existing private surface water drainage
- 7 — Existing foul water discharge connection point onto Thames Water public sewer
- Existing private foul water catchment boundary

Notes

1. The exisitng rates shown are indicative only and are subject to the final masterplan, parcel layout and detailed design.

2. All existing foul water sewers have been taken from Thames Water sewer records. The location and levels of these sewers are indicative only and are to be verified by a site survey.

3. The existing foul water discharge rates shown in the table are based on water consumption rates for the Arborfield Garrison site provided by Severn Trent Costain and have not been verified. The discharge rate for each connection is an estimate based on a proportional area of the total site.

DRAFT

ISSUE/REVISION

I/R	DATE	DESCRIPTION
P.1	31/03/14	Draft - for information

PROJECT NUMBER

60312043 - Arborfield Garrison SDL

SHEET TITLE

Existing Foul Water Drainage

Scale - 1:2500 @ A0

SHEET NUMBER

60312043/CIV/004

Crest NICHOLSON

Appendix E

Notes of meetings

Notes of Discussion

AECOM

Project:	**Arborfield Garrison SDL**	Job No/Ref:	**60312043**
Purpose:	**Flood Risk Assessment Scoping and Methodology**	Date held:	**28th November 2013**
Held at:	WBC's office	Made by:	**C Changula**

Present:	Matt Melville (MM)	WBC (Principal Planning Officer)	Distribution: All +
	Julia Greene (JG)	WBC (Drainage Manager)	Sammie Bryans (Crest Nicholson)
	Natalie Mees (NM)	EA (Partnerships & Strategic Overview)	Simon Knight (Wates Developments)
	Niall Connolly (NC)	EA (Major Projects)	Stephen Hollowood (GVA)
	Eddie Napper (EN)	WBC (Flood Risk Manager)	
	Steve Martin (SM)	AECOM	
	Chipego Changula (CC)	AECOM	
Apologies:			

No.	Item	Action By
1	**Introductions and Purpose** SM opened the meeting and introductions were made all round. The purpose of the meeting was to discuss and agree the proposed scope and methodology for undertaking a Flood Risk Assessment comprising fluvial modelling and the preparation of a Surface Water Drainage Strategy. JG reiterated that WBC is overall looking for sufficient modelling evidence to support the FRA application. Amongst other reasons, the previous proposals were considered unacceptable because they showed vulnerable uses in Flood Zone 3 and lacked sequential and exception tests (more detail provided in JG's consultation comments).	
2	**Flood Modelling** **<u>Survey</u>** The watercourse channels are to be surveyed in accordance with the EA's standard specification. SM sought clarification on whether 100m cross section intervals would be sufficient. NC to liaise with their modelling team and confirm back to AECOM. The channel survey is to capture cross sections at 100m intervals (to be confirmed by the EA), at changes in channel characteristics and structures. The extent of channels to be surveyed is shown in blue lines in Figure 1 (larger plan attached).	NC External Surveyor through AECOM

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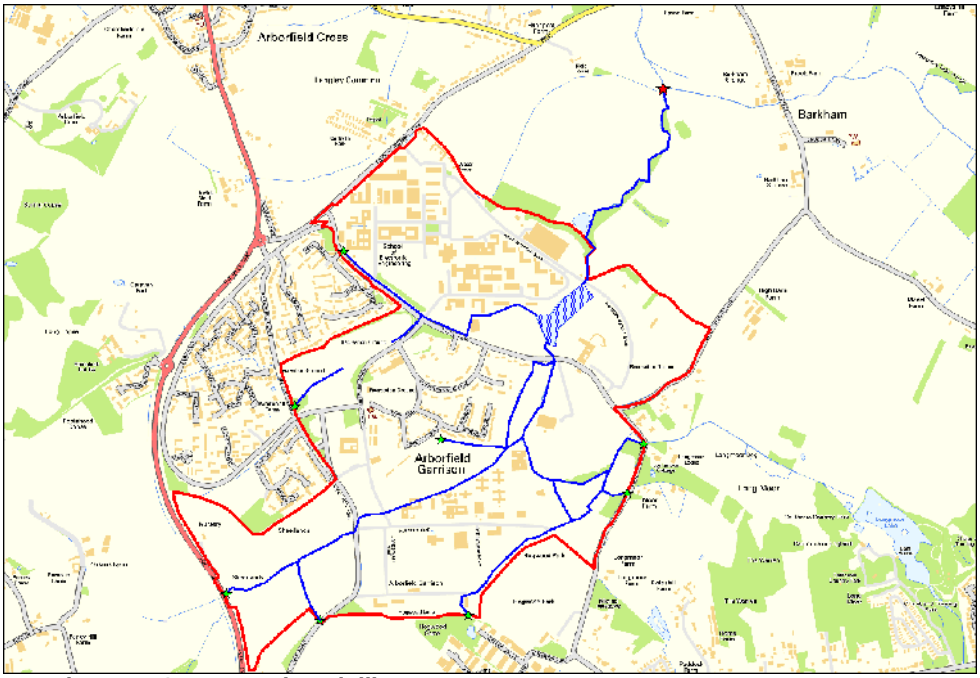

Figure 1: Survey and Modelling extents

SM confirmed that the Surveyor will be Maltby Land Surveys Ltd and this was welcomed by both the EA and WBC as they have carried out numerous surveys for both in the past and to a good quality.

Hydrology

SM informed the meeting that a number of methods would be investigated to obtain the best available fluvial inputs into the model. It is envisaged that the following methodologies will be employed dependent upon catchment size and characteristics:

- FEH
- IOH Report 124
- Modified Rational Method

In light of the above JG stated the EA would need to review the hydrological analysis undertaken by AECOM.

NM and JG confirmed that the required fluvial return periods for this FRA would be the following:

- 20 year
- 100 year,
- 100 year + Climate change (20%)

Modelling

Modelling extents agreed, as shown by the blue lines, in Figure 1. The upstream extents are highlighted by the green stars. The downstream extent (red star) would be at the confluence of the stream from the balancing pond and Barkham Brook.

SM made known to the meeting that the overall programme for the resubmission

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of a planning application is to include the need for additional data gathering requirements such as the channel survey and a more detailed topographical and tree survey.

During the site visit of 20th November discussions with Angie Phillips (facilities manager at the Arborfield Garrison) revealed that there was a proposed programme to undertake channel clearing.

JG queried whether the channel and structure survey would be undertaken prior to or after channel clearing. CC to make enquiries although due to the urgency of the programme, the survey would commence as soon as possible regardless of whether the channel had been cleared or not. CC

JG mentioned there was a portion of watercourse in the vicinity of Nuffield Road where the watercourse was culverted that required particular attention as it was felt that previous studies had not captured the flooding mechanisms adequately. This is highlighted by a black polygon in Figure 2.

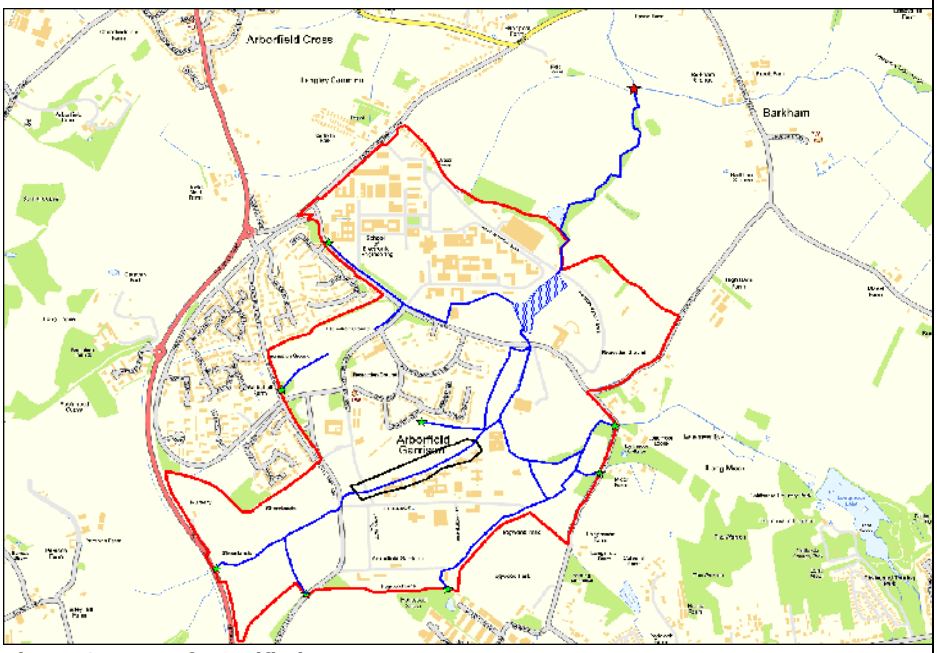

Figure 2: Area of specific interest

All modelling work is to include any proposals for daylighhting of culverts and any new structures.

CC confirmed that the fluvial hydraulic modelling would be undertaken using ISIS-TUFLOW hybrid modelling methodology. In addition, AECOM would provide Hazard Mapping outputs. AECOM

It was agreed that the revised baseline model would be need to be reviewed and agreed upon by the EA, WBC and AECOM prior to the design model runs.

<u>Longmoor Lake Reservoir</u>

EN stated Longmoor Lake caused flooding in 2007 and that the EA have data regarding flooding from it. CC noted however that the existing published outlines available on the EA's website appeared coarse and misaligned. EN mentioned ALL

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	however that he is aware of two Longmoor Lake breach datasets held by the EA which would most likely be sufficient for analysis. CC to contact the EA's customers relationship team to request copies of data. AECOM to also discuss impact of increased population in reservoir inundation zone with Peter Stuart, WBC's Community Resilience Officer.	AECOM/ EA/WBC
	In light of the existing data it was therefore agreed by all that there would be no need to remodel any breaches from Longmoor Lake. The FRA should include more information on the development that is to be located within the flood area of the Longmoor Lake Reservoir. Assuming EA modelling results show safe development is achievable, information need only include the expected number of dwellings, density, anticipated floor levels above existing ground and discussion on general layout to demonstrate that safe development in that area could be achieved. In such a case, it was agreed that drawings were not required showing layout.	CC
3	**Surface Water Drainage** SM proposed that a surface water drainage strategy document is prepared as a separate report to the FRA. This was agreed by all.	AECOM
	SM stated that the new design team will promote the use of Sustainable Drainage Systems throughout the development. AECOM will in particular work with the Landscape Architects to combine green infrastructure with blue infrastructure to maximise amenity and environmental benefits.	
	AECOM are aware of WBC's emerging MDD Policy CC10 which states that '*all development proposals must a) reproduce greenfield runoff characteristics and return runoff rates and volumes back to greenfield runoff characterstics. For greenfield sites and brownfield sites both runoff rates and volumes must be reduced to as near greenfield as practibaly possible*'	
	SM confirmed that the potential flooding envelope will be a major constraint for the development and therefore providing storage to achieve as near to greenfield rates as possible will be particularly challenging.	
	SM suggested that where this policy cannot be achieved for practical reasons then AECOM would seek to provide betterment of 20%. This is however subject to design and modelling and further discussions with the EA and WBC. The onus will be on the developer to demonstrate why greater betterment is unachievable.	
	SM confirmed that a 1 in 100year + 30%cc storm return period will be modelled and flood flow paths provided. SM stated that these flood levels will be used to ensure that there is no residual risk to properties or persons. SM stated that it is also not always necessary to contain the 1 in 100year +30% storm within a pond or detention basis but more importantly that flood flow paths are understood and retained on site as much as practicably possible. **Post meeting note from WBC:** As plot layouts would not be required at the outline application stage, there are concerns that there would not be sufficient detail to demonstrate that water can be stored safely within the development areas. It is recommended that strategic SuDS are planned to accommodate all the run-off.	
	WBC welcomed the SuDS approach and reinforced that they do not like designs that are 'end pipe' solutions i,e. pipes to ponds.	

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	JG noted the following: o A watercourse upstream of the site was reported to be drying – WBC will investigate the catchment draining into this stream and report to the relevant stakeholders if this influences the strategy to attenuate flows below o A Ground Investigation should be undertaken sufficient for the purpose of the planning application. WBC accepted that there may be constraints, however storing flood water on internal roads and carparks should be a last resort and would not usually be considered acceptable. o WBC would like to see contours on a masterplan for SuD's design	
4	**Offsite watercourses** The only offsite watercourse identified is that running from the outlet of the balancing pond to its confluence with the Barkham Brook.	
5	**Detailed elements of the application** Drainage design details are required to support the detailed application elements including the on and off-site highway improvements and SANGS.	AECOM
6	**Any Other Business** MM noted WBC would require a written scope with respect to all works related to this FRA.	AECOM
	CC discussed that in order to undertake the study adequately, requests for data would need to be made. The following information is considered to be required: o Existing AMEC model, hydrology and associated reports o LiDAR o Mastermap 10K OS Tiles o NFCDD and informal defence layers o EA gauge data o Longmor Lake flooding depth data o Barkham Brook model data and results in the vicinity of the confluence. In terms of timescales, AECOM explained that they expected the channel survey data to be available by the end of January and that a draft FRA report could be issued to EA and WBC in March – to allow for their comments prior to submission.. This approach was welcomed by both. NC stated that from Januray 2014 the EA will be charging for pre-application work. Costs will be determined on a site by site basis and will be dependent upon work effort involved. Costs will be recovered on a time charge basis.	

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ITEM NO: 138.00

TITLE	**Interim Sustainable Drainage Systems (SuDS) Policy**
FOR CONSIDERATION BY	The Executive on 28 March 2013
WARD	None Specific
STRATEGIC DIRECTOR	Mark Moon, Strategic Director of Neighbourhood Services
LEAD MEMBER	Angus Ross, Executive Member for Environment

OUTCOME / BENEFITS TO THE COMMUNITY

To provide clear guidance to Developers on the procedures for voluntary Sustainable Drainage Systems adoption by Wokingham Borough Council to avoid future uncertainty over ownership and future maintenance and performance, with the potential issues of flooding occurring.

RECOMMENDATION

That the Executive approves the attached Interim Policy to go to consultation for a period of 4 weeks.

SUMMARY OF REPORT

Sustainable Drainage Systems ensure water from development sites are managed effectively and sustainably on site. In 2010 the Flood and Water Management Act set out an aspiration for guidance and national policy to be set on such systems making their use compulsory and defining the costs for developers. The Act made it clear that such systems would become the responsibility of local authorities.

The government have not yet published their guidance on SUDS and so several authorities have chosen to develop an interim approach. This is interim policy for Wokingham sets out a system for the voluntary adoption of Sustainable Drainage Systems. The policy allows Wokingham Borough Council to enter into an adoption agreement with developers via Commuted Sums either through a Section 106 planning agreement, or a Section 38 highway agreement thereby avoiding any future maintenance liabilities for the Borough. This interim policy will help protect the authority's interest as major new development come forward.

Background

The original date for enacting Schedule 3 of the Flood and Water Management Act 2010 to enable adoption of Sustainable Drainage Systems was October 2011, but due to various reasons this date was not met. The Government has now stated that it will not be enacted before April 2014 at the earliest. Wokingham Borough Council has no obligation to approve or adopt any SuDS before the law is commenced and are not able to use the powers related to the new responsibilities

During this interim period between publishing the Flood and Water Management Act 2010 and enacting Schedule 3, other legislation and guidance is requiring or recommending the construction of Sustainable Drainage Systems.

This interim policy is to allow Wokingham Borough Council to voluntarily adopt Sustainable Drainage Systems until Schedule 3 of the Flood and Water Management Act 2010 is enacted based upon the charging, approval and inspection proposals set out in the report.

Research has shown that several other local authorities are either already adopting Sustainable Drainage Systems or are planning to adopt Sustainable Drainage Systems as an interim measure. These include: Bracknell Forest Borough Council, Oxfordshire County Council, Cornwall County Council, Kent County Council, Cambridge City Council, Leeds City Council and Wakefield City Council.

Analysis of Issues

Sustainable Drainage Systems is the practice of controlling surface water runoff as close to its origin as possible, before it is discharged to a watercourse or sewer. This involves moving away from traditional piped drainage systems towards softer engineering solutions which seeks to mimic natural drainage regimes. Sustainable drainage techniques have many benefits such as reducing flood risk, improving water quality, encouraging groundwater recharge and providing amenity and wildlife benefits.

Risks

The lack of adoption could lead to:

a) Developers being granted planning permission which they may not wish to implement until Sustainable Drainage Systems adoption commences under the Flood and Water Management Act 2010,

b) Developers constructing Sustainable Drainage Systems and keeping them private, by possibly transferring them to residents or a management company. This would have a future undesirable affect upon maintenance and highway adoption.

c) Arguing the case with the Local Planning Authority for continued use of conventional drainage systems, thereby undermining the positive benefits of the introduction of Sustainable Drainage Systems

There are no risks associated with adopting the policy.

FINANCIAL IMPLICATIONS OF THE RECOMMENDATION

Sustainable drainage systems on development sites will be built by developers at their cost. The cost of assessing the proposals will be met through a fee as set out in the policy document.

On going costs relating to the systems will be covered through a commuted sum designed to alleviate the authority of an expense relating to maintaining this new asset for the first 40 years of its life.

The details of how the commuted sums are calculated are set out in Annex A of the policy document. They follow work done by Cambridgeshire County Council and have been used and accepted by developers.

The actual sums charged by the Borough to developers and spent each year on maintenance will vary dependent upon the number of developments that come forward and the type of SUDS implemented.

Overall this policy is cost neutral.

	How much will it Cost/ (Save)	Is there sufficient funding – if not quantify the Shortfall	Revenue or Capital?
Current Financial Year (Year 1)	£0		
Next Financial Year (Year 2)	£0		
Following Financial Year (Year 3)	£0		

Other financial information relevant to the Recommendation/Decision
N/A

Cross-Council Implications
Need to involve other Council services in the implementation of this policy

List of Background Papers
Attached Report

Contact Eddie Napper	**Service** Neighbourhood Services
Telephone No 0118 9746227	**Email** eddie.napper@wokingham.gov.uk
Date 8 February 2013	**Version No.** 2

INTERIM ADOPTION OF SUSTAINABLE DRAINAGE SYSTEMS (SuDS) FLOOD AND WATER MANAGEMENT ACT 2010

1 REASONS FOR RECOMMENDATION(S)

1.1 Sustainable Drainage Systems (SuDS), are an integral part of sustainable development. As part of its objective to promote strong, resilient, sustainable communities the Council positively encourages the use of such techniques but also wishes to ensure that they are used appropriately and are properly designed and constructed. Sustainable Drainage Systems will need to be fit for purpose, serviceable and not cause future liabilities for the Council.

1.2 Developers will find themselves in the position where the Local Planning Authority is requiring Sustainable Drainage Systems to be given priority as a means of draining a site (supported by Environment Agency advice) but there will be no mechanism for those Sustainable Drainage Systems to be adopted and maintained by a public body.

1.3 The Government recognised this possibility in the Consultation on the National Standards for Sustainable Drainage Systems using the phrase "orphan SuDS" for those Sustainable Drainage Systems which were constructed but which did not come under any public maintenance regime. The responses to the Consultation showed that 90% of the respondents felt that the increase in un-adopted Sustainable Drainage Systems should be avoided (including Wokingham Borough Council in their response).

1.4 The lack of adoption would lead to:
a) Developers being granted planning permission which they may not wish to implement until SuDS adoption commences under the Flood and Water Management Act 2010,
b) Developers constructing Sustainable Drainage Systems and keeping them private, by possibly transferring them to residents or a management company. This would have a future undesirable affect upon maintenance and highway adoption.
c) Arguing the case with the Local Planning Authority for continued use of conventional drainage systems, thereby undermining the positive benefits of the introduction of Sustainable Drainage Systems

1.5 By offering Developers the opportunity for having their Sustainable Drainage Systems adopted (with an agreed inspection regime, maintenance period and payment of a commuted sum), they will be in a position to proceed with their developments knowing that the majority of the surface water drainage system will be adopted and maintained by a public body.

2 ALTERNATIVE OPTIONS CONSIDERED

2.1 The adoption of Sustainable Drainage Systems is not pursued until the government enacts Schedule 3 of the Flood and Water Management Act 2010.

2.2 The Local Planning Authority is faced with the possibility of developers challenging the priority given to the use of Sustainable Drainage Systems to drain a site and insisting upon adoptable "conventional" drainage solutions.

2.3 Developers construct Sustainable Drainage Systems which remain private and un-adopted which will lead to:
a) Uncertainty over ownership and future maintenance and performance, with the potential issues of flooding occurring.
b) The highway authority not agreeing to adopt roads as they would not drain to a suitable outfall (the highway authority requires that highways drain to an adopted surface water sewer or a watercourse which has an enforceable maintenance liability on the owner).

3 SUPPORTING INFORMATION

3.1 The National Planning Policy Framework (NPPF) expects Local Planning Authorities to give priority to the use of Sustainable Drainage Systems in determining planning applications. The Technical guidance to the National Planning Policy Framework refers.

3.2 Approved Document Part H of the Building Regulations 2010 also establishes a hierarchy for surface water disposal, which encourages the use of Sustainable Drainage Systems first and a conventional piped system as a last resort.

3.3 Wokingham Borough Councils Local Planning Authority documents support the use of Sustainable Drainage Systems in developments including The Core Strategy Policy CP1, Sustainable Design & Construction Supplementary Document, Sustainable Design & Construction Supplementary Planning Document (SPD), Borough Design Guide SPD, Strategic Development Location SPDs and the Infrastructure Delivery and Contributions SPD.

4 PROPOSED MECHANISM FOR THE INTERIM ADOPTION OF SUSTAINABLE DRAINAGE SYSTEMS

4.1 In this interim period the authority would not have powers of entry to inspect Sustainable Drainage Systems, insist on repair works, carry out maintenance, etc; It would therefore be prudent for Wokingham Borough Council to only adopt Sustainable Drainage Systems which fall within adoptable Public Open Space and adoptable Highway so that access is available for inspection works, future maintenance, etc. However any agreement entered into could include for access for the purpose of inspection and maintenance. Wokingham Borough Council will not adopt developments of less than 10 properties unless they fall within the above criteria.

4.2 Any agreement to adopt Sustainable Drainage Systems would be voluntary on either party.

4.3 During this interim period and before the Government is prepared to pay for the maintenance of adopted Sustainable Drainage Systems, the Authority should not take on any additional maintenance liabilities which would lead to a budget pressure in the future, without securing a means of paying for future maintenance, repair, etc;

4.4 The Authority would therefore seek Commuted Sums from Developers either via a Section 106 planning agreement (Town and Country Planning Act 1990 as amended) with respect to Sustainable Drainage Systems in a Public Open Space, or a Section 38 highway agreement (Highways Act 1980) with respect to Sustainable Drainage Systems within the adoptable highway. The sums would cover:
a) Fees for inspection
b) Costs involved in adoption of the Sustainable Drainage Systems
c) Maintenance liabilities for: 40 years in respect of highways and 125 years in respect of POS.

The calculation of the Commuted Sum will be based upon the cost to the Authority of maintaining the Sustainable Drainage Systems for the periods given above, less the cost of maintaining the same highway or Public Open Space as if it didn't contain any Sustainable Drainage Systems. i.e.

the developer would only be expected to pay the additional cost of maintaining the Sustainable Drainage Systems which are "over and above" the usual cost of maintenance.

4.5 The Authority would charge a fee to deal with the "drainage application" covering both the private and adoptable Sustainable Drainage Systems, based upon the proposed national fees set out in the draft Regulations (Extract shown in Annex A). In order to protect purchasers and the authority from any liability, adoptable Sustainable Drainage Systems within Public Open Space would be subject to a performance Bond (Sustainable Drainage Systems within adoptable highway would be covered by a Bond under the highway adoption agreement).

4.6 The calculations necessary to determine the Commuted Sums would be based upon "best practice", drawn from other Local Authorities who already adopt Sustainable Drainage Systems.

4.7 The rates to be used to determine the cost of maintenance would be calculated using figures supplied by those sections of the Authority currently carrying out maintenance of Public Open Space and the public highway, together with comparison with rates used by other Local Authorities who already adopt Sustainable Drainage Systems.

4.8 The fees and charges to be incorporated in a revision of the annual fees and charges published by the Authority.

4.9 *The Authority would check and approve submissions* for adoptable Sustainable Drainage Systems broadly in line with the guidance issued by Department for Environment Food & Rural Affairs, The Environment Agency and any relevant national guidance (such as The SuDS Manual published by the Construction Industry Research and Information Association (CIRIA).

4.10 The Authority would inspect the construction and finally adopt the Sustainable Drainage Systems using procedures based upon those used currently used for adoptable highways and Public Open Space

5 COMMUTED SUM CALCULATIONS

5.1 The Authority would seek Commuted Sums from Developers either via a
Section 106 planning agreement (Town and Country Planning Act 1990 as amended) with respect to Sustainable Drainage Systems in a Public Open Space, or a Section 38 highway agreement (Highways Act 1980) with respect to Sustainable Drainage Systems within the adoptable highway. The sums would cover:
a) Fees for inspection
b) Costs involved in adoption of the Sustainable Drainage Systems
c) Maintenance liabilities for: 40 years in respect of highways and 125 years in respect of POS.

5.2 The calculation of the Commuted Sum will be based upon the cost to the Authority of *maintaining the Sustainable Drainage Systems* for the periods given above, less the cost of maintaining the same highway or Public Open Space as if it didn't contain any Sustainable Drainage Systems. i.e. the developer would only be expected to pay the additional cost of maintaining the Sustainable Drainage Systems which are "over and above" the usual cost of maintenance.

5.3 The calculations necessary to determine the Commuted Sums would be based upon rates in the SPON's External Works and Landscape Price Book 2010. The calculation will take into account the maintenance regime recommended for each SuDS component in the SuDS Manual (CIRIA C697). *This method will allow each bespoke SuDS component to be calculated* accurately.

5.4 This method of calculating Commuted Sums for SuDS is already in use by other Authorities that have adopted an Interim SuDS policy.

Annex B – Recommended maintenance tasks and frequencies.

The following table has been constructed from extracts of The SuDS Manual (CIRIA C697). It provides a guide to the types and frequencies of maintenance for SuDS components. It does not provide a definitive list and the exact type and nature of the maintenance will be heavily dependent on the construction of the individual SuDS technique.

SuDS Component	**Regular Maintenance**		**Occasional Maintenance**		**Monitoring**	
	Item	***Frequency***	**Item**	***Frequency***	**Item**	***Frequency***
Permeable Paving	Brushing and vacuuming	*3 times per year*	Stabilise and mow contributing and adjacent areas	*as required*	Initial inspection	*monthly for three months after installation*
			Removal of weed	*as required*	Inspect for evidence of poor operation and/or weed growth. If required take remedial action	*3-monthly, 48 h after large storms*
					Inspect silt accumulation rates and establish appropriate brushing frequencies	*Annually*
					Monitor inspection chambers	*Annually*
Cellular Storage	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	*Monthly for 3 months, then six monthly*			Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	*Annually and after large storms*
	Debris removal from	*Monthly*				

	catchment surface (where may cause risks to performance)					
	Where rainfall infiltrates into blocks from above, check surface of filter for blockage by silt, algae or other matter. Remove and replace surface infiltration medium as necessary	*Monthly (and after large storms)*				
	Remove sediment from pre-treatment structures	*Annually, or as Required*				
Detention Basin	Litter and debris removal	*Monthly*	Re-seed areas of poor vegetation growth	*Annually or as required*	Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly/after large storms
	Grass cutting – for spillways and access routes	*Monthly during growing season*	Prune and trim trees and remove cuttings	*2 years or as required*	Inspect banksides, structures, pipework, etc for evidence of physical damage	Monthly/after large storms
	Grass cutting – meadow grass in and around basin	half yearly	Remove sediment from forebay, when 50% full and from micropools if volume reduced by > 25%	3-10 years	Inspect inlets and facility surface for silt accumulation . Establish appropriate silt removal frequencies. Check penstocks and other	Half yearly

					mechanical devices	
	Manage other vegetation and remove nuisance plants. Tidy all dead growth before start of growing season. Remove sediment from inlets, outlet and forebay. Manage wetland plants in outlet pool – where *Provided*	Annually				

Annex A
These fees are to cover checking the submitted design by the LPA.

Extract from:
The Sustainable Drainage (Procedure) (England) Regulations 2012
PART 2
Applications
Fees for applications for approval made by 30th September 2015
6.—(1) Until 30th September 2015, an approving body may charge a fee for an application for approval determined as follows—
(a) £350 for each application; and
(b) an additional amount up to £7,500 calculated by reference to the size of the construction area as follows—
(i) £70 for each 0.1 hectare or fraction of a 0.1 of a hectare, for the first 0.5 hectare;
(ii) £50 for each 0.1 hectare or fraction of a 0.1 of a hectare, from 0.5 hectare up to and including 1.0 hectare;
(iii) £20 for each 0.1 hectare or fraction of a 0.1 of a hectare, from 1.0 hectare up to and including 5.0 hectares; and
(iv) £10 for each additional 0.1 hectare or fraction of a 0.1 of a hectare.

Appendix F

Surface Water Drainage Strategy Drawings

Proposed Surface Water Strategy	60312043/CIV/001
Catchment Area Plan	60312043/CIV/010
Proposed SuDS Sections	60312043/CIV/009
Flood Exceedence Routes	60312043/CIV/011

Project Management Initials: Designed: Checked: Approved:

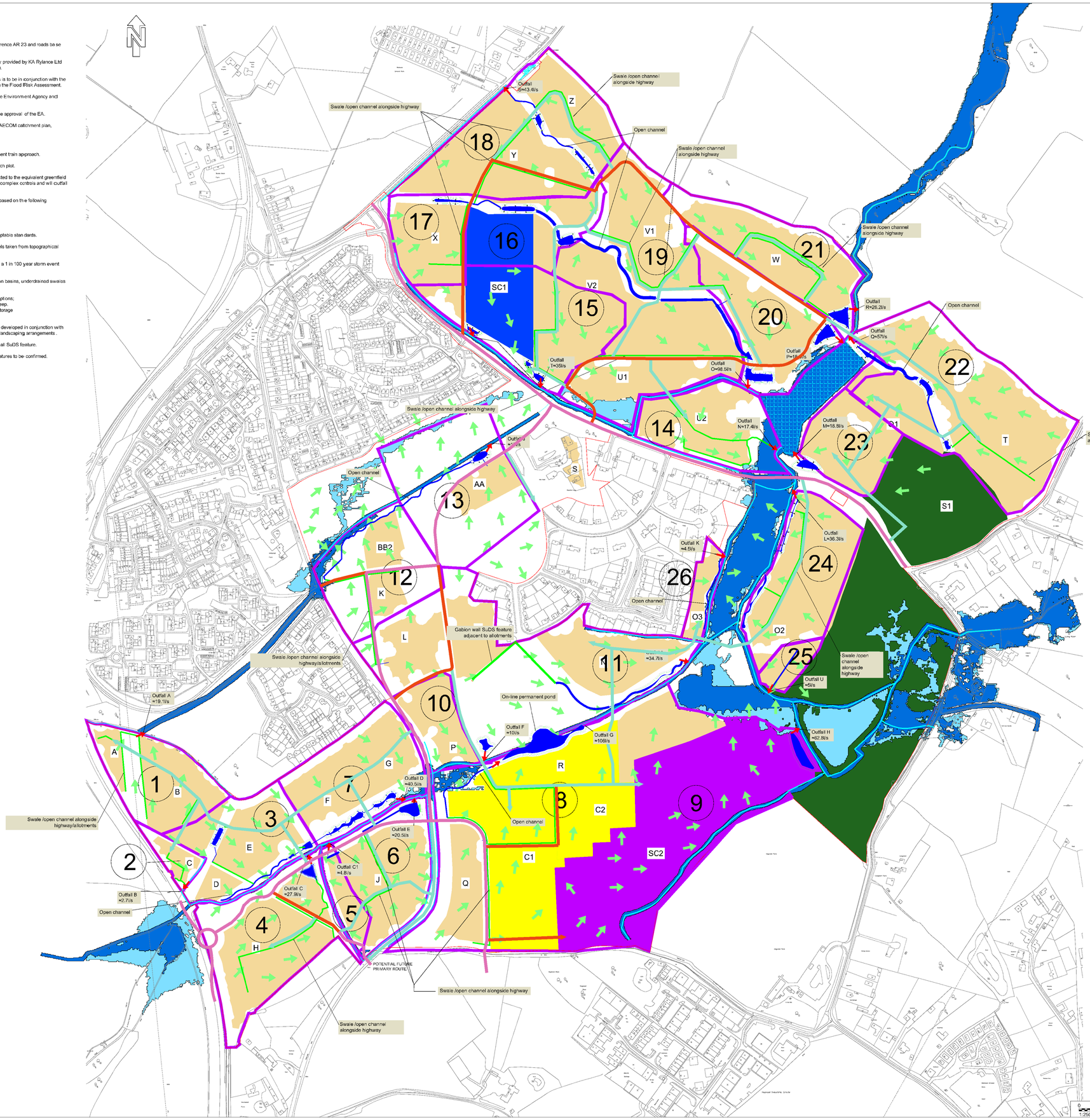
ISO A0 841mm x 1189mm

Notes

1. Drawing based on IDP masterplan reference AR 23 and roads base rev I issued 19 September 2014.
2. Design based on Topographical Survey provided by KA Rylance Ltd dated March 2014 (ref Abor release v6).
3. The location of the attenuation features is to be in conjunction with the fluvial flood extents as determined from the Flood Risk Assessment.
4. Extents of flooding to be agreed with the Environment Agency and Wokingham Borough Council.
5. On line permanent pond is subject to the approval of the EA.
6. Drawing to be read in conjunction with AECOM catchment plan, section and flood routing drawings.

SuDS Strategy

1. SuDS strategy is based on a management train approach.
2. Source control to be provided within each plot.
3. Outflow from the development is restricted to the equivalent greenfield rate of runoff (Qm & Q100) by the use of complex controls and will outfall to existing watercourses.
4. Assumed areas of impermeability are based on the following assumptions;
   - Residential 65%
   - Commercial - 80%
   - Schools - 50%
5. Drainage system to be designed to adoptable standards.
6. Drainage design based on existing levels taken from topographical survey.
7. SuDS features to attenuate runoff from a 1 in 100 year storm event plus 30% climate change.
8. SuDS storage features include detention basins, underdrained swales and open channels.
9. SuDS layout based on following assumptions;
   - Basins and channels - 1 - 1.5m deep.
   - Underdrained swales - 1.5m³/m storage
   - 150mm freeboard.
10. SuDS features layout and design to be developed in conjunction with Murdoch Wickham to reflect proposed landscaping arrangements.
11. Maintenance access to be provided for all SuDS feature.
12. Adoption and maintenance of SuDS features to be confirmed.



Catchment	Impermeable Area (ha)	Q100 Discharge Rate (l/s)	FEH Volume	Outfall
1	1.38	19.1	885	A
2	0.19	2.7	117	B
3	1.36	18.8	810	D
4	2.02	27.9	1200	C
5	0.35	4.8	225	C1
6	1.48	20.5	950	E
7	1.57	21.7	991	D
8	7.67	105.9	5000	G
9	4.55	62.8	2900	H
10	0.71	9.9	460	F
11	2.51	34.7	1580	I
12	0.63	8.8	580	J
13	0.45	6.3	290	J
14	1.26	17.4	832	N
15	2.53	35.0	1625	T
16	1.19	16.4	760	O
17	1.37	18.9	880	O
18	3.14	43.4	2010	S
19	4.58	63.2	2950	O
20	1.37	18.8	880	P
21	1.90	26.2	1250	R
22	4.15	57.4	2600	Q
23	1.37	18.8	880	M
24	2.63	36.3	1700	L
25	0.38	5.3	253	U
26	0.32	4.5	225	K

Summary of Proposed Attenuation

0 25 50 75 100 150 200 250m
1:2500

Scale 1:2500 @A0

AECOM

PROJECT

Arborfield Garrison SDL

CLIENT

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KEY

- Proposed SuDS Surface water attenuation feature.
- Proposed SuDS Open channel - storage & conveyance.
- Proposed SuDS Swale/Underdrained swale – storage & conveyance.
- Existing watercourse
- Existing pond
- Proposed Site Boundary
- Extent of 100 year flood envelope including 30% climate change
- Extent of 20 year flood envelope
- Existing drainage path
- Existing drainage sub- catchment boundary.
- 25 — Drainage catchment reference
- Outfall T =5l/s — Proposed discharge rate from 1 in 100 year storm event plus climate change.
- Proposed outfall point.
- Proposed Highway Network (Primary)
- Proposed Highway Network (Secondary)
- Proposed Highway Network (Tertiary)

WORK IN PROGRESS

ISSUE/REVISION

Rev.	Date	Detail	Made	Chk'd	Appr'd
P7	09/09/16	Notes added, masterplan updated	SM	SLM	SLM
P6	09/07/16	SuDS repositioned	PP	GEM	SLM
P5	01/07/16	Updated to latest masterplan	PP	GEM	SLM
P4	19/05/16	Updated to latest masterplan	PP	GEM	SLM
P3	12/05/14	Masterplan Removed	AM	GEM	SLM
P2	24/03/14	For information	AM	GEM	SLM
P1	17/03/16	For Discussion	AM	GEM	SLM

PROJECT NUMBER

60312043 - Arborfield Garrison SDL

SHEET TITLE

DRAFT Surface Water Drainage Strategy

SHEET NUMBER

60312043/CIV/001

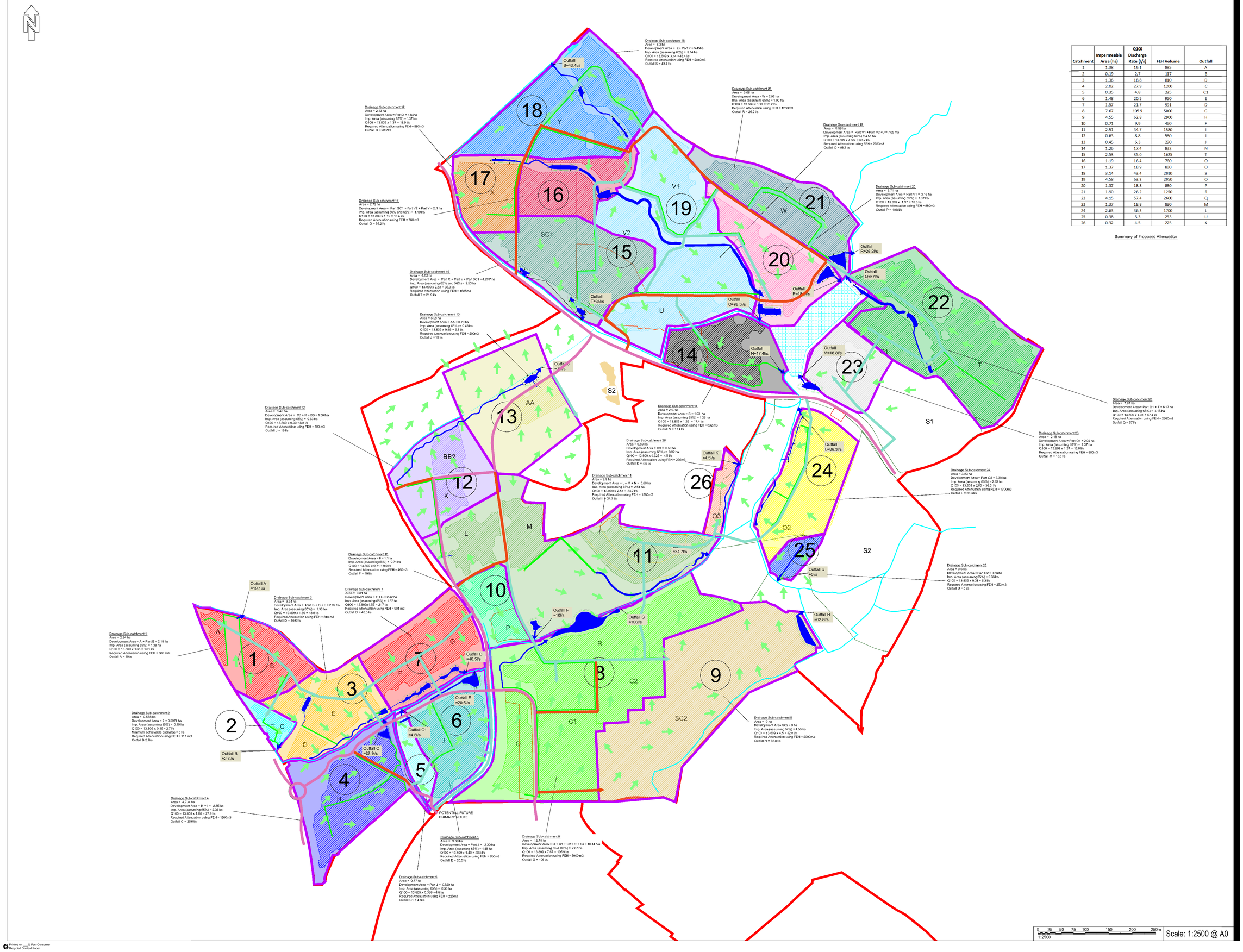
ISO A0 841mm x 1189mm

Approved:

Checked:

Designer:

Project Management Initials:



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Summary of Proposed Attenuation

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- Proposed SuDS Open channel - storage & conveyance.
- Proposed SuDS Swale/Underdrained swale - storage & conveyance.
- Existing watercourse
- Existing pond
- Proposed Site Boundary
- Existing drainage path
- Existing drainage sub-catchment boundary.
- 25 — Drainage catchment reference
- Outfall T =5l/s — Proposed discharge rate from 1 in 100 year storm event plus climate change.
- Proposed outfall point.
- Sub-catchment
- Impermeable area within Sub-catchment

Notes

1. Do no scale from this drawings.
2. Based on "oographical survey provided by KA Rylances Ltd dated March 2014 (ref Arbor release v6).
3. Drawing based on IDP Masterplan reference AR 23 and roads base rev I issued 19 September 2014.
4. To be read in conjunctionwith AECOM drainage strategy drawings.

WORK IN PROGRESS

ISSUE/REVISION

Rev	Date	Detail	Made	Chk'd	Appr'd
P1	09/09/14	Preliminary Issue	LP	SM	SLM

PROJECT NUMBER

60312043 - Arborfield Garrison SDL

SHEET TITLE

Surface Water Drainage Strategy Catchment Area Plan

SHEET NUMBER

60312043/CIV/010

Scale: 1:2500 @ A0

AECOM

PROJECT

Arborfield Garrison SDL

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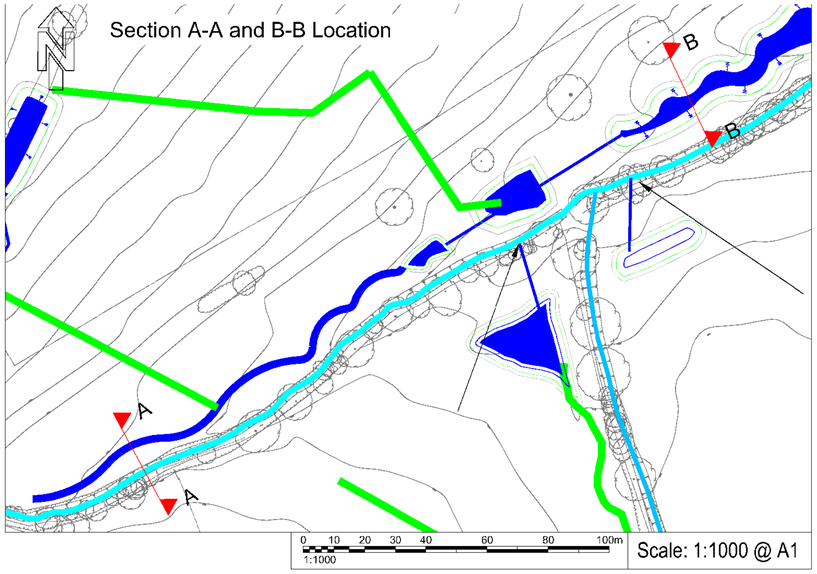

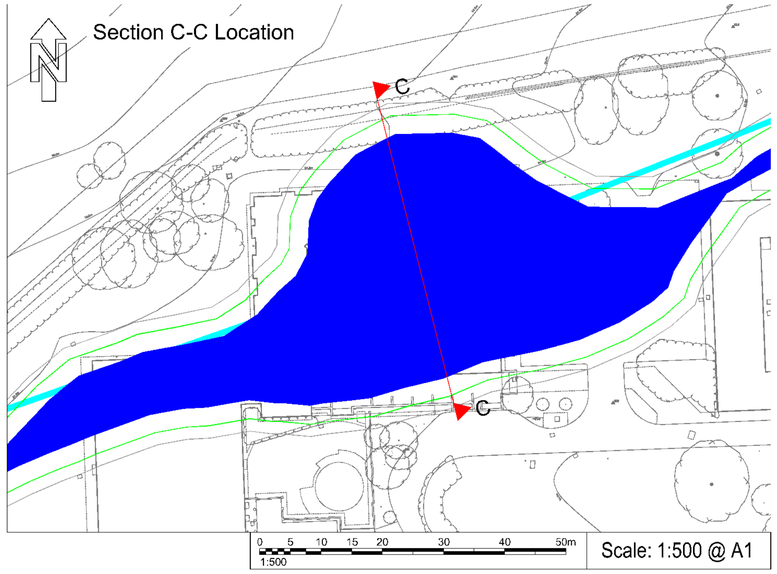

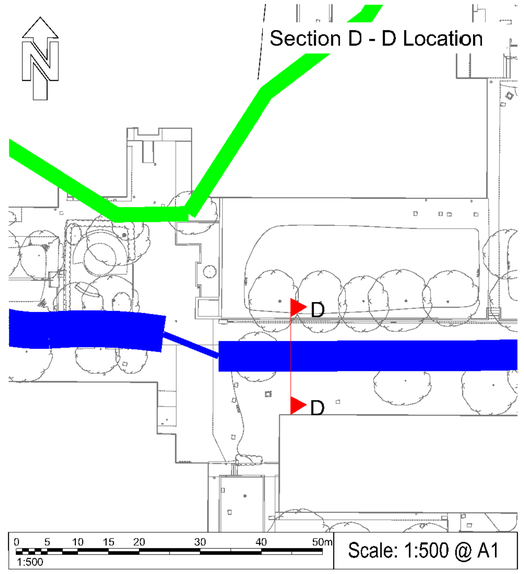

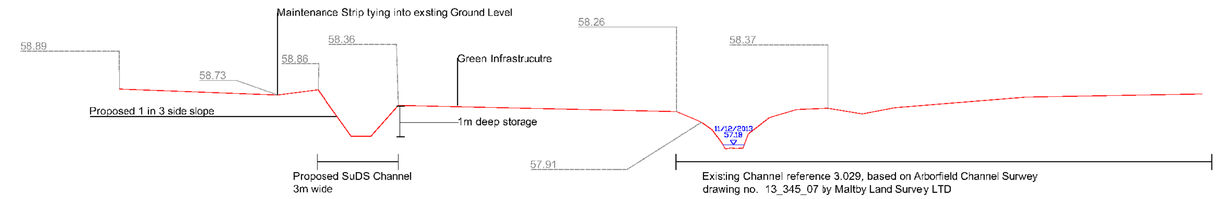

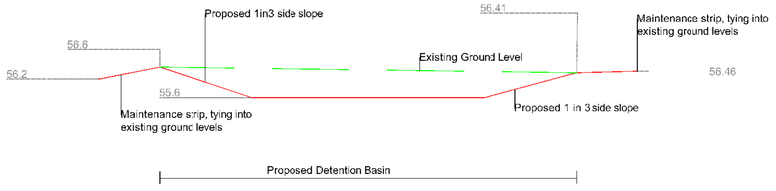

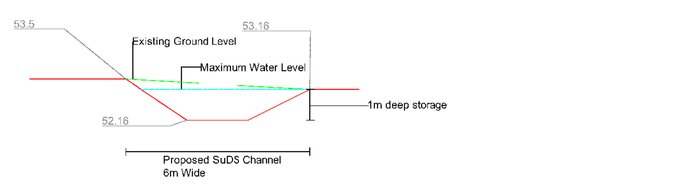

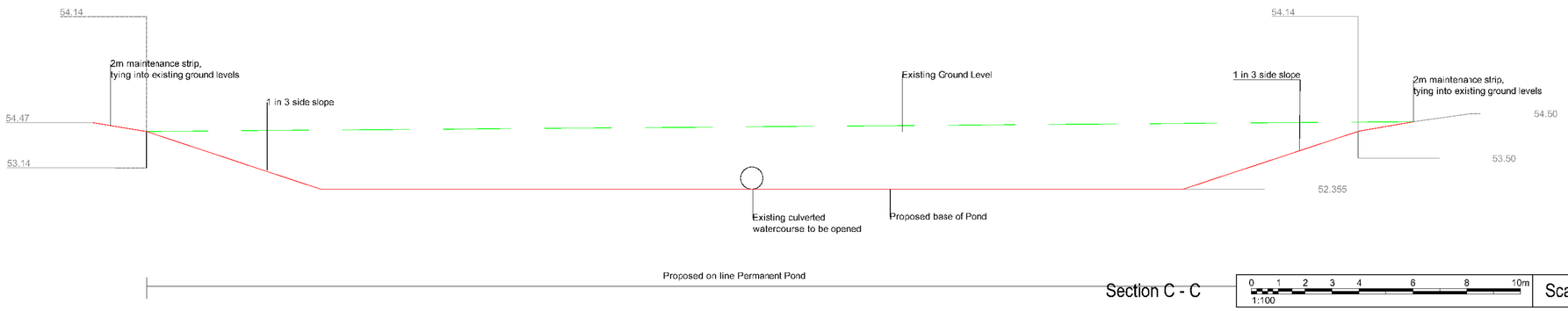

AECOM

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Key

Proposed surface water attenuation feature

Existing watercourse

Section Lccations

Notes

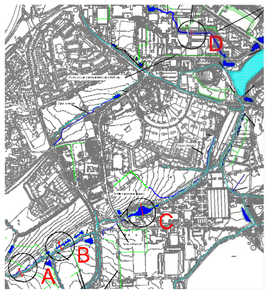
1. Do not scale rom this drawing.

2. Based on Topographical survey provided by KA Rylance Ltd datsd March 2014 (ref Arbor release v6).

3. Drawing based on IDP masterplan reference AR 23 and roads base rev H issued 15 September 2014.

4. To be read in conjunction with AECOM drainage strategy drawings.

Key Plan



ISSUE/REVISION

Rev	Date	Description	Made	Chk'd	App'd
P1	15.09.14	Preliminary Issue	LP	SB	SLM

PROJECT NUMBER

60312043 - Aborfield Garrison SDL

SHEET TITLE

Surface Water Drainage Strategy
Proposed SuDS Sections

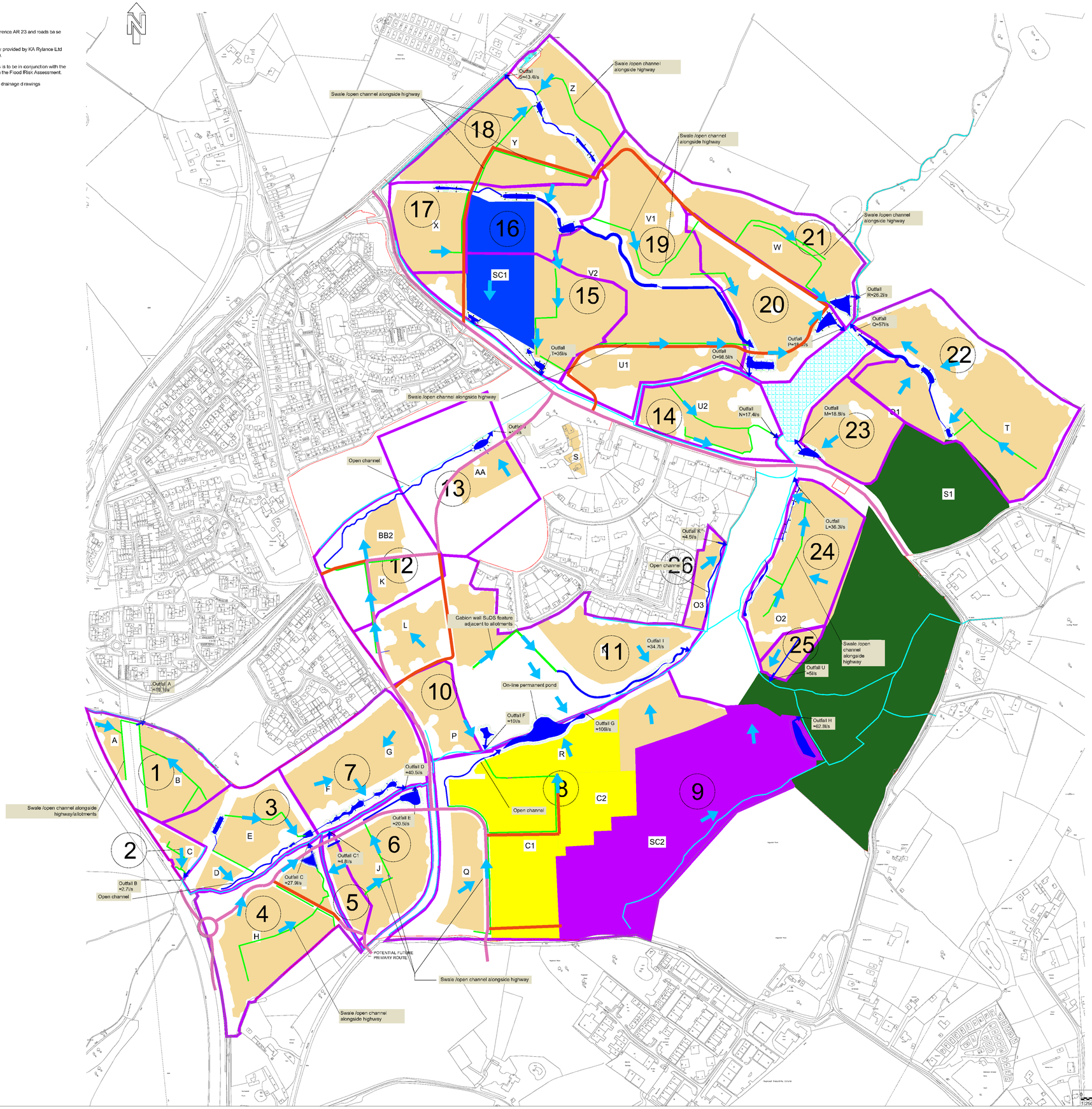
SHEET NUMBER

60312043/CIV/009

Project Management Initials: Designed: Checked: Approved: ISO A0 841mm x 1189mm

Notes

1. Drawing based on IDP masterplan reference AR 23 and roads base rev I issued 19 September 2014.
2. Design based on Toographical Survey provided by KA Rylance Ltd dated March 2014 (ref Abor release v6).
3. The location of the attenuation features is to be in conjunction with the fluvial flood extents as determined from the Flood Risk Assessment.
4. To be read in conjurction with AECOM drainage drawings



0 25 50 75 100 150 200 250m
1:2500

Scale 1:2500 @A0

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AECOM

PROJECT

Arborfield Garrison SDL

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KEY

- Proposed SuDS Surface water attenuation feature.
- Proposed SuDS Open channel – storage & conveyance.
- Proposed SuDS Swale/Underdrained swale – storage & conveyance.
- Existing watrcourse
- Existing pond
- Proposed Site Boundary
- Extent of 100 year flood envelope including 30% climate change
- Extent of 20 year flood envelope
- Existing drainage sub- catchment boundary.
- 25 — Drainage catchment reference
- Outfall T =5l/s — Proposed discharge rate from 1 in 100 year storm event plus climate change.
- Proposed outfall point.
- Flood Exceedance Route. To be confirmed with site layout

WORK IN PROGRESS

ISSUE/REVISION

Rev	Date	Detail	Made	Chk'd	Appr'd
P1	03/09/14	Preliminary Issue	LP	SB	SLM

PROJECT NUMBER

60312043 - Arborfield Garrison SDL

SHEET TITLE

Surface Water Drainage Strategy
Flood Exceedence Routes

SHEET NUMBER

60312043/CIV/011

Appendix G

Surface Water Calculations

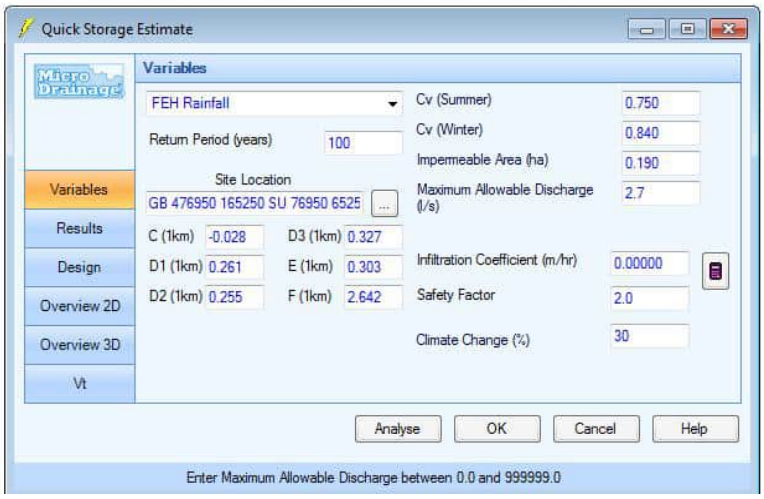
IH 124 Mean Annual Flood

Input

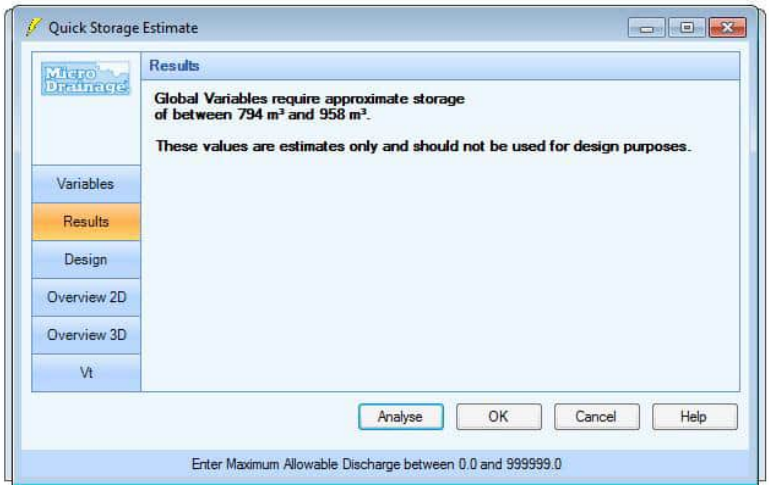
Return Period (years) 100 SAAR (mm) 700 Urban 0.000
Area (ha) 79.080 Soil 0.457 Region Number Region 6

Results	l/s
QBAR Rural	341.6
QBAR Urban	341.6
Q100 years	1089.6
Q1 year	290.3
Q2 years	300.9
Q5 years	437.2
Q10 years	553.4
Q20 years	684.2
Q25 years	733.7
Q30 years	774.1
Q50 years	894.9
Q100 years	1089.6
Q200 years	1280.9
Q250 years	1342.4
Q1000 years	1762.5

Quick Storage Estimates



Input data for FEH QSE (Area and Discharge vary by catchment)



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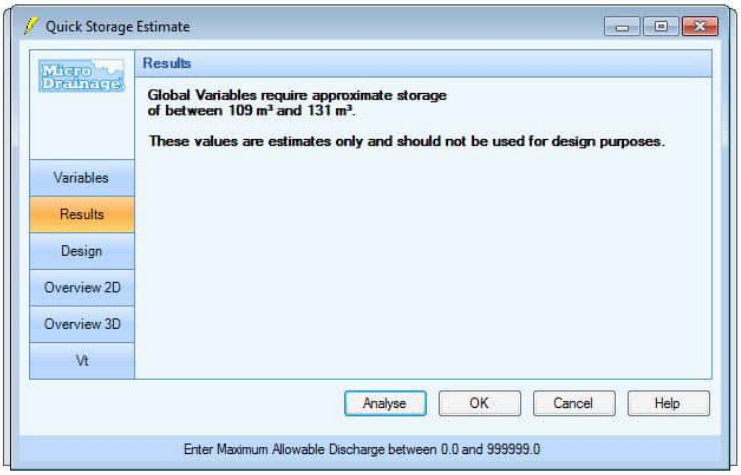

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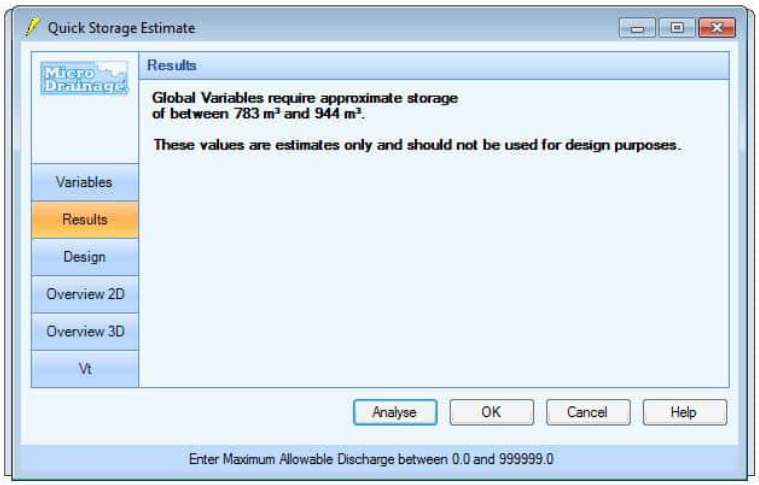

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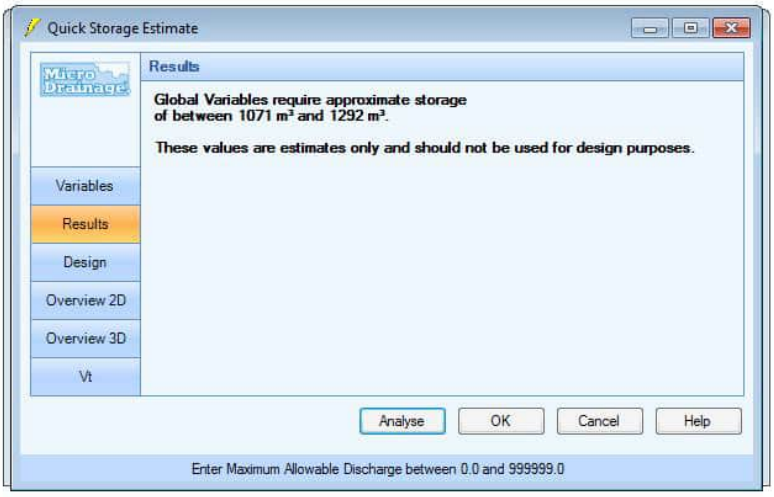

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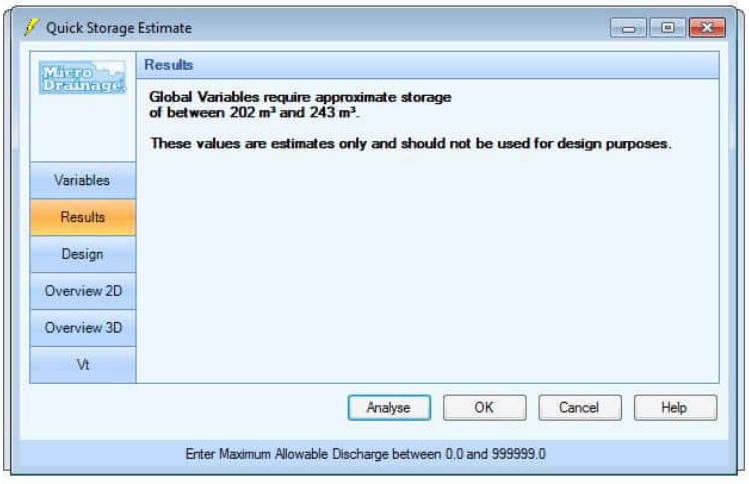

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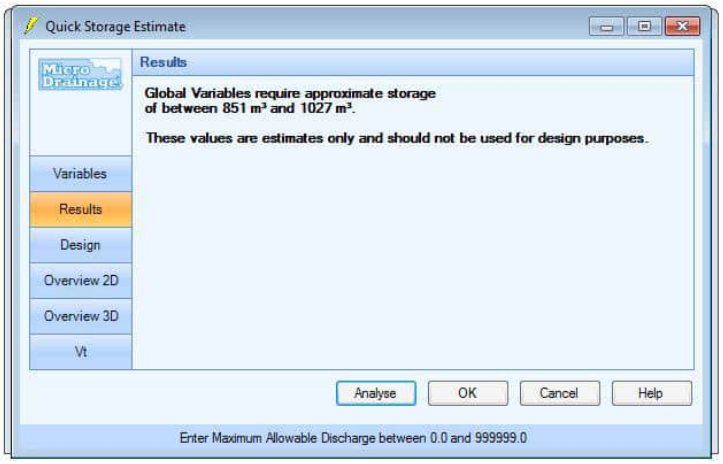

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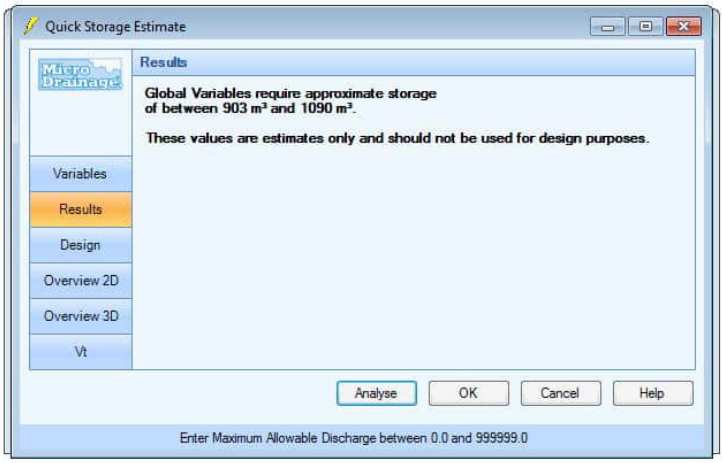

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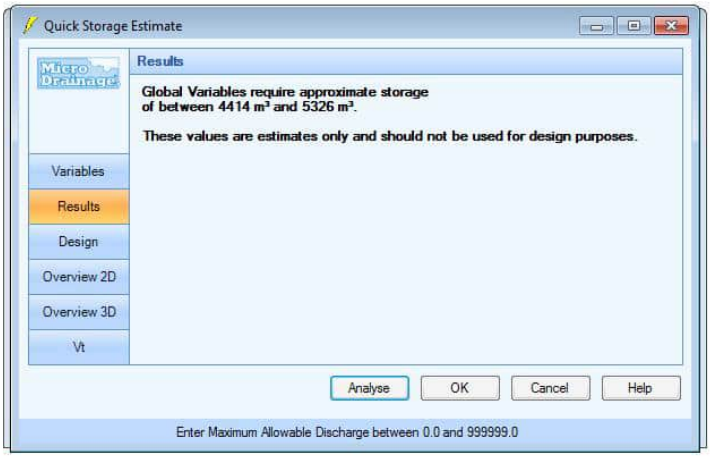

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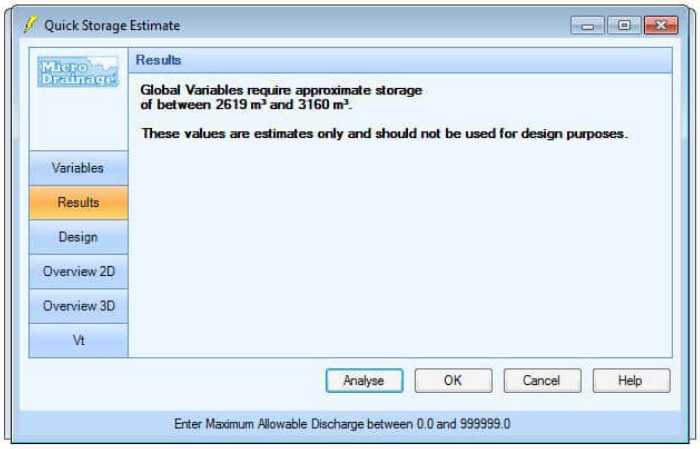

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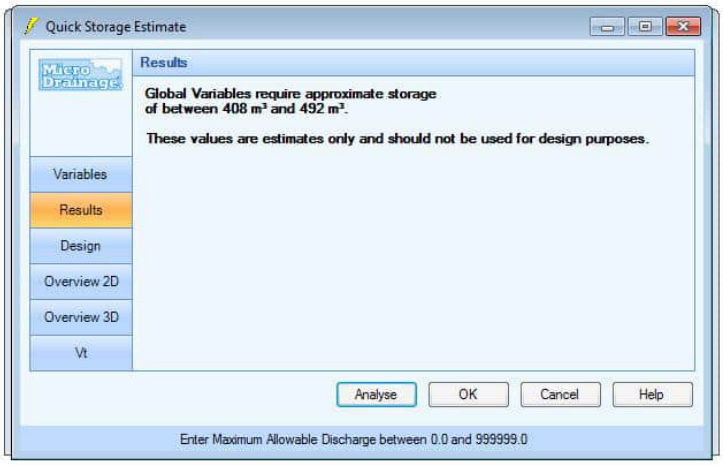

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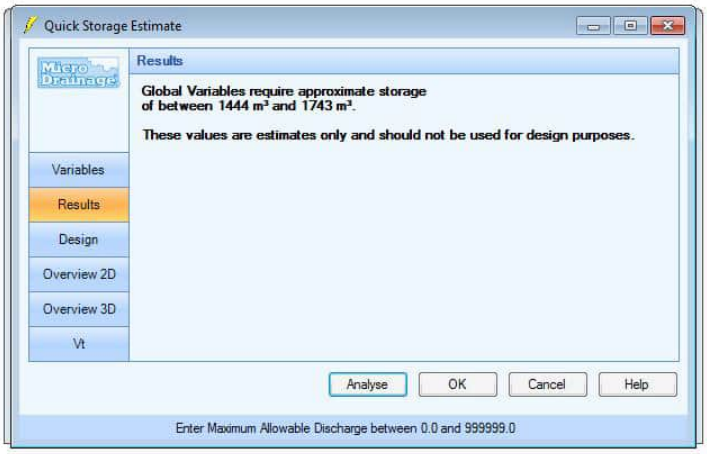

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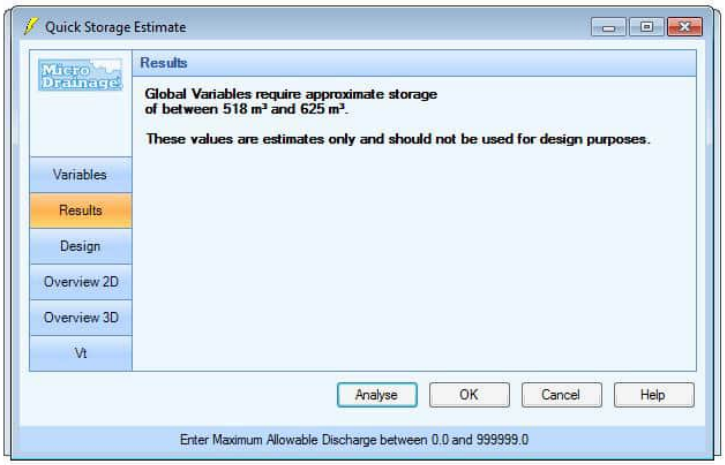

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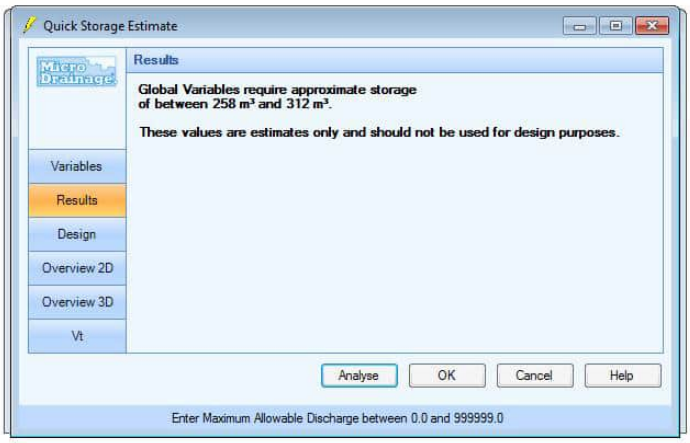

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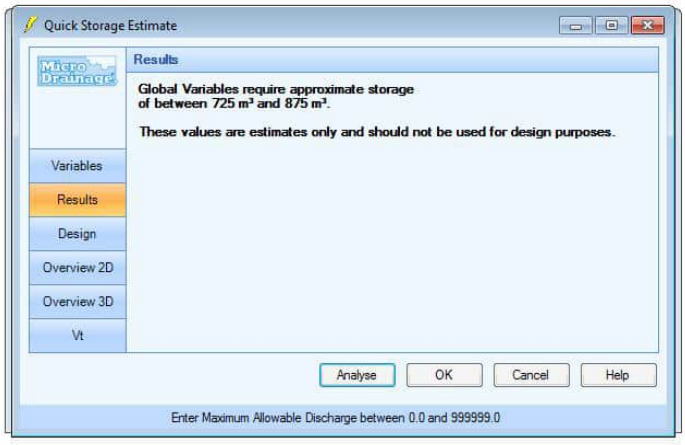

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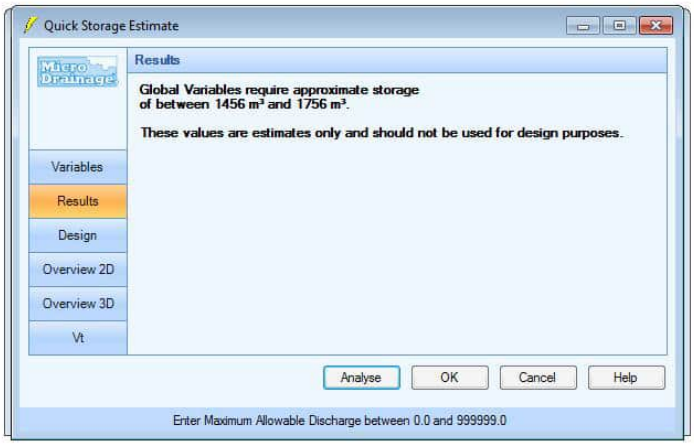

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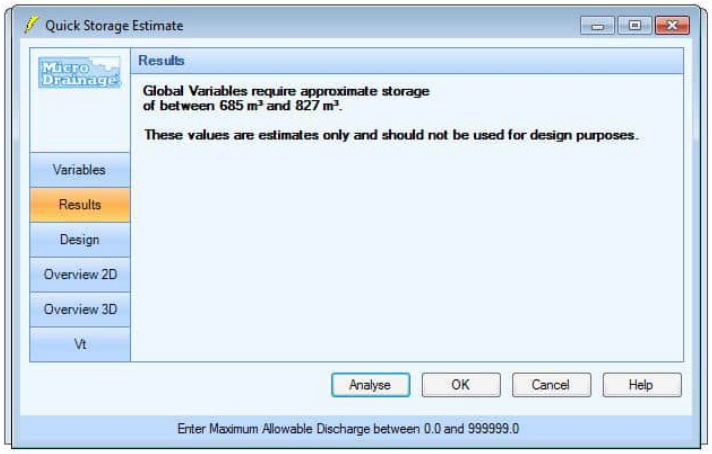

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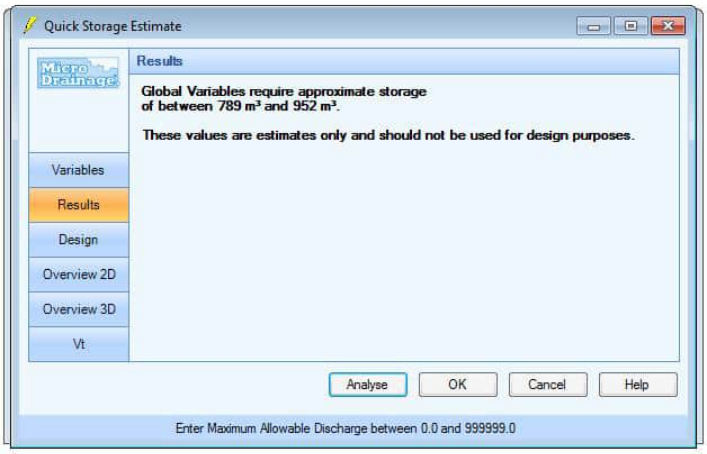

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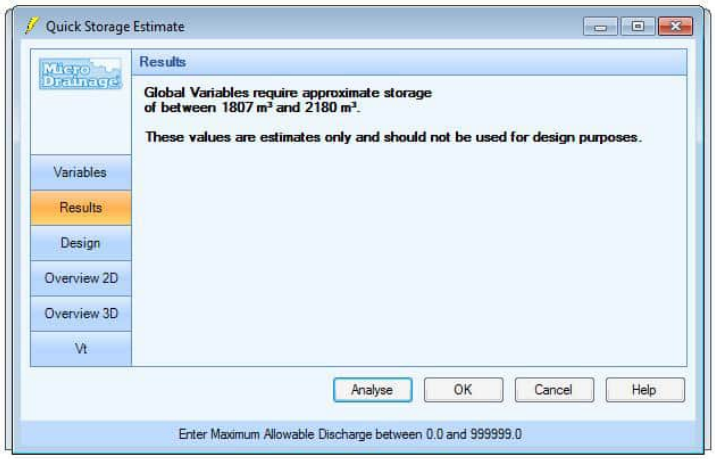

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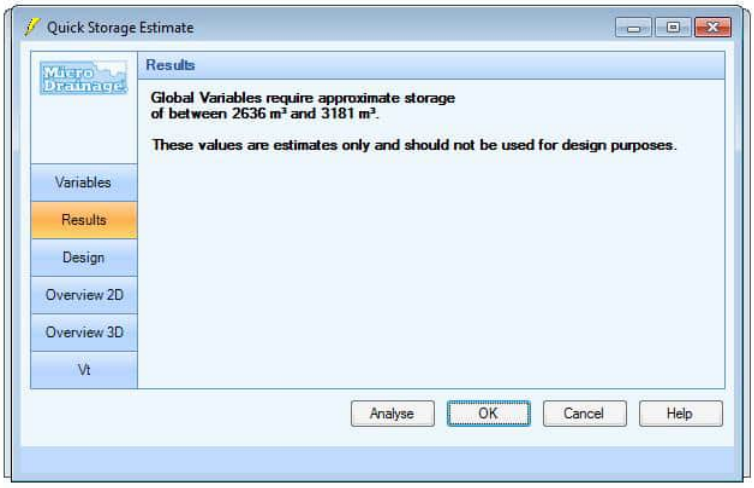

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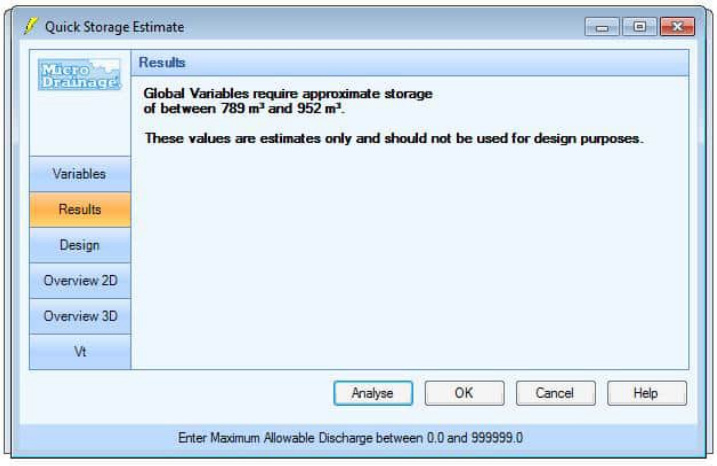

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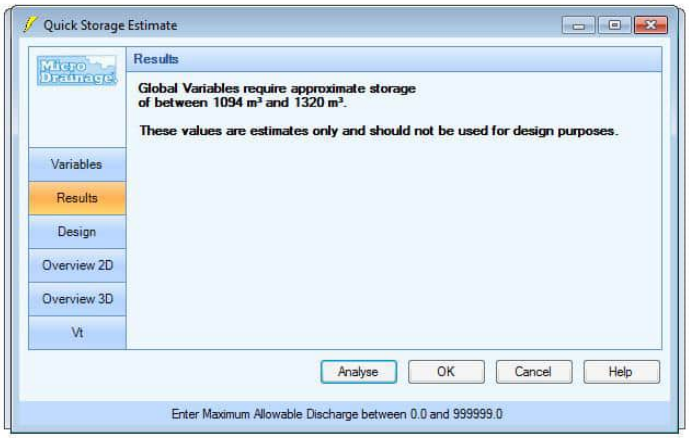

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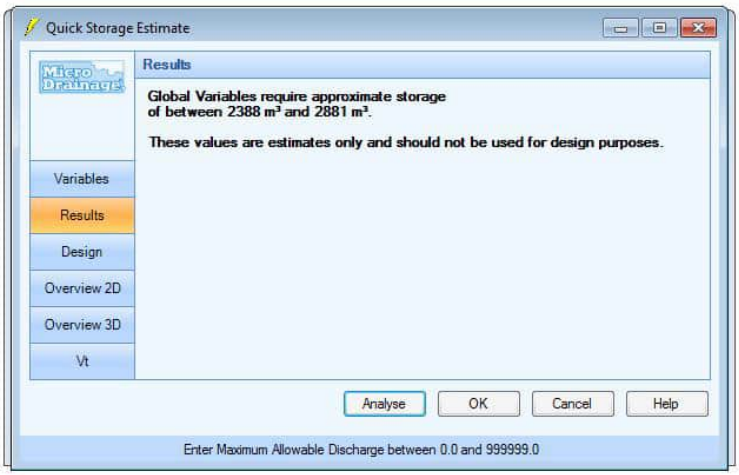

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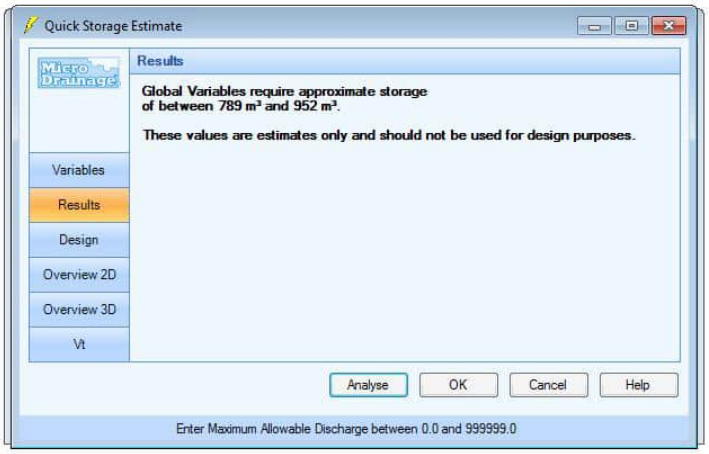

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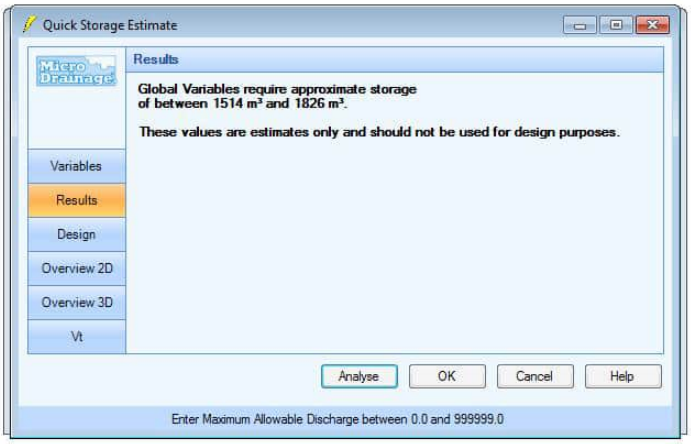

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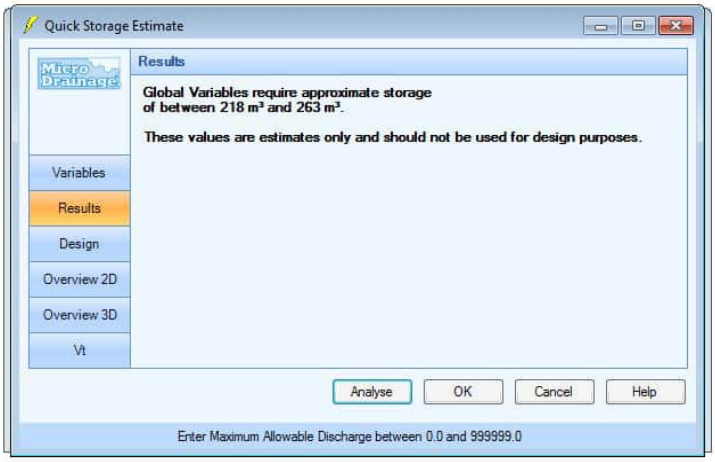

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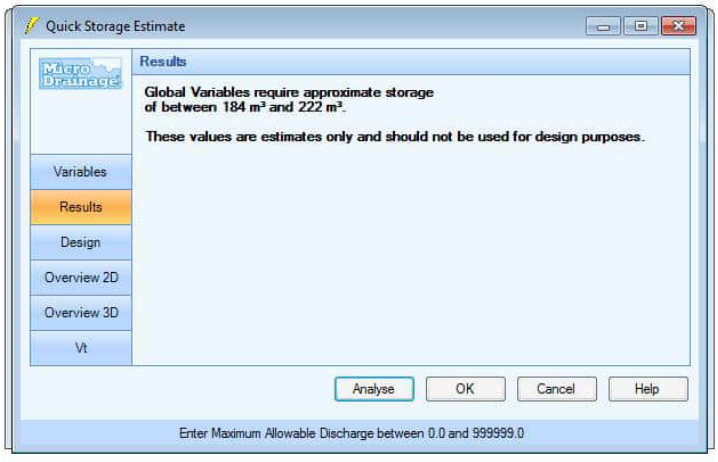


Catchment 26

Appendix H

Foul Water Drainage Strategy Drawings

Proposed Foul Water Strategy 60312043/CIV/002

ISO A0 841mm x 1189mm

Approved:

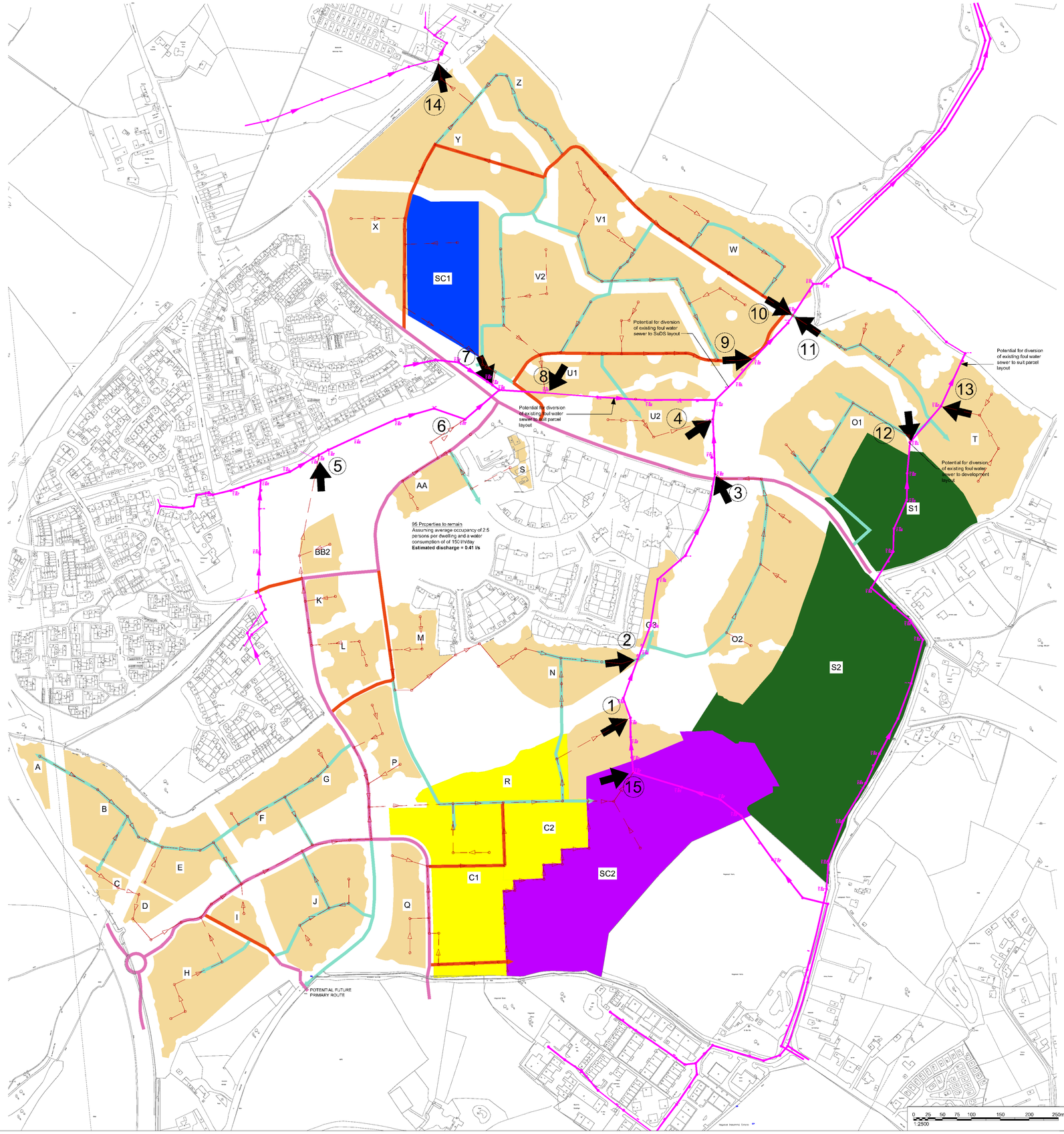
Checked:

Designer:

Project Management Initials:

Discharge point	Average DWF (l/s)	Peak DWF (l/s)
1	5.0	30.0
2	0.7	4.4
3	1.1	6.9
4	0.5	2.9
5	0.5	2.9
6	0.2	1.1
7	0.6	3.8
8	0.9	5.5
9	2.1	12.4
10	0.7	4.4
11	0.8	4.9
12	0.8	5.1
13	0.4	2.4
14	1.5	9.1
15	0.5	3.2
TOTAL	16.4	98.8

Tabble A - Proposed Foul Water Discharge Rates
(based on SfA 4000 l/dwelling/day)



Scale - 1:2500 @ A0

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KEY

- Proposed Highway Network (Primary)
- Proposed Highway Network (Secondary)
- Proposed Highway Network (Tertiary)
- Existing Thames Water public foul water sewer
- Proposed foul water sewer
- Proposed Site Boundary
- 5 — Proposed foul water discharge connection point onto Thames Water public sewer

Notes

1. Drawing based on IDP masterplan reference AR 23 and roads base rev I issued 19 September 2014.
2. Design based on Topographical Survey provided by KA Rylance Ltd dated March 2014 (ref Abor release v6).
3. The proposed sewers, connection points and discharge rates shown are indicative only and are subject to the final parcel layout and detailed design.
4. All existing foul water sewers have been taken from Thames Water sewer records. The location and levels of these sewers are indicative only and are to be verified by a site survey at earliest opportunity.
5. The proposed sewers as shown on the plan indicate a gravity sewerage system. There may be isolated low spots in the development following confirmation of finished ground levels, which may require a pumping station.
6. The proposed foul water discharge rates shown in Table A are based on a design flow of 4000 l/dwelling/day (as per SfA). The flow rates are subject to confirmation of the final masterplan and parcel housing density etc.

WORK IN PROGRESS

ISSUE/REVISION

Rev	Date	Detail	Made	Chkd	Apprd
P5	19/09/14	Updated to current masterplan and roles added	CH	SM	SLM
P4	04/07/14	Updated to current masterplan	PP	SLM	SLM
P3	11/06/14	Proposals updated	PP	SLM	SLM
P2	23/05/14	Masterplan Removed	AM	SLM	SLM
P1	21/03/14	Preliminary issue	AM	SEM	SLM

PROJECT NUMBER

60312043 - Arborfield Garrison SDL

SHEET TITLE

DRAFT Foul Water Drainage Strategy

SHEET NUMBER

60312043/CIV/003