



Flood Risk Assessment and Drainage Strategy Report

Phase 1B Barns Court, Copthorne

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DOCUMENT CONTROL

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1.0 INTRODUCTION

- 1.1 HDR Consulting Limited was commissioned by The Turvey Corporation (the Client) to produce a Flood Risk Assessment (FRA) and drainage strategy for a proposed development at Barns Court in Copthorne, West Sussex.
- 1.2 The relevant national planning guidance is set out by the National Planning Policy Framework (NPPF, updated in 2024). This FRA must assess all sources of flood risk both to the development itself and the potential impact on people and property elsewhere within the catchment.
- 1.3 The overall objective of this study is to carry out an FRA that meets the requirements of the NPPF and West Sussex County Council (WSCC) flood risk policies. These consider surface water runoff management and the guidance published by the Environment Agency (EA), WSCC and Thames Water. The study is required to assess all aspects of flood risk to the proposed development, the potential impacts of the development on people and property elsewhere within the catchment and identify possible mitigation measures to ensure that the development is safe in the event of a flood. To achieve this aim, the following key actions were undertaken:
- Obtain publicly available flood data from the gov.uk website;
 - Review topographical and flood risk data to identify the existing flood risk posed to the site from all sources;
 - Assess the residual flood risk post-development;
 - Consider the vulnerability of the users and the development, taking account of the vulnerability classification;
 - Assess the safety of the route of access/egress from the site in a flood event;
 - Identify suitable mitigation measures to protect the development site against flooding; and
 - The production of a concept surface water drainage strategy for the proposed development.

2.0 PROJECT DETAILS AND ENVIRONMENTAL SETTING

2.1 LOCATION

2.1.1 The site is located west of Turners Hill Road and south of Copthorne Common Road (the A264) on the eastern edge of the village of Copthorne in West Sussex. Its post code is RH10 4HQ and it is approximately centred on Ordnance Survey National Grid Reference TQ 334 389. The site itself is part of a wider development, this development has now been split into different phases, Phase 1A, Phase 1B and Phase 2. This part of the site is called Phase 1B which was formerly a part of Phase 2.

2.1.2 An FRA for Phase 1A can be found in Appendix G and a drainage strategy for Phase 2 can be found in Appendix H. A location plan is provided in Appendix A.

2.2 DESCRIPTION

2.2.1 The Phase 1B site is irregular in plan shape and covers a total area of about 0.5 hectares. It consists of various land uses which are described in broad terms below.

2.2.2 This development area of Barns Court comprises a mix of open grass-covered fields, assumed to be in agricultural/grazing use. A ditch extends through the middle of the site that is currently denoting an existing field boundary. The western part of the site comprises a mix of dense vegetation including mature trees. To the south of the site there are ponds that retain water year-round. At the east of the site there is a gravel access road. At the north of the site there is dense vegetation denoting an existing field boundary.

2.2.3 A June 2020 topographical survey produced by APR Services indicates ground levels fall from about 92.9 mAOD at the site entrance in the southern east to about 90.5 mAOD on the north west boundary. A copy of the survey is provided in Appendix B.

2.3 SURROUNDING LAND USE

2.3.1 The Phase 1B site is situated in a generally rural environmental, with surrounding land use predominantly comprising agricultural land, there are ponds located to the south and to the north there is an industrial hardstanding service area. To the west of the site there is a residential garden behind the dense vegetation.

2.4 PROPOSED DEVELOPMENT

2.4.1 An architect's drawings of the proposed Phase 1B layout is provided in Appendix C. This indicates an extension to the existing business park (which is predominantly B1c light industrial) comprising a new commercial property (B1c use class) with associated access, parking and soft landscaping.

2.5 MAPPED GEOLOGY

2.5.1 The site is mapped to be underlain by solid geology of the Upper Tunbridge Wells Sand. This lithology is described as thinly bedded silty mudstones, siltstones, silty sandstones and fine-grained sandstones.

2.6 HYDROGEOLOGY

- 2.6.1 The Upper Tunbridge Wells Sand is a Secondary 'A' aquifer however the site is not located within a groundwater source protection zone.

2.7 HYDROLOGY

- 2.7.1 The nearest surface water features are series of ponds are located below the site's southern boundary.
- 2.7.2 A south-north oriented drainage ditch is present to the west of these ponds and is assumed to receive outflows from them. Flows within this ditch are then directed westwards via the regional ditch network towards Copthorne, ultimately reaching Copthorne Brook about 1 km to the west.

3.0 POLICY AND GUIDANCE

3.1 NATIONAL PLANNING POLICY FRAMEWORK (DECEMBER 2024)

3.1.1 In determining an approach for the assessment of flood risk for the development proposal there is a need to review the policy context. Government guidance requires that consideration be given to flood risk in the planning process. The National Planning Policy Framework (NPPF) was last updated in December 2024 and outlines the national policy position on development and flood risk assessment.

3.1.2 The Framework states that inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk. Where development is necessary in flood risk areas, it can be permitted provided it is made safe without increasing flood risk elsewhere.

3.1.3 The essence of NPPF is that:

- Local Plans should be supported by Strategic Flood Risk Assessment and develop policies to manage flood risk from all sources, taking advice from the Environment Agency and other relevant flood risk management bodies, such as lead local flood authorities and internal drainage boards.
- Policies in development plans should outline the consideration, which will be given to flooding issues, recognising the uncertainties that are inherent in the prediction of flooding and that flood risk is expected to increase as a result of climate change.
- Planning authorities should apply the precautionary principle to the issue of flood risk, using a risk-based search sequence to avoid such risk where possible and managing it elsewhere;
- The vulnerability of a proposed land use should be considered when assessing flood risk;
- Opportunities offered by new developments should be used to reduce the causes and impacts of flooding;
- Planning authorities should recognise the importance of functional floodplains, where water flows or is held at times of flood, and avoid inappropriate development on undeveloped and undefended floodplains; and
- The concept of Flood Risk Reduction, particularly in circumstances where development has been sanctioned on the basis of the “Exception Test”.

3.2 FLOOD AND WATER MANAGEMENT ACT 2010

3.2.1 The Flood and Water Management Act 2010 (‘the Act’) places significantly greater responsibility on Local Authorities to manage and lead on local flooding issues.

3.2.2 The Act raises the requirements and targets Local Authorities need to meet, including:

- Playing an active role leading Flood Risk Management;
- Development of Local Flood Risk Management Strategies (LFRMS);
- Implementing requirements of Flood and Water Management legislation;
- Development and implementation of drainage and flooding management strategies;
- Responsibility for first approval, then adopting, management and maintenance of Sustainable Drainage System (SuDS) where they service more than one property.

3.2.3 The Flood and Water Management Act also clarifies three key areas that influence development:

- Sustainable Drainage Systems (SuDS) - the Act makes provision for a national standard to be prepared on SuDS, and developers will be required to obtain local authority approval for SuDS in accordance with the standards, likely with conditions. Supporting this, the Act requires local authorities to adopt and maintain SuDS, removing any ongoing responsibility for developers to maintain SuDS if they are designed and constructed robustly.
- Flood risk management structures - the Act enables the EA and local authorities to designate structures such as flood defences or embankments owned by third parties for protection if they affect flooding or coastal erosion. A developer or landowner will not be able to alter, remove or replace a designated structure or feature without first obtaining consent from the relevant authority.
- Permitted flooding of third party land - The EA and local authorities have the power to carry out work which may cause flooding to third party land where the works are deemed to be in the interest of nature conservation, the preservation of cultural heritage or people's enjoyment of the environment or of cultural heritage.

3.3 PLANNING PRACTICE GUIDANCE FLOOD RISK AND COASTAL CHANGE

3.3.1 The Planning Practise Guidance (PPG) for Flood Risk and Coastal Change (last updated September 2022) sets strict tests to protect people and property from flooding which all local planning authorities are expected to follow. Where these tests are not met, national policy is clear that new development should not be allowed. A key aspect of the guidance is that if there are better sites in terms of flood risk, or a proposed development cannot be made safe, it should not be permitted.

3.3.2 The document provides guidance on how local planning authorities should:

- Assess flood risk;
- Avoid flood risk; and
- Manage and Mitigate flood risk and coastal change.

3.3.3 There is also information on the requirements to consult the Environment Agency, on the role of lead local flood authorities and on flood risk in relation to minor developments.

3.4 SUDS MANUAL, CIRIA C753 (2015)

3.4.1 The CIRIA SuDS Manual provides advice on the implementation of sustainable drainage techniques in the UK. It provides guidance on:

- Initial planning;
- Design through to construction;
- The management of SuDS in the context of the current regulatory framework; and
- Advice on landscaping, waste management, cost, and community engagement.

3.5 LOCAL FLOOD RISK MANAGEMENT STRATEGY (2013/14)

3.5.1 The LFRMS sets out how WSCC carries out its responsibilities under the Flood and Water Management Act. WSCC is the Lead Local Flood Authority for the site area and is therefore required to produce such a strategy to define how flood risk will be properly managed within the county.

4.0 FLOOD PROBABILITY AND HAZARD

4.1 POTENTIAL SOURCES

4.1.1 The flood risk elements that need to be considered for any site are defined in BS 8533 as the “Forms of Flooding” and are listed as:

- flooding from Rivers (fluvial flood risk)
- flooding from the Sea (tidal flood risk)
- flooding from the Land
- flooding from Groundwater
- flooding from Sewers (sewer and drain exceedance, pumping station failure etc)
- flooding from Reservoirs, Canals and other Artificial Structures.

4.2 FLUVIAL FLOOD RISK AND EA FLOOD ZONE

4.2.1 Fluvial flooding occurs when the amount of water exceeds the flow capacity of the channel. Most rivers have a natural floodplain into which the water spills in times of flood.

4.2.2 As noted in the introduction, the study site falls within Flood Zone 1 and has less than 1 in 1,000 annual probability of river flooding.

4.3 FLOODING FROM THE SEA

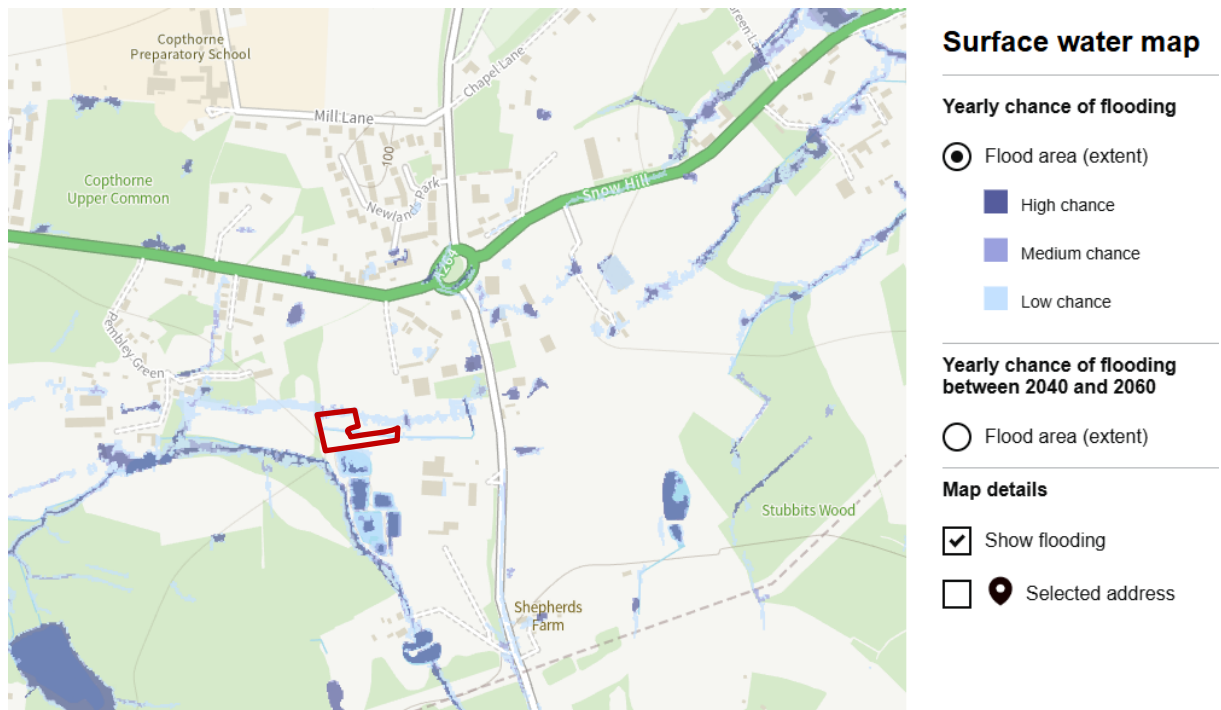
4.3.1 On the coast, storm surges and high tides can threaten low lying areas and can sometimes be large and rapid enough to overtop defences. However tidal flooding is not considered a risk to the site, due to its inland location.

4.4 PLUVIAL FLOOD RISK

4.4.1 If intense rain is unable to soak into the ground or be carried through manmade drainage systems, for a variety of reasons, it can run off over the surface causing localised floods before reaching a river or another watercourse.

4.4.2 Generally, where there is impermeable surfacing or where the ground infiltration capacity is exceeded, surface water runoff will occur.

4.4.3 The Environment Agency’s surface water flood map, reproduced below, shows that most of the site is at ‘low’ risk of flooding, with some localised areas to the northern boundary categorised ‘medium risk’:



- 4.4.4 It is recognised that the impermeable surfacing associated with the proposed development will increase the volume of surface water runoff generated and so lead to a greater volume of surface water flow. A drainage strategy has been developed to mitigate the associated flood risk, as described in Section 5 below.

4.5 GROUNDWATER

- 4.5.1 Groundwater flooding tends to occur after prolonged periods of sustained high rainfall. Higher rainfall means more water will infiltrate into the ground and cause the water table to rise above normal levels. In low-lying areas, the water table may be at shallow depth, and during very wet periods, with additional groundwater flowing towards these areas, the water table can rise up to the surface causing groundwater flooding.
- 4.5.2 As noted above, the site is predominantly underlain by Upper Tunbridge Wells Sand which comprises mudstone and siltstones. These deposits are likely to be of relatively low porosity and permeability, such that groundwater is not expected to be present in significant volumes at shallow depth. The risk of flooding from this source is concluded to be relatively low.

4.6 FLOODING FROM SEWERS

- 4.6.1 Flooding from artificial drainage occurs when flow entering the system exceeds its conveyance capacity, the system becomes blocked, or it cannot discharge due to a high-water level in the receiving watercourse.

- 4.6.2 The proposed development will lead to an increase in impermeable area and therefore an associated increase in surface water runoff rates and volumes.
- 4.6.3 In this context, a surface water drainage scheme has been designed to accommodate the projected runoff, the details of which are set out in section 5 of this report.

4.7 CLIMATE CHANGE

- 4.7.1 Projections of the likely impact of climate change indicate that more frequent short-duration, high intensity rainfall events can be expected in the UK, as well as more frequent prolonged periods of rainfall.
- 4.7.2 For the surface water runoff assessment, an allowance of an increase in the rainfall intensity values by 25% has been included to account for the impact of climate change. This concurs with current EA / DEFRA guidance for the type of commercial properties proposed and the anticipated lifespan of the development (circa 40 years).

5.0 DRAINAGE STRATEGY AND SUDS

5.1 EXISTING RUNOFF

5.1.1 In accordance with DEFRA guidelines, it is proposed that surface water runoff from the development be restricted to the applicable greenfield runoff rates for the 1 in 1 year and 1 in 100 year rainfall events.

5.1.2 The theoretical greenfield run-off rates for the 1 in 1 year and 1 in 100 year return period storms have been calculated based on the FEH method, with a pro-rata value to account for the whole development site area. These calculations can be found in Appendix D and are summarised as follows:

- 1 in 1 year: 4.7 l/s/ha
- 1 in 100 year: 17.6 l/s/ha

5.2 INFILTRATION DEVICES

5.2.1 As previously stated, the site is mapped to be underlain by soils anticipated to be of relatively low permeability with an insufficient infiltration coefficient, into which it may not be feasible to install functioning soakaways for the commercial areas of the new development.

5.3 GREEN ROOFS

5.3.1 The proposed building on site is a new steel-framed industrial / commercial unit. This building will be of lightweight and economic construction and the adoption of green roofs would require significant and costly modifications to the structural design, including significantly upgraded foundations and more extensive use of structural steelwork. It has been determined that such an option is not compatible within the proposed development.

5.4 PONDS / BASINS

5.4.1 Inclusion of above-ground attenuation storage in the form of detention basins/ponds, where feasible within the development layout constraints, would be a suitable and beneficial SuDS option.

5.5 SURFACE WATER DRAINAGE STRATEGY

5.5.1 The proposed surface water drainage strategy is provided on the drawings in Appendix E, with supporting calculations in Appendix D.

5.5.2 It is proposed that runoff from the new commercial building and hard surfacing be directed into a below-ground cellular storage system and then to an existing basin to the south of the site. The basin is to be re-shaped to accommodate the proposed development levels and invert level, as indicated on the drawing. The runoff will then ultimately outfall into the existing surface water basin at a controlled greenfield rate.

- 5.5.3 Permeable paving is proposed to be installed to new car park areas - this will likely be a 'Type B' system, where the proportion of rainfall that exceeds the infiltration capacity of the subsoil will flow into the drainage network.
- 5.5.4 The proposed finished levels for this new scheme will mimic the existing topography as far as is practicable. Any overland surface water flows will be directed into the remodelled pond thus ensuring flood risk is not increased off site.
- 5.5.5 A flow control device (Hydrobrake or similar) will be used to control outflow from the development into the pond to the south. The on-site below-ground storage has been sized to accommodate all runoff up to the 1 in 100 year return period storm plus 25% additional climate change allowance.
- 5.5.6 The gravity drainage system will be designed in accordance with the requirements of BS EN 752:2017 which stipulates that no surcharging should occur during a critical storm event of 1 in 2 years return period. It also requires that no exceedance flooding should occur during a critical storm event of 1 in 30 years return period. The drainage proposals are such that runoff from storm events up to 1 in 100 years return period plus a 25% allowance for climate change will be stored within the site.

5.6 FOUL DRAINAGE

- 5.6.1 A Thames Water foul sewer currently passes below the site, approximately south-east to north-west. All foul effluent from the new commercial building is proposed to be directed into this sewer, subject to a S106 public sewer connection agreement. Details are illustrated on the appended drainage drawing and the associated calculations are provided in Appendix E. Thames Water public sewer records are enclosed as Appendix F.

5.7 DRAINAGE MAINTENANCE

- 5.7.1 In general, sewers, manholes and drainage channels are unlikely to require maintenance other than periodic inspections, unless a blockage occurs. Sewers, manholes, drainage channels and silt pits should be inspected at 6 monthly intervals and cleaned out at 12 monthly intervals. A full CCTV survey should also be carried out at 10 yearly intervals.
- 5.7.2 Reference should be made to all manufacturer's information and maintenance requirements for recommended intervals and safe methods of cleaning for the following proprietary systems:
- drainage channels
 - oil separators
 - flow controls
- 5.7.3 In all instances, inspection and cleaning is to be carried out only by a suitable Specialist Contractor, following the guidelines given in BS EN 752:2008 "Maintenance Considerations" and "Safe Working in Sewers and at Sewage Works", published by the National Joint Health and Safety Committee for the Water Services.

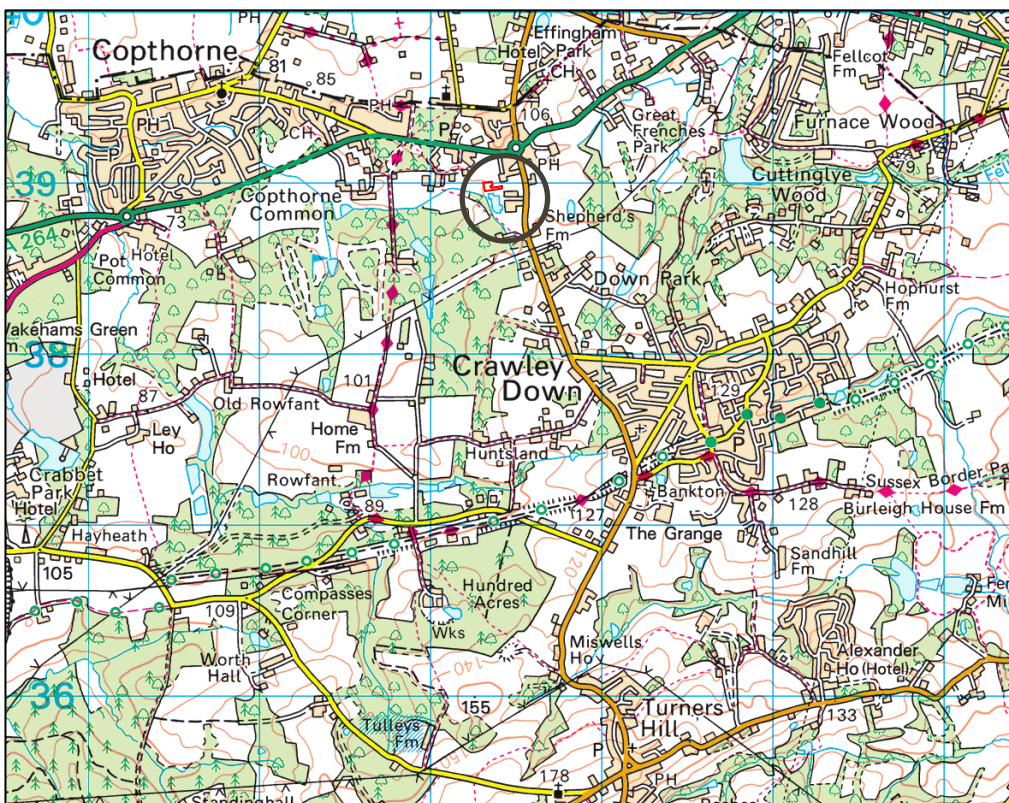
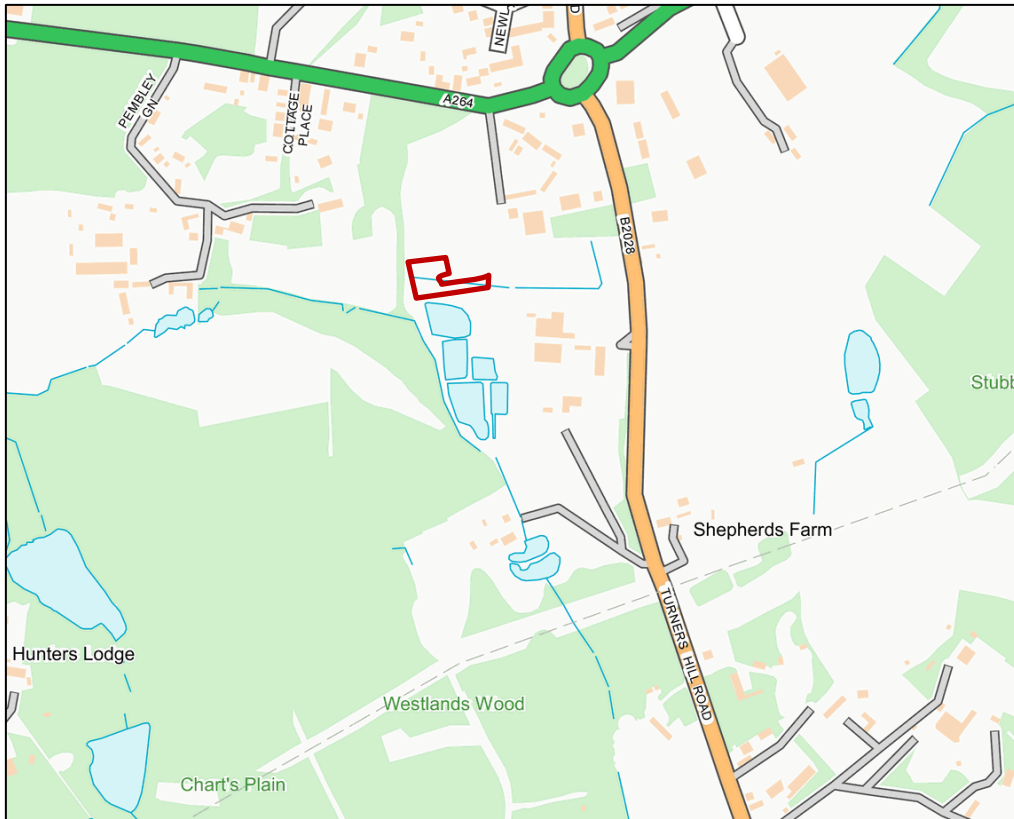
- 5.7.4 All underground and under-floor drains and manholes (including oil separators) represent confined spaces. Appropriate precautions should be taken before entering drains and manholes. Access should only be undertaken by appropriately trained personnel.

6.0 CONCLUSIONS

- 6.1 HDR Consulting was appointed by The Turvey Corporation (the Client) to produce a Flood Risk Assessment and Drainage Strategy in connection with a proposed extension to Barns Court as part of Phase 1B near Copthorne, West Sussex.
- 6.2 The site is located in Flood Zone 1 and is at low probability of flooding from fluvial or tidal sources. Future flood risk, both on and off-site, from site-generated runoff has been addressed via a surface water drainage strategy.
- 6.3 The strategy described in this report comprises the use of, below-ground storage, and above ground ponds, and permeable pavements to attenuate run-off and is designed to accommodate up to a 1 in 100 year return period storm, plus 25% for climate change. Off-site discharge will then be directed south into the existing local surface water basin network and will be restricted to greenfield run-off rate.
- 6.4 This FRA demonstrates that appropriate attenuation measures and SuDS techniques can be incorporated into the development. The surface water strategy shows how the scheme can accommodate the critical storm event whilst still preventing on- and off-site flooding. The development is therefore considered to be at low risk from flooding and is not considered to increase flood risk to others.

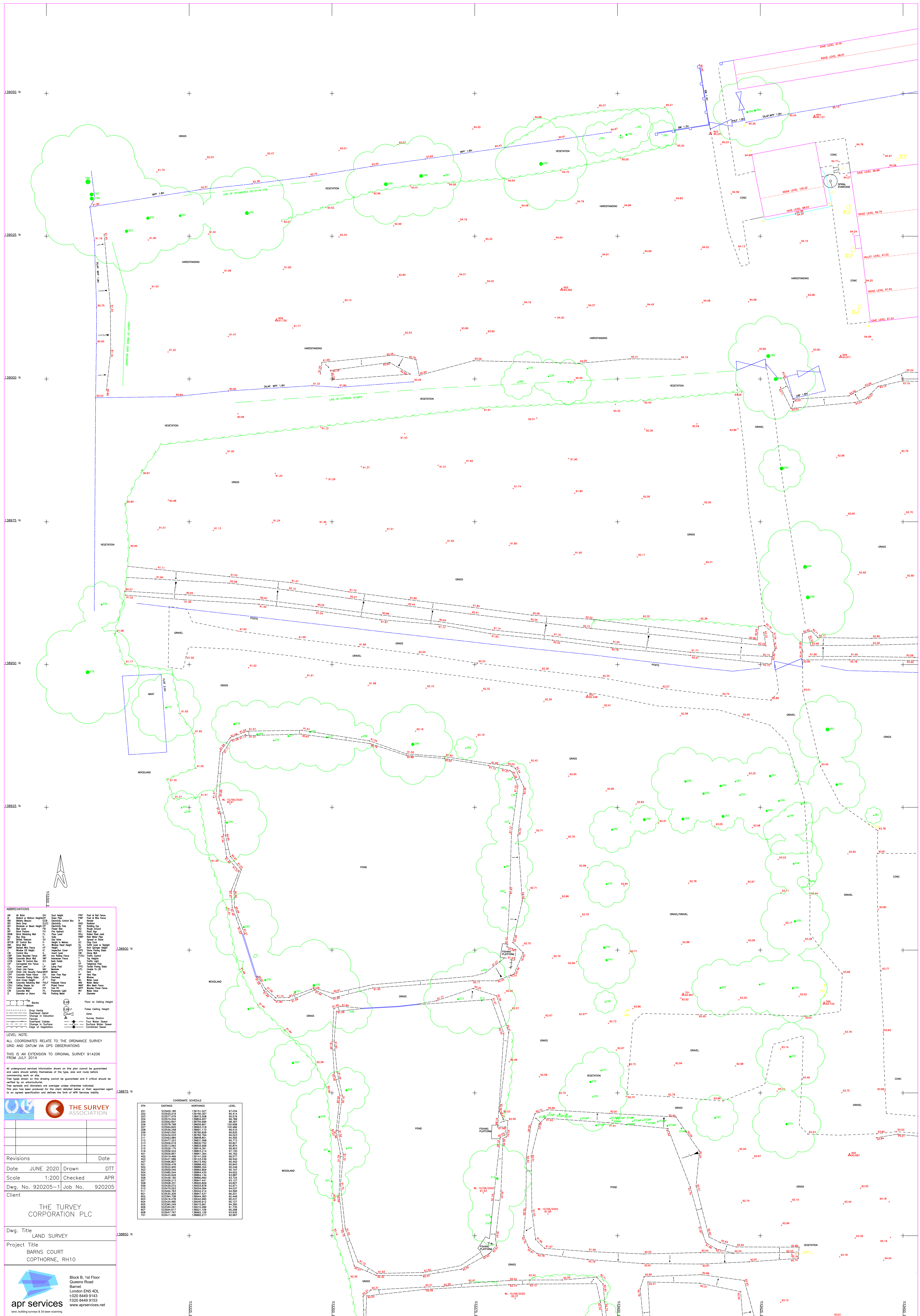
APPENDIX A

SITE LOCATION PLAN



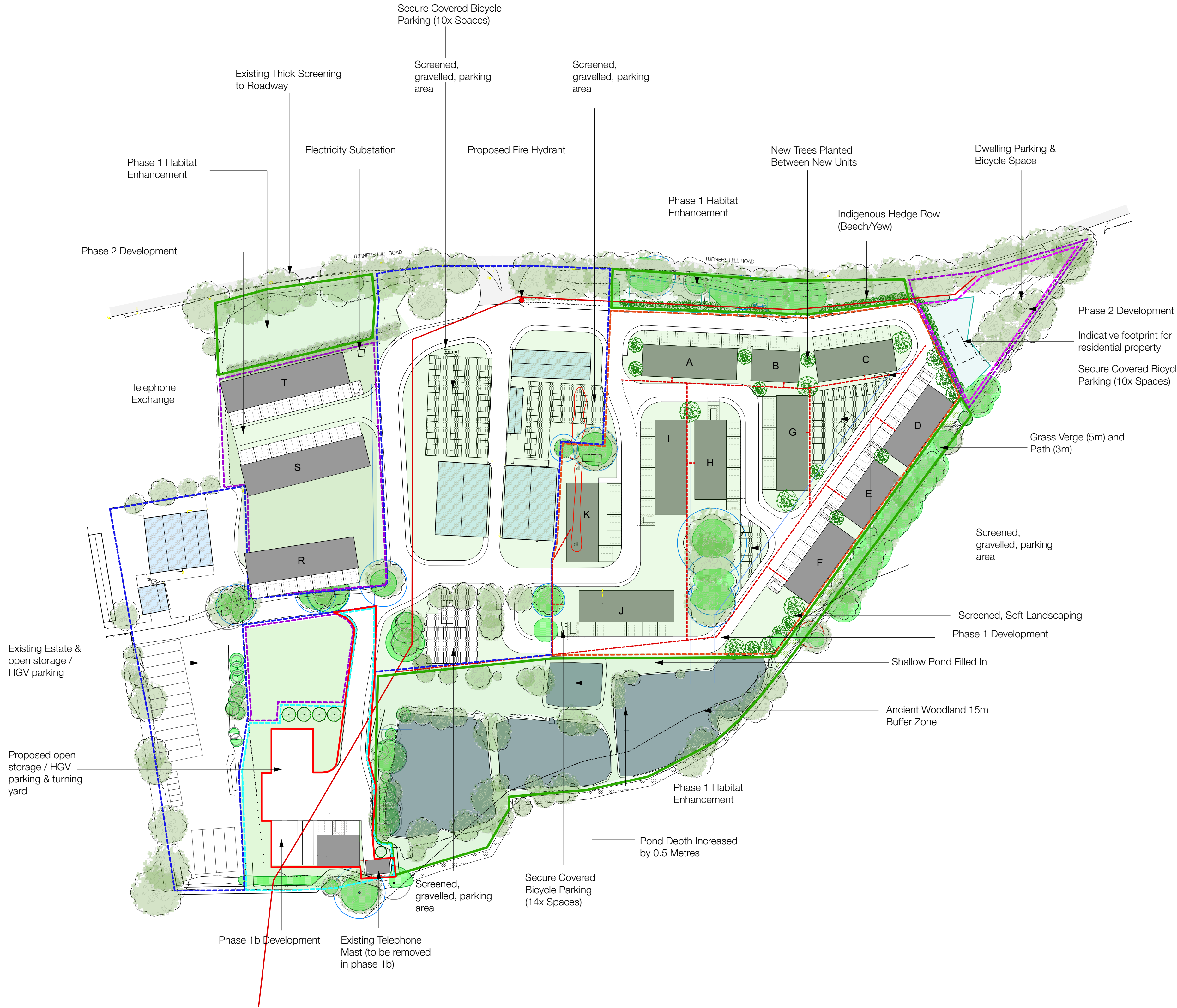
APPENDIX B

TOPOGRAPHICAL SURVEY



APPENDIX C

ARCHITECT'S PROPOSED DEVELOPMENT PLAN

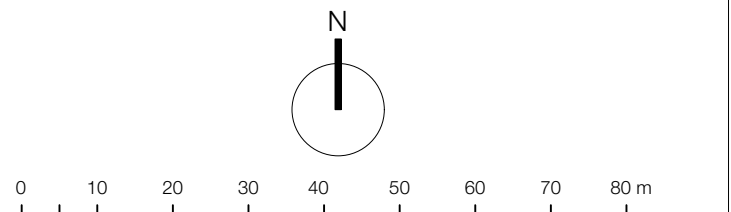


Building Code	Units
A	6
B	3
C	5
D	5
E	4
F	5
G	6
H	5
I	6
J	6
K	5
TOTAL	56

Parking	Units
Car - User	148
Car - Visitor	10
Disabled Spaces	9
Bicycle Spaces	34
Total Spaces	158

Notes: Do Not Scale
Check all dimensions on site
© Dunthorne Parker Architects

- Existing Sewage Drain
- Electrical Mast
- Rain Water Drainage
- Foul Drainage
- Proposed Work Storage
- Like for Like Replacement Dwelling Boundary
- Existing Buildings
- Screened, gravelled, parking area
- Existing Estate
- Phase 1 Development
- Phase 1b Development
- Phase 2 Development
- Phase 1 Habitat Enhancement
- Ancient Woodland Buffer Zone to South of Site



H	28/03/25	HN		Phase 1, 1b & 2
G	20/10/23	MK		Amended Pathway
F	18/10/23	MK		Amended Layouts
E	07/07/23	MK		Amended Landscaping
D	20/06/23	HN		Indicative footprint for residential property added
C	26/04/23	MK		Amended Turning Circles
B	25/04/23	MK		Amended Layout
A	03/03/23	HN		Annotations added
No	Date	By	Chkd	Revision

Project
Barn Court, Crawley

Drawing
Proposed Site Plan

Job 1450	Dwg No. 201H	
Scale 1:1000	By MK	Date Drawn 31/08/22



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APPENDIX D

DRAINAGE CALCULATIONS

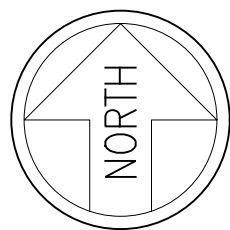
HDR		Page 1
7th Floor 240 Blackfriars Road London, UK, SE1 8NW		
Date 15/05/2023 17:12 File GREENFIELD RUN OFF.SRCX	Designed by JJOHN Checked by	
Innovyze	Source Control 2020.1	
ICP SUDS Mean Annual Flood Input Return Period (years) 100 SAAR (mm) 860 Urban 0.000 Area (ha) 1.000 Soil 0.450 Region Number Region 6 Results 1/s QBAR Rural 5.6 QBAR Urban 5.6 Q100 years 17.8 Q1 year 4.8 Q30 years 12.7 Q100 years 17.8		
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APPENDIX E

DRAINAGE STRATEGY DRAWINGS

DRAINAGE NOTES

- ALL PRIVATE DRAINAGE WORKS ARE TO BE CARRIED OUT IN ACCORDANCE WITH BS EN 752:2008 AND BUILDING REGULATIONS PART H.
- ALL DRAINAGE WORKS WITHIN ADOPTABLE AREAS ARE TO COMPLY WITH THE REQUIREMENTS OF THE WATER UK/WATER RESEARCH CENTRE PUBLICATION 'SEWERS FOR ADOPTION' (CURRENT EDITION).
- ALL CONNECTIONS TO EXISTING PUBLIC SEWERS TO BE IN ACCORDANCE WITH AND TO THE SATISFACTION OF THE LOCAL AUTHORITY.
- CONCRETE PROTECTION (BEDDING CLASS 'Z') TO PIPEWORK TO BE PROVIDED AS FOLLOWS:
(I) ALL PIPEWORK WITHIN SOFT AREAS WITH A COVER OF LESS THAN 600mm.
(II) ALL PIPEWORK BENEATH ROADS, CAR PARKS AND ALL OTHER TRAFFICKED HARDSTANDING AREAS WITH A COVER LESS THAN 1200mm.
(III) ALL PIPEWORK ADJACENT TO EXISTING AND PROPOSED TREES/DENSE VEGETATION IN LANDSCAPED AREAS. AN EXPANSION JOINT SHALL BE PROVIDED AT ALL JOINT LOCATIONS.
- ALL BELOW GROUND FOUL DRAINAGE FROM WITHIN BUILDING FOOTPRINT TO BE 100mm DIA. UNLESS STATED OTHERWISE. REFER TO SEPARATE NOTE FOR RECOMMENDED MINIMUM GRADIENTS.
ALL BELOW GROUND SURFACE WATER DRAINAGE FROM RWP LOCATIONS TO MAIN CARRIER DRAINS TO MATCH THE DIAMETER OF THE DOWNPIPE (TO ARCHITECT'S AND SPECIALIST CONTRACTOR'S DETAILS) UNLESS STATED OTHERWISE.
ALL BELOW GROUND DRAINAGE FROM ROAD GULLIES TO BE 150mm DIA. UNLESS STATED OTHERWISE.
- ALL PIPEWORK IN MANHOLES ARE TO BE LAID SOFFIT TO SOFFIT UNLESS NOTED OTHERWISE. ALL CHAMBER INVERT LEVELS, SHOWN ON THE DRAWING, ARE FOR THE OUTGOING PIPE.
- ALL MANHOLES LOCATED WITHIN BLOCK PAVED AREAS TO HAVE RECESSED MANHOLE COVERS.
- ALL INTERNAL DRAINAGE TO BE TO THE ARCHITECT'S AND M & E ENGINEER'S DRAWINGS AND DETAILS.
- THE POSITION AND INVERT LEVELS OF ALL EXISTING DRAINS, SEWERS AND MANHOLES TO BE CONFIRMED BY THE CONTRACTOR PRIOR TO THE COMMENCEMENT OF THE PROPOSED WORKS AND ANY DISCREPANCIES REPORTED IMMEDIATELY TO HDR CONSULTING.
- ALL PIPES ARE TO HAVE A CLASS 'S' BED AND SURROUND UNLESS NOTED OTHERWISE (SEE NOTE 4 ABOVE).
- ALL CONCRETE PIPES ARE TO BE HIGH STRENGTH AND TO BE IN ACCORDANCE WITH BS EN 1916 AND BS 5911.
- ALL VITRIFIED CLAY PIPES ARE TO BE IN ACCORDANCE WITH BS EN 295.
- FOR SETTING OUT OF FOUL AND RAINWATER OUTLETS REFER TO THE ARCHITECT'S DRAWINGS.
- THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEER'S AND ARCHITECT'S DRAWINGS, SPECIFICATIONS AND DOCUMENTATION.
- THE CONTRACTOR IS TO ALLOW FOR GREASE TRAPS IN THE KITCHEN AND OTHER APPROPRIATE AREAS.
- DRAINAGE CHANNELS AND SILT PITS TO BE DESIGNED BY A SPECIALIST MANUFACTURER FOR CRITICAL STORMS OF 1:5 YEAR RETURN PERIOD, TO SUIT SITE CONDITIONS AND IN ACCORDANCE WITH LOAD CLASS REQUIREMENTS AS SHOWN ON THE PLAN.
DESIGN TO BE SUBMITTED FOR COMMENT TO HDR CONSULTING, PRIOR TO ORDERING.
- ALL EXTERNAL FINISHED LEVELS AND MANHOLE COVER LEVELS SHOWN ON THIS DRAWING ARE INDICATIVE AND SUBJECT TO ADJUSTMENT ON SITE TO SUIT THE FINISHED GROUND LEVELS. FOR FINAL LEVELS REFER TO THE ARCHITECT'S DRAWINGS.
- ALL LEVELS ARE IN METRES AND ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
- ANY COORDINATES PROVIDED FOR MANHOLES OR INSPECTION CHAMBERS ARE RELEVANT TO THE MAIN DRAINAGE RUN INTERSECTION AND NOT THE CENTRE OF THE MANHOLE.
- CHALK AND LIMESTONE ARE NOT TO BE USED AS BEDDING OR BACKFILLING MATERIAL IN SOILS WITH A PH VALUE LESS THAN 7.
- A CCTV DRAINAGE SURVEY IS TO BE CARRIED OUT BOTH AT THE PRE-COMMENCEMENT OF CONSTRUCTION AND AT THE COMPLETION OF THE CONTRACT TO PROVE THE INTEGRITY OF THE AS-BUILT DRAINAGE SYSTEMS. AT THE COMPLETION OF THE CONTRACT THIS IS TO BE CARRIED OUT PRIOR TO THE ISSUE OF THE PRACTICAL COMPLETION CERTIFICATE.
- DURING CONSTRUCTION SEWERS ARE TO BE INSPECTED AND TESTED IN LINE WITH 'CONSTRUCTION AND TESTING OF DRAINS AND SEWERS' BS EN 1610 LATEST EDITION. VISUAL INSPECTION FOLLOWED BY A LEAKTIGHTNESS INSPECTION TO BE CARRIED OUT. LEAKTIGHTNESS TESTING CAN BE CARRIED OUT USING THE AIR OR WATER METHODS.
- SEWERS, MANHOLES, GULLIES, DRAINAGE CHANNELS AND SILT PITS SHOULD BE INSPECTED AT 6 MONTHLY INTERVALS AND CLEANED OUT AT 12 MONTHLY INTERVALS. A FULL CCTV SURVEY SHOULD ALSO BE CARRIED OUT AT 10 YEARLY INTERVALS. REFER ALSO TO SPECIALIST DRAINAGE CHANNEL AND PETROL INTERCEPTOR MANUFACTURER'S INFORMATION AND MAINTENANCE REQUIREMENTS IN ALL INSTANCES. INSPECTION AND CLEANING SHOULD BE CARRIED OUT ONLY BY A SPECIALIST CONTRACTOR AND IN ACCORDANCE WITH THE GUIDELINES GIVEN IN 'SAFE WORKING IN SEWERS AND AT SEWAGE WORKS' PUBLISHED BY NATIONAL JOINT HEALTH AND SAFETY COMMITTEE FOR THE WATER SERVICES.



FURTHER LEVELS
INFORMATION REQUIRED ON
WESTERN SITE BOUNDARY.
EXISTING LEVELS HAVE
BEEN INTERPOLATED

SURFACE WATER DRAINS INTO DRAINAGE CHANNELS
VIA GRAVITY AND THEN THROUGH A PETROL
INTERCEPTOR PRIOR TO ENTERING BELOW GROUND
ATTENUATION. SURFACE WATER TO FURTHER
DISCHARGE INTO ABOVE GROUND ATTENUATION
BASIN AT GREENFIELD RUN OFF RATE.

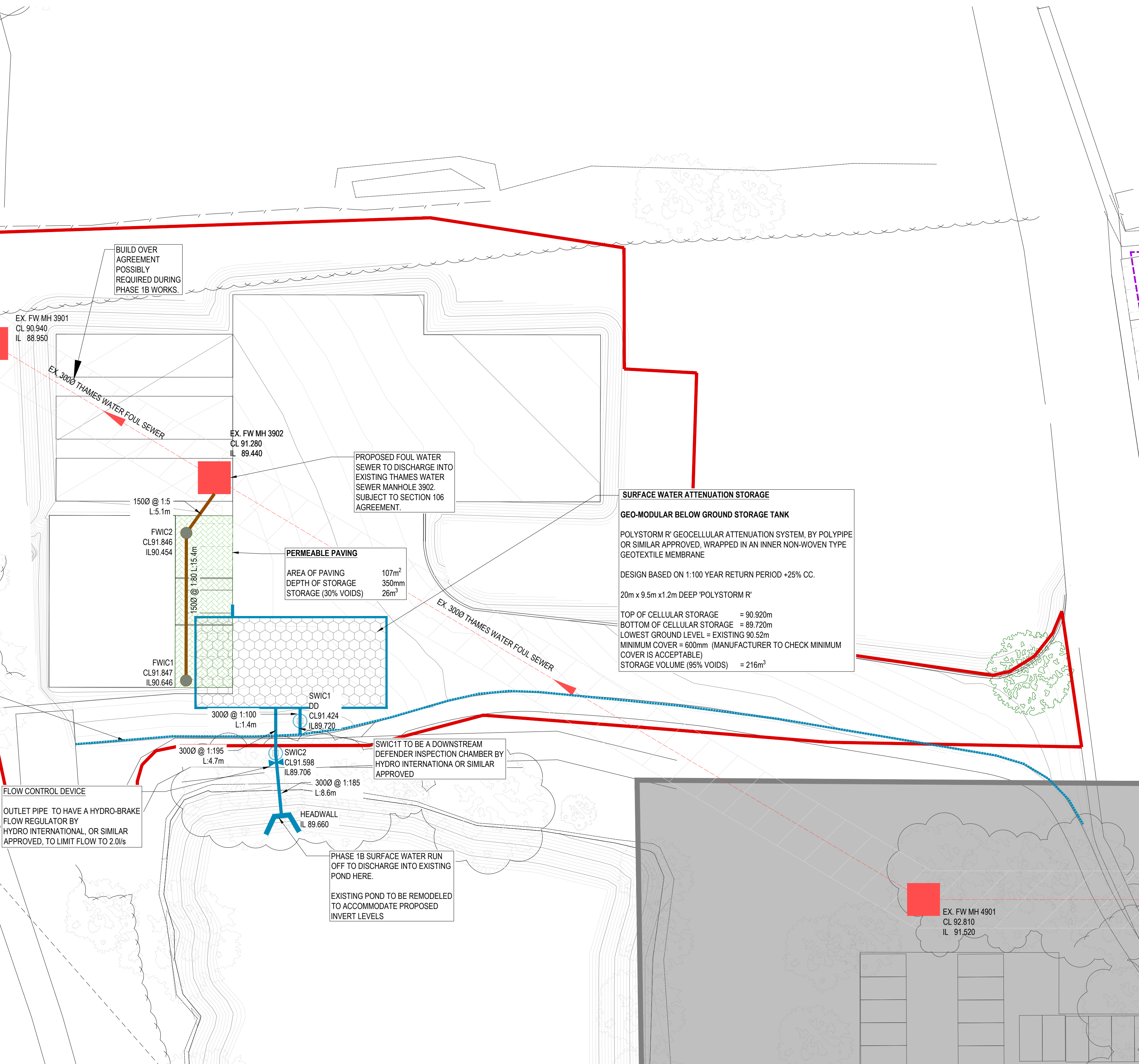
AREA POSITIVELY DRAINED = 0.3HA
GREENFIELD RUN OFF RATE = 5.6 L/SEC/ha
THEREFORE TOTAL DISCHARGE = 2.0 l/s.

REQUIRED STORAGE:
DESIGN BASED ON 1:100 YEAR + 25% CLIMATE
CHANGE
REQUIRED STORAGE = 235m³ APPROXIMATELY

IMPORTANT NOTE:
THE CONTRACTOR IS TO EXERCISE EXTREME CARE WHEN EXCAVATING
FOR DRAINAGE PIPES AND MANHOLES AND NOT TO UNDERMINE EXISTING
OR NEW COLUMN BASES AND/OR STRIP FOOTINGS ALREADY CAST. REFER
ALSO TO NOTE 4 ON THIS DRAWING AND 'CONCRETING OF DRAINS LAID
NEAR FOUNDATIONS' DETAIL ON DRAWING 20-088D / xxx.

FOR NEW CONSTRUCTION, COLUMN FOUNDATIONS/STRIP FOOTINGS MUST
BE TAKEN DOWN TO BELOW INVERT LEVEL OF ANY NEARBY, ADJACENT
SERVICES (DRAINAGE, GAS, WATER, ETC.)

USE OF THERMOPLASTIC PIPES
IF THERMOPLASTIC PIPES ARE TO BE USED THEY ARE TO BE OF THE
STRUCTURED WALL TYPE AND SHALL COMPLY WITH WIS 4-35-01 AND
BS EN 13476 AND MUST BE BSI KITEMARKED (E.G. POLYSEWER/RIDGISEWER BY POLYPIPE CIVILS, ULTRARIB BY WAVIN
OR SIMILAR). PIPES ARE TO BE INSTALLED STRICTLY IN ACCORDANCE
WITH THE MANUFACTURER'S REQUIREMENTS AND
RECOMMENDATIONS. NOTE: ALL INSTALLATION MUST BE IN
ACCORDANCE WITH BUILDING REGULATIONS PART: H, BS EN 752:2008,
SPECIFICATION FOR HIGHWAY WORKS AND ALL RELEVANT BRITISH
AND EUROPEAN CODES OF PRACTICE.



THIS DRAWING IS COPYRIGHT AND OWNED BY HDR CONSULTING, AND IS NOT TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT THE WRITTEN PERMISSION OF HDR CONSULTING.

DO NOT SCALE THIS DRAWING (PRINTED OR ELECTRONIC VERSIONS). CONSULT THE DIMENSIONS SHOWN ON THE DRAWING. CHECK ALL DIMENSIONS FROM SITE.

ALL OTHER DESIGN TEAM ELEMENTS, WHERE INDICATED, HAVE BEEN IMPROVED BY THE ARCHITECT'S DETAILING. CONSULTANT'S DRAWINGS AND REFERENCE SHOULD BE MADE TO THE INSTRUCTIONS FOR THE ARCHITECT'S DETAILING. CONSULTANT'S DRAWINGS FOR EXACT SETTING OUT, SIZE AND TYPE OF COVER, SHALL BE PROVIDED BY THE ARCHITECT BEFORE PROCEEDING.

DISCREPANCIES AND / OR AMBIGUITIES WITHIN THIS DRAWING, BETWEEN THE ARCHITECT'S DETAILING AND THE ARCHITECT'S DETAILING, GIVEN ELSEWHERE, MUST BE REPORTED IMMEDIATELY TO THE ARCHITECT BEFORE PROCEEDING.

ALL WORKS ARE TO BE CARRIED OUT IN ACCORDANCE WITH THE LATEST EDITIONS OF THE BRITISH STANDARDS INSTITUTION (BSI) AND CODES OF PRACTICE UNLESS SPECIFICALLY DIRECTED OTHERWISE BY THE ARCHITECT.

ALL SETTING OUT TO BE IN ACCORDANCE WITH THE ARCHITECT'S DETAILING. THE ARCHITECT'S DETAILING SHALL TAKE PRECEDENCE OVER ANY SETTING OUT SHOWN ON THE DRAWING.

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION
REFER TO THE RELEVANT CONSTRUCTION (DESIGN AND MANAGEMENT) DRAWING FOR SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION WHERE APPLICABLE.

IT IS ASSUMED THAT ALL WORKS ON THIS DRAWING WILL BE CARRIED OUT IN ACCORDANCE WITH THE LATEST EDITIONS OF THE BRITISH STANDARDS INSTITUTION (BSI) AND CODES OF PRACTICE UNLESS SPECIFICALLY DIRECTED OTHERWISE BY THE ARCHITECT.

LEGEND

- SITE BOUNDARY
- EXISTING THAMES WATER FOUL DRAIN WITH MANHOLE
- PROPOSED PROPRIETARY DRAINAGE CHANNEL
- PROPOSED FOUL WATER DRAIN WITH MANHOLE
- PROPOSED SURFACE WATER DRAIN WITH MANHOLE
- PROPOSED BELOW GROUND STORAGE TANK
- PROPOSED PERMEABLE PAVING

P01	FIRST ISSUE
Rev	Description

Drawing Status:

PRELIMINARY

BOURNE HOUSE
PRINCE EDWARD STREET
BERGHAMSTED,
UK HP4 3EZ
UNITED KINGDOM
t: +44 (0) 203 696 1911
e: info@hdrinc.co.uk
w: www.hdrinc.co.uk

Client:
THE SURVEY CORPORATION PLC

Architect:
DUNTHORNE PARKER ARCHITECTS

Project:
BARNES COURT AND FRIDAY FARM
COPTHORNE

Title:
PHASE 1B DRAINAGE LAYOUT

HDR Project Number: 10427658			
Cad File Name: BRC-HDR-XX-XX-DR-C-000303.dwg			
Drawn: MFP	Chkd/Appd: SM	Date: 10.04.2025	Scale: As Shown
Drawing Number: BRC-HDR-XX-XX-DR-C-000303			

APPENDIX F

THAMES WATER PUBLIC SEWER RECORDS

Asset location search



Property Searches

HDR
Bourne House
Prince Edward Street
BERKHAMSTED
HP4 3EZ

Search address supplied Barns Court
Turners Hill Road
Crawley Down
Crawley
RH10 4HQ

Your reference 20-089

Our reference ALS/ALS Standard/2020_4264691

Search date 28 September 2020

Knowledge of features below the surface is essential for every development

The benefits of this knowledge not only include ensuring due diligence and avoiding risk, but also being able to ascertain the feasibility of any development.

Did you know that Thames Water Property Searches can also provide a variety of utility searches including a more comprehensive view of utility providers' assets (across up to 35-45 different providers), as well as more focused searches relating to specific major utility companies such as National Grid (gas and electric).

Contact us to find out more.



Thames Water Utilities Ltd
Property Searches, PO Box 3189, Slough SL1 4WW
DX 151280 Slough 13



searches@thameswater.co.uk
www.thameswater-propertysearches.co.uk



0845 070 9148

Search address supplied: Barns Court, Turners Hill Road, Crawley Down, Crawley, RH10 4HQ

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 search provides 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

Waste Water Services

Please provide a copy extract from the public sewer map.

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.

With regard to the fresh water supply, this site falls within the boundary of another water company. For more information, please redirect your enquiry to the following address:

South East Water
Rocfort Road
Snodland



Kent
ME6 5AH

Tel: 0845 301 0845

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.

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

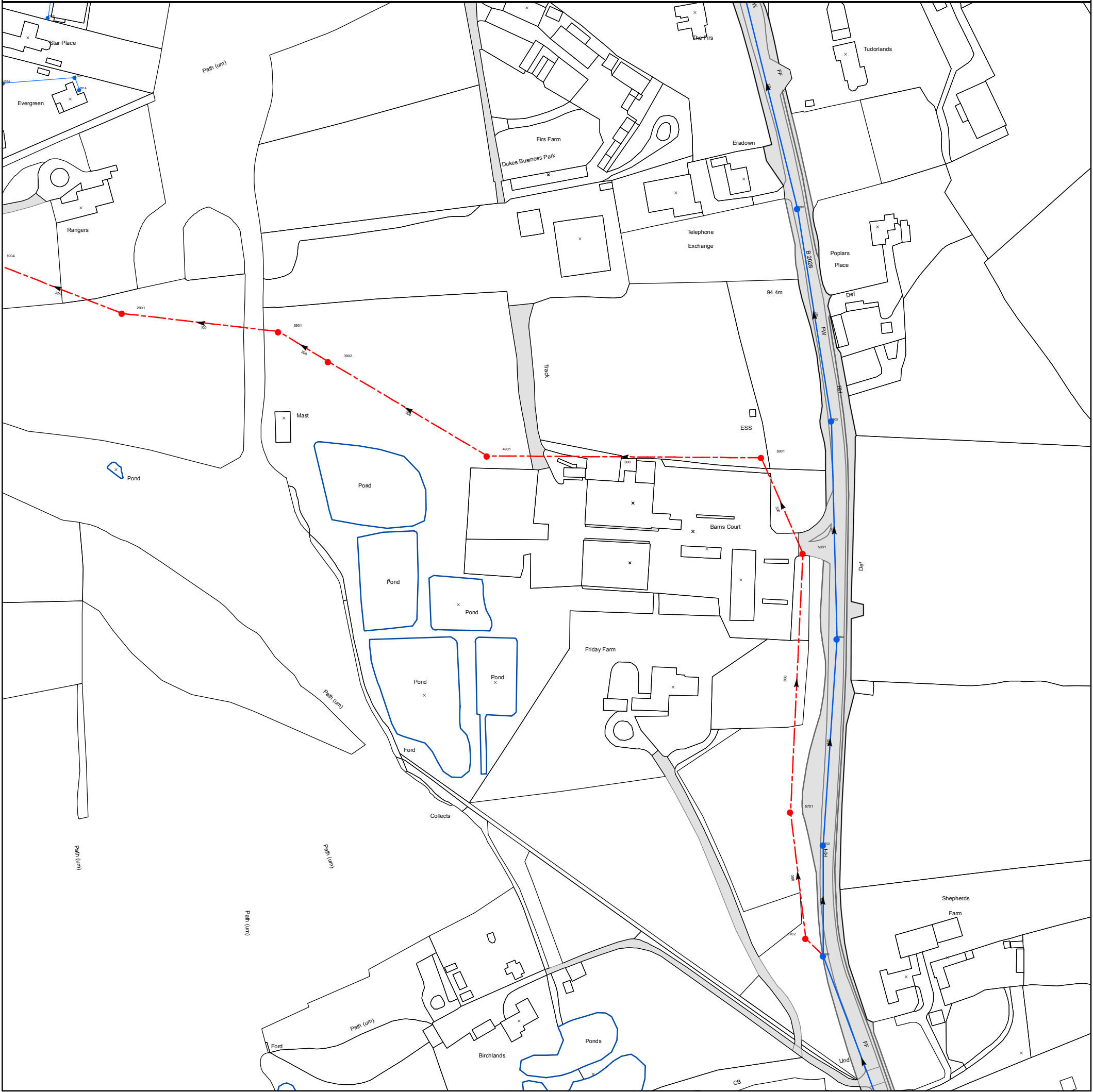
Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

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: 0800 009 3921
Email: developer.services@thameswater.co.uk



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 before any works are undertaken. Crown copyright Reserved

Scale: 1:1792
Width: 500m
Printed By: G1KANAGA
Print Date: 29/09/2020
Map Centre: 533438,138886
Grid Reference: TQ3338NW

Comments:

ALS/ALS Standard/2020_4264691

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL
5701	98.79	96.82
5702	100.16	98.01
2901	89.42	87.69
3902	91.28	89.44
101A		
5001	94.59	91.69
5902	95.11	92.29
5601	100.21	98.12
211B		

REFERENCE	COVER LEVEL	INVERT LEVEL
5801	95.92	94.62
5901	94.71	93.05
3901	90.94	88.95
4901	92.81	91.52
211A		
5703	98.18	96.2
5802	96.3	94.45
201A		



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.		Trunk Foul
	Surface Water: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.		Trunk Surface Water
	Combined: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.		Trunk Combined
	Storm Relief		Bio-solids (Sludge)
	Vent Pipe		Proposed Thames Water Foul Sewer
	Proposed Thames Surface Water Sewer		Foul Rising Main
	Gallery		Combined Rising Main
	Surface Water Rising Main		Proposed Thames Water Rising Main
	Sludge Rising Main		Vacuum

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.

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		Gully
	Culverted Watercourse		Proposed
			Abandoned Sewer

- 6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in millimetres. 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.

Terms and Conditions

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 0800 316 9800

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 her 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 / OSS	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.

APPENDIX G

PHASE 2 DRAINAGE STRATEGY DRAWING

1. ALL PRIVATE DRAINAGE WORKS ARE TO BE CARRIED OUT IN ACCORDANCE WITH BS EN 752:2008 AND BUILDING REGULATIONS PART H.
2. ALL DRAINAGE WORKS WITHIN ADAPTABLE AREAS ARE TO COMPLY WITH THE REQUIREMENTS OF THE WATER UK/WATER RESEARCH CENTRE PUBLICATION 'SEWERS FOR ADOPTION' (CURRENT EDITION).
3. ALL CONNECTIONS TO EXISTING PUBLIC SEWERS TO BE IN ACCORDANCE WITH AND TO THE SATISFACTION OF THE LOCAL AUTHORITY.
4. CONCRETE PROTECTION (BEDDING CLASS 'Z') TO PIPEWORK TO BE PROVIDED AS FOLLOWS;
(I) ALL PIPEWORK WITHIN SOFT AREAS WITH A COVER OF LESS THAN 600mm.
(II) ALL PIPEWORK BENEATH ROADS, CAR PARKS AND ALL OTHER TRAFFICATED HARDSTANDING AREAS WITH A COVER LESS THAN 1200mm.
(III) ALL PIPEWORK ADJACENT TO EXISTING AND PROPOSED TREES/SEES LOCATED IN LANDSCAPED AREAS.
AN EXPANSION JOINT SHALL BE PROVIDED AT ALL JOINT LOCATIONS.
5. ALL BELOW GROUND FOUL DRAINAGE FROM WITHIN BUILDING FOOTPRINT TO BE 100mm DIA. UNLESS STATED OTHERWISE. REFER TO SEPARATE NOTE FOR RECOMMENDED MINIMUM GRADIENTS.
(I) ALL BELOW GROUND SURFACE WATER DRAINAGE FROM RW/ LOCATIONS TO MAIN CARRIER DRAINS TO MATCH THE DIAMETER OF THE DOWNPIPE (TO ARCHITECT'S AND SPECIALIST CONTRACTOR'S DETAILS) UNLESS STATED OTHERWISE.
(II) ALL BELOW GROUND DRAINAGE FROM ROAD GULLIES TO BE 150mm DIA. UNLESS STATED OTHERWISE.
6. ALL PIPEWORK IN MANHOLES ARE TO BE LAID SOFFIT TO SOFFIT UNLESS NOTED OTHERWISE. ALL CHAMBER INVERT LEVELS, SHOWN ON THE DRAWING, ARE FOR THE OUTGOING PIPE.
7. ALL MANHOLES LOCATED WITHIN BLOCK PAVED AREAS TO HAVE RECESSED MANHOLE COVERS.
8. ALL INTERNAL DRAINAGE TO BE TO THE ARCHITECT'S AND M & E ENGINEERS' DRAWINGS AND DETAILS.
9. THE POSITION AND INVERT LEVELS OF ALL EXISTING DRAINS, SEWERS AND MANHOLES TO BE CONFIRMED BY THE CONTRACTOR PRIOR TO THE COMMENCEMENT OF THE PROPOSED WORKS AND ANY DISCREPANCIES REPORTED IMMEDIATELY TO HDR CONSULTING.
10. ALL PIPES ARE TO HAVE A CLASS 'S' BED AND SURROUND UNLESS NOTED OTHERWISE (SEE NOTE 4 ABOVE).
11. ALL CONCRETE PIPES ARE TO BE HIGH STRENGTH AND TO BE IN ACCORDANCE WITH BS EN 1916 AND BS 5911.
12. ALL VITRIFIED CLAY PIPES ARE TO BE IN ACCORDANCE WITH BS EN 255.
13. REFER TO DRAWING NOS. XXX AND XXX FOR DRAINAGE CONSTRUCTION DETAILS.
14. FOR SETTING OUT OF FOUL AND RAINWATER OUTLETS REFER TO THE ARCHITECT'S DRAWINGS.
15. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEERS' AND ARCHITECT'S DRAWINGS, SPECIFICATIONS AND DOCUMENTATION.
16. THE CONTRACTOR IS TO ALLOW FOR GREASE TRAPS IN THE KITCHEN AND OTHER APPROPRIATE AREAS.
17. DRAINAGE CHANNELS AND SILT PITS TO BE DESIGNED BY A SPECIALIST MANUFACTURER FOR CRITICAL STORMS OF 1:5 YEAR RETURN PERIOD, TO SUIT SITE CONDITIONS AND IN ACCORDANCE WITH LOAD CLASS REQUIREMENTS AS SHOWN ON THE PLAN.
DESIGN TO BE SUBMITTED FOR COMMENT TO HDR CONSULTING. PRIOR TO ORDERING.
18. ALL EXTERNAL FINISHED LEVELS AND MANHOLE COVER LEVELS SHOWN ON THIS DRAWING ARE INDICATIVE AND SUBJECT TO ADJUSTMENT ON SITE TO SUIT THE FINISHED GROUND LEVELS. FOR FINAL LEVELS REFER TO THE ARCHITECT'S DRAWINGS.
19. ALL LEVELS ARE IN METRES AND ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
20. ANY COORDINATES PROVIDED FOR MANHOLES OR INSPECTION CHAMBERS ARE RELEVANT TO THE MAIN DRAINAGE RUN INTERSECTION AND NOT THE CENTRE OF THE MANHOLE.
21. CHALK AND LIMESTONE ARE NOT TO BE USED AS BEDDING OR BACKFILLING MATERIAL IN SOILS WITH A PH VALUE LESS THAN 7.

- 2.2 A CCTV DRAINAGE SURVEY IS TO BE CARRIED OUT BOTH AT THE PRE-COMMENCEMENT OF CONSTRUCTION AND AT THE COMPLETION OF THE CONTRACT TO PROVE THE INTEGRITY OF THE AS-BUILT DRAINAGE SYSTEMS. AT THE COMPLETION OF THE CONTRACT THIS IS TO BE CARRIED OUT PRIOR TO THE ISSUE OF THE PRACTICAL COMPLETION CERTIFICATE.
- 2.3 DURING CONSTRUCTION SEWERS ARE TO BE INSPECTED AND TESTED IN LINE WITH CONSTRUCTION AND TESTING OF DRAINS AND SEWERS BS EN 1610 LATEST EDITION. VISUAL INSPECTION FOLLOWED BY A LEAKTIGHTNESS INSPECTION TO BE CARRIED OUT. LEAKTIGHTNESS TESTING CAN BE CARRIED OUT USING THE AIR OR WATER METHODS.
- 2.4 SEWERS, MANHOLES, GULLIES, DRAINAGE CHANNELS AND SILT PITS SHOULD BE INSPECTED AT 6 MONTHLY INTERVALS AND CLEANED OUT AT 12 MONTHLY INTERVALS. A FULL CCTV SURVEY SHOULD ALSO BE CARRIED OUT AT 10 YEARLY INTERVALS. REFER ALSO TO SPECIALIST DRAINAGE CHANNEL AND PETROL INTERCEPTOR MANUFACTURERS INFORMATION AND MAINTENANCE REQUIREMENTS IN ALL INSTANCES. INSPECTION AND CLEANING SHOULD BE CARRIED OUT ONLY BY A SPECIALIST CONTRACTOR AND IN ACCORDANCE WITH THE GUIDELINES GIVEN IN 'SAFE WORKING IN SEWERS AND AT SEWAGE WORKS' PUBLISHED BY NATIONAL JOINT HEALTH AND SAFETY COMMITTEE FOR THE WATER SERVICES.

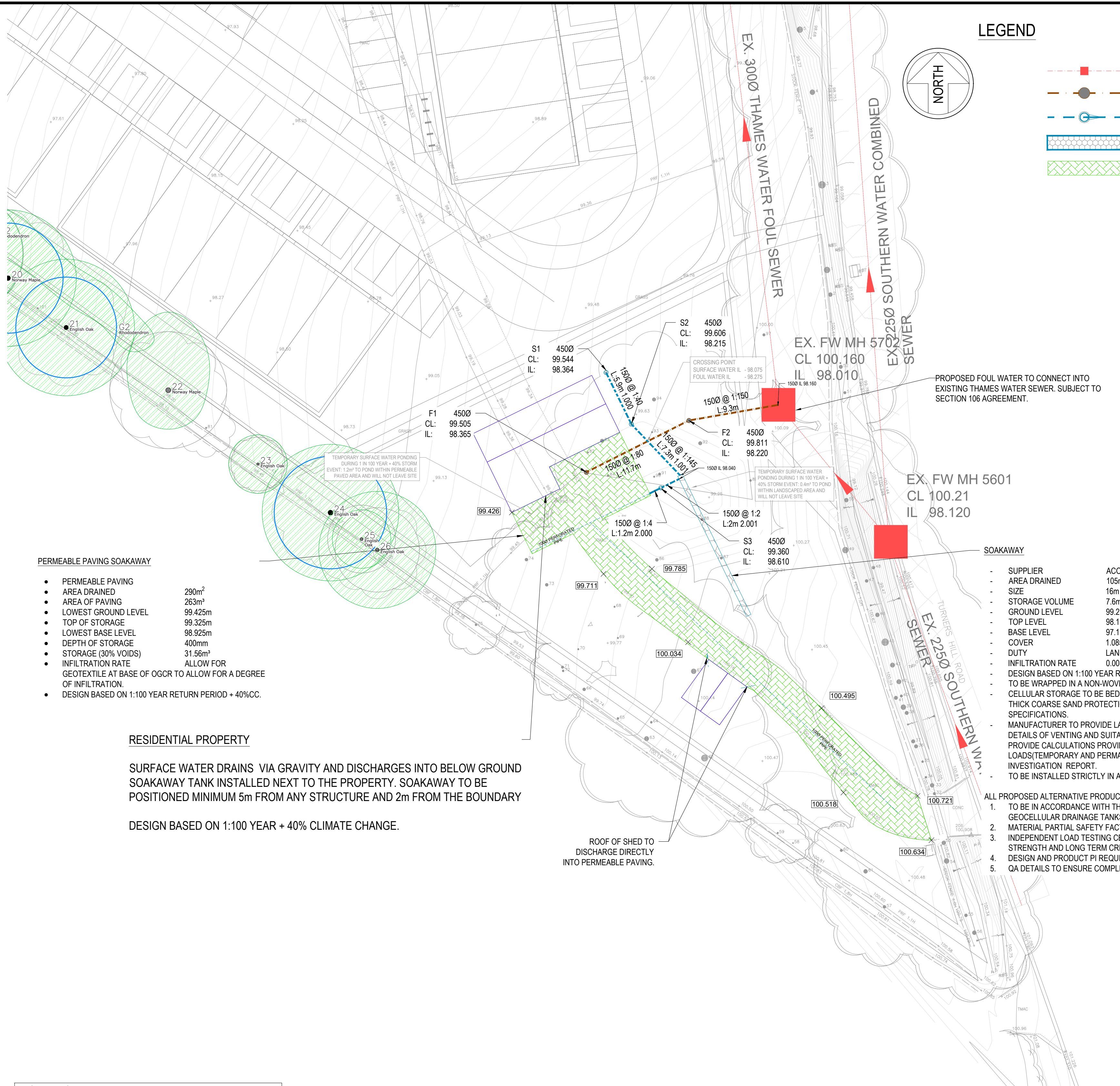
IMPORTANT NOTE:
THE CONTRACTOR IS TO EXERCISE EXTREME CARE WHEN EXCAVATING FOR DRAINAGE PIPES AND MANHOLES AND NOT TO UNDERMINE EXISTING OR NEW COLUMN BASES AND/OR STRIP FOOTINGS ALREADY CAST. REFER ALSO TO NOTE 4 ON THIS DRAWING AND 'CONCRETE OF DRAINS LAID NEAR FOUNDATIONS' DETAIL ON DRAWING 20-089D / xxx.

FOR NEW CONSTRUCTION, COLUMN FOUNDATIONS/STRIP FOOTINGS MUST BE TAKEN DOWN TO BELOW INVERT LEVEL OF ANY NEARBY, ADJACENT SERVICES (DRAINAGE, GAS, WATER, ETC.)

USE OF THERMOPLASTIC PIPES
IF THERMOPLASTIC PIPES ARE TO BE USED THEY ARE TO BE OF THE STRUCTURED WALL TYPE AND SHALL COMPLY WITH WIS 4-35-01 AND BS EN 13476 AND MUST BE BSI KITEMARKED (E.G. POLYSEWER/RIDGISEWER BY POLYPIPE CIVILS, ULTRARIB BY WAVIN OR SIMILAR). PIPES ARE TO BE INSTALLED STRICTLY IN ACCORDANCE WITH THE MANUFACTURER'S REQUIREMENTS AND RECOMMENDATIONS. NOTE: ALL INSTALLATION MUST BE IN ACCORDANCE WITH BUILDING REGULATIONS PART: H, BS EN 752:2008, SPECIFICATION FOR HIGHWAY WORKS AND ALL RELEVANT BRITISH AND EUROPEAN CODES OF PRACTICE.

SURFACE WATER DRAINS VIA GRAVITY AND DISCHARGES INTO BELOW GROUND SOAKAWAY TANK INSTALLED NEXT TO THE PROPERTY. SOAKAWAY TO BE POSITIONED MINIMUM 5m FROM ANY STRUCTURE AND 2m FROM THE BOUNDARY

DESIGN BASED ON 1:100 YEAR + 40% CLIMATE CHANGE.



	EXISTING THAMES WATER FOUL WATER DRAIN WITH MANHOLE
	PROPOSED FOUL WATER DRAIN WITH MANHOLE
	PROPOSED SURFACE WATER DRAIN WITH MANHOLE
	PROPOSED BELOW GROUND SOAKAWAY
	PROPOSED POROUS PAVING

- SUPPLIER ACO STORMBRIX OR SIMILAR
- AREA DRAINED 105m²
- SIZE 16m X 0.5m X 1m (8m³)
- STORAGE VOLUME 7.6m³ (95% VOIDS.)
- GROUND LEVEL 99.275m
- TOP LEVEL 98.190m
- BASE LEVEL 97.190m
- COVER 1.085m
- DUTY LANDSCAPING
- INFILTRATION RATE 0.003m/hr
- DESIGN BASED ON 1:100 YEAR RETURN PERIOD + 40%CC.
- TO BE WRAPPED IN A NON-WOVEN TYPE GEOTEXTILE MEMBRANE TO THE MANUFACTURER'S RECOMMENDATIONS.
- CELLULAR STORAGE TO BE BEDDED ON MIN. 100mm THICK COARSE SAND BLINDING AND COVERED WITH A 100mm THICK COARSE SAND PROTECTION LAYER. COMPACTED BACKFILL IN ACCORDANCE WITH ENGINEER'S SPECIFICATIONS.
- MANUFACTURER TO PROVIDE LAYOUT AND DETAILS DRAWINGS FOR CONSTRUCTION WHICH SHOULD INCLUDE DETAILS OF VENTING AND SUITABLE ACCESS POINTS FOR INSPECTION AND MAINTENANCE. MANUFACTURER TO PROVIDE CALCULATIONS PROVING STRUCTURAL SUITABILITY TAKING CONSIDERANCE OF THE APPLIED CONSTRUCTION LOADS (TEMPORARY AND PERMANENT) AND PREVAILING GROUND CONDITIONS AS DETAILED IN THE SITE INVESTIGATION REPORT.
- TO BE INSTALLED STRICTLY IN ACCORDANCE WITH THE MANUFACTURE'S REQUIREMENTS AND RECOMMENDATIONS.

1. TO BE IN ACCORDANCE WITH THE RECOMMENDATIONS STATED IN CIRIA C680 - STRUCTURAL DESIGN OF MODULAR GEOCELLULAR DRAINAGE TANKS.
2. MATERIAL PARTIAL SAFETY FACTOR OF 2.75 TO BE USED IN DESIGN CALCULATIONS.
3. INDEPENDENT LOAD TESTING CERTIFICATION TO BE PROVIDED INCLUDING COMPRESSIVE STRENGTH, LATERAL STRENGTH AND LONG TERM CREEP TESTING.
4. DESIGN AND PRODUCT PI REQUIRED.
5. QA DETAILS TO ENSURE COMPLIANCE WITH THE ABOVE.

Rev.	Tech	Date	Description
P3	SA	14.08.24	SOAKAWAY DIMENSIONS AMENDED.
P2	SA	12.08.24	SOAKAWAY SIZE AMENDED.
P1	SA	29.07.24	FIRST ISSUE.

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Client	THE TURVEY CORPORATION PLC
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Project Title

**BARNs COURT AND FRIDAY FARM,
COPTHORNE**

Drawing Title

RESIDENTIAL PROPERTY DRAINAGE LAYOUT

Purpose of Issue

Information ☐ Preliminary ☒ Approval ☐ Tender ☐ Construction ☐ Record Copy ☐

First Issue Date	Drawn By	Scale	Checked
JULY 24	SA	1:250 @ A1	NDH
Drawing Number			Rev.
20-089 / 302			P3



IMPORTANT NOTE:
THE CONTRACTOR IS TO EXERCISE EXTREME CARE WHEN EXCAVATING FOR DRAINAGE PIPES AND MANHOLES AND NOT TO UNDERMINE EXISTING OR NEW COLUMN BASES AND/OR STRIP FOOTINGS ALREADY CAST. REFER ALSO TO NOTE 4 ON THIS DRAWING AND CONCRETING OF DRAINS LAID NEAR FOUNDATIONS DETAIL ON DRAWING 20-089D / 301.

FOR NEW CONSTRUCTION, COLUMN FOUNDATIONS/STRIP FOOTINGS MUST BE TAKEN DOWN TO BELOW INVERT LEVEL OF ANY NEARBY ADJACENT SERVICES (DRAINAGE, GAS, WATER, ETC.)

USE OF THERMOPLASTIC PIPES
IF THERMOPLASTIC PIPES ARE TO BE USED THEY ARE TO BE OF THE STRUCTURED WALL TYPE AND SHALL COMPLY WITH WIS 4-35-01 AND BS EN 13476 AND MUST BE BSI KITEMARKED (E.G. POLYSEWER/SDSEWER BY POLYPIPE CIVILS, ULTRARIB BY WAVIN OR SIMILAR). PIPES ARE TO BE INSTALLED STRICTLY IN ACCORDANCE WITH THE MANUFACTURER'S REQUIREMENTS AND RECOMMENDATIONS. NOTE: ALL INSTALLATION MUST BE IN ACCORDANCE WITH BUILDING REGULATIONS PART: H, BS EN 752-2008, SPECIFICATION FOR HIGHWAY WORKS AND ALL RELEVANT BRITISH AND EUROPEAN CODES OF PRACTICE.

- ### DRAINAGE NOTES
1. ALL PRIVATE DRAINAGE WORKS ARE TO BE CARRIED OUT IN ACCORDANCE WITH BS EN 752-2008 AND BUILDING REGULATIONS PART H.
 2. ALL DRAINAGE WORKS WITHIN ADAPTABLE AREAS ARE TO COMPLY WITH THE REQUIREMENTS OF THE WATER UK WATER RESEARCH CENTRE PUBLICATION 'SEWERS FOR ADOPTION' (CURRENT EDITION).
 3. ALL CONNECTIONS TO EXISTING PUBLIC SEWERS TO BE IN ACCORDANCE WITH AND TO THE SATISFACTION OF THE LOCAL AUTHORITY.
 4. CONCRETE PROTECTION (BEDDING CLASS 'Z') TO PIPEWORK TO BE PROVIDED AS FOLLOWS:
(i) ALL PIPEWORK WITHIN SOFT AREAS WITH A COVER OF LESS THAN 600MM.
(ii) ALL PIPEWORK BENEATH ROADS, CAR PARKS AND ALL OTHER TRAFFICATED HARDESTANDING AREAS WITH A COVER LESS THAN 1200MM.
(iii) ALL PIPEWORK ADJACENT TO EXISTING AND PROPOSED TREES/SHRUBS/VEGETATION IN LANDSCAPED AREAS. AN EXPANSION JOINT SHALL BE PROVIDED AT ALL JOINT LOCATIONS.
 5. ALL BELOW GROUND FOUL DRAINAGE FROM WITHIN BUILDING FOOTPRINT TO BE 100MM DIA. UNLESS STATED OTHERWISE. REFER TO SEPARATE NOTE FOR RECOMMENDED MINIMUM GRADIENTS.
ALL BELOW GROUND SURFACE WATER DRAINAGE FROM RWP LOCATIONS TO MAIN CARRIER DRAINS TO MATCH THE DIAMETER OF THE DOWNPIPE (TO ARCHITECTS AND SPECIALIST CONTRACTOR'S DETAILS) UNLESS STATED OTHERWISE.
ALL BELOW GROUND DRAINAGE FROM ROAD GULLIES TO BE 150MM DIA. UNLESS STATED OTHERWISE.
 6. ALL PIPEWORK IN MANHOLES ARE TO BE LAID SOFFIT TO SOFFIT UNLESS NOTED OTHERWISE. ALL CHAMBER INVERT LEVELS, SHOWN ON THE DRAWING, ARE FOR THE OUTGOING PIPE.
 7. ALL MANHOLES LOCATED WITHIN BLOCK PAVED AREAS TO HAVE RECESSED MANHOLE COVERS.
 8. ALL INTERNAL DRAINAGE TO BE TO THE ARCHITECTS AND M & E ENGINEER'S DRAWINGS AND DETAILS.
 9. THE POSITION AND INVERT LEVELS OF ALL EXISTING DRAINS, SEWERS AND MANHOLES TO BE CONFIRMED BY THE CONTRACTOR PRIOR TO THE COMMENCEMENT OF THE PROPOSED WORKS AND ANY DISCREPANCIES REPORTED IMMEDIATELY TO HDR CONSULTING.
 10. ALL PIPES ARE TO HAVE A CLASS 'S' BED AND SURROUND UNLESS NOTED OTHERWISE (SEE NOTE 4 ABOVE).
 11. ALL CONCRETE PIPES ARE TO BE HIGH STRENGTH AND TO BE IN ACCORDANCE WITH BS EN 1916 AND BS 5911.
 12. ALL VITRIFIED CLAY PIPES ARE TO BE IN ACCORDANCE WITH BS EN 295.
 13. REFER TO DRAWING NOS. XXX AND XXX FOR DRAINAGE CONSTRUCTION DETAILS.
 14. FOR SETTING OUT OF FOUL AND RAINWATER OUTLETS REFER TO THE ARCHITECT'S DRAWINGS.
 15. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEERS AND ARCHITECT'S DRAWINGS, SPECIFICATIONS AND DOCUMENTATION.
 16. THE CONTRACTOR IS TO ALLOW FOR GREASE TRAPS IN THE KITCHEN AND OTHER APPROPRIATE AREAS.
 17. DRAINAGE CHANNELS AND SILT PITS TO BE DESIGNED BY A SPECIALIST MANUFACTURER FOR CRITICAL STORMS OF 1:5 YEAR RETURN PERIOD, TO SUIT SITE CONDITIONS AND IN ACCORDANCE WITH LOAD CLASS REQUIREMENTS AS SHOWN ON THE PLAN. DESIGN TO BE SUBMITTED FOR COMMENT TO HDR CONSULTING PRIOR TO ORDERING.
 18. ALL EXTERNAL FINISHED LEVELS AND MANHOLE COVER LEVELS SHOWN ON THIS DRAWING ARE INDICATIVE AND SUBJECT TO ADJUSTMENT ON SITE TO SUIT THE FINISHED GROUND LEVELS. FOR FINAL LEVELS REFER TO THE ARCHITECT'S DRAWINGS.
 19. ALL LEVELS ARE IN METRES AND ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
 20. ANY COORDINATES PROVIDED FOR MANHOLES OR INSPECTION CHAMBERS ARE RELEVANT TO THE MAIN DRAINAGE RUN INTERSECTION AND NOT THE CENTRE OF THE MANHOLE.
 21. CHALK AND LIMESTONE ARE NOT TO BE USED AS BEDDING OR BACKFILLING MATERIAL IN SOILS WITH A PH VALUE LESS THAN 7.
 22. A CCTV DRAINAGE SURVEY IS TO BE CARRIED OUT BOTH AT THE PRE-COMMENCEMENT OF CONSTRUCTION AND AT THE COMPLETION OF THE CONTRACT TO PROVE THE INTEGRITY OF THE AS-BUILT DRAINAGE SYSTEMS. AT THE COMPLETION OF THE CONTRACT THIS IS TO BE CARRIED OUT PRIOR TO THE ISSUE OF THE PRACTICAL COMPLETION CERTIFICATE.
 23. DURING CONSTRUCTION SEWERS ARE TO BE INSPECTED AND TESTED IN LINE WITH CONSTRUCTION AND TESTING OF DRAINS AND SEWERS BS EN 1610 LATEST EDITION. VISUAL INSPECTION FOLLOWED BY A LEAKTIGHTNESS INSPECTION TO BE CARRIED OUT. LEAKTIGHTNESS TESTING CAN BE CARRIED OUT USING THE AIR OR WATER METHODS.
 24. SEWERS, MANHOLES, GULLIES, DRAINAGE CHANNELS AND SILT PITS SHOULD BE INSPECTED AT 6 MONTHLY INTERVALS AND CLEANED OUT AT 12 MONTHLY INTERVALS. A FULL CCTV SURVEY SHOULD ALSO BE CARRIED OUT AT 10 YEARLY INTERVALS. REFER ALSO TO SPECIALIST DRAINAGE CHANNEL AND PETROL INTERCEPTOR MANUFACTURERS INFORMATION AND MAINTENANCE REQUIREMENTS IN ALL INSTANCES. INSPECTION AND CLEANING SHOULD BE CARRIED OUT ONLY BY A SPECIALIST CONTRACTOR AND IN ACCORDANCE WITH THE GUIDELINES GIVEN IN 'SAFE WORKING IN SEWERS AND AT SEWAGE WORKS' PUBLISHED BY NATIONAL JOINT HEALTH AND SAFETY COMMITTEE FOR THE WATER SERVICES.

UNITS R, S & T

SURFACE WATER DRAINS INTO DRAINAGE CHANNELS VIA GRAVITY AND THEN THROUGH A PETROL INTERCEPTOR PRIOR TO ENTERING BELOW GROUND ATTENUATION. SURFACE WATER TO FURTHER DISCHARGE INTO ABOVE GROUND ATTENUATION BASIN AT GREENFIELD RUN OFF RATE.

AREA POSITIVELY DRAINED = 0.37HA
GREENFIELD RUN OFF RATE = 5.6 L/SEC/ha
THEREFORE TOTAL DISCHARGE = 2.1 l/s.

REQUIRED STORAGE:
DESIGN BASED ON 1:100 YEAR + 25% CLIMATE CHANGE
REQUIRED STORAGE = 300m³ APPROXIMATELY

- SOAKAWAY**
- SUPPLIER ACO STORMBRIXX OR SIMILAR
 - AREA DRAINED 105m²
 - SIZE 16m X 0.5m X 1m (8m³)
 - STORAGE VOLUME 7.6m³ (95% VOIDS.)
 - GROUND LEVEL 99.275m
 - TOP LEVEL 98.190m
 - BASE LEVEL 97.190m
 - COVER 1.085m
 - DUTY LANDSCAPING
 - INFILTRATION RATE 0.008m/hr
 - DESIGN BASED ON 1:100 YEAR RETURN PERIOD + 40%CC.
 - TO BE WRAPPED IN A NON-WOVEN TYPE GEOTEXTILE MEMBRANE TO THE MANUFACTURER'S RECOMMENDATIONS.
 - CELLULAR STORAGE TO BE BEDDED ON MIN. 100mm THICK COARSE SAND BLINDING AND COVERED WITH A 100mm THICK COARSE SAND PROTECTION LAYER. COMPACTED BACKFILL IN ACCORDANCE WITH ENGINEER'S SPECIFICATIONS.
 - MANUFACTURER TO PROVIDE LAYOUT AND DETAILS DRAWINGS FOR CONSTRUCTION WHICH SHOULD INCLUDE DETAILS OF VENTING AND SUITABLE ACCESS POINTS FOR INSPECTION AND MAINTENANCE. MANUFACTURER TO PROVIDE CALCULATIONS PROVING STRUCTURAL SUITABILITY TAKING COGNIZANCE OF THE APPLIED CONSTRUCTION LOADS (TEMPORARY AND PERMANENT) AND PREVAILING GROUND CONDITIONS AS DETAILED IN THE SITE INVESTIGATION REPORT.
 - TO BE INSTALLED STRICTLY IN ACCORDANCE WITH THE MANUFACTURE'S REQUIREMENTS AND RECOMMENDATIONS.

- ALL PROPOSED ALTERNATIVE PRODUCTS TO SATISFY THE FOLLOWING:
1. TO BE IN ACCORDANCE WITH THE RECOMMENDATIONS STATED IN CIRIA C680 - STRUCTURAL DESIGN OF MODULAR GEOCELLULAR DRAINAGE TANKS.
 2. MATERIAL PARTIAL SAFETY FACTOR OF 2.75 TO BE USED IN DESIGN CALCULATIONS.
 3. INDEPENDENT LOAD TESTING CERTIFICATION TO BE PROVIDED INCLUDING COMPRESSIVE STRENGTH, LATERAL STRENGTH AND LONG TERM CREEP TESTING.
 4. DESIGN AND PRODUCT PI REQUIRED.
 5. QA DETAILS TO ENSURE COMPLIANCE WITH THE ABOVE.

- LEGEND**
- EXISTING THAMES WATER FOUL WATER DRAIN WITH MANHOLE
 - PROPOSED FOUL WATER DRAIN WITH MANHOLE
 - PROPOSED SURFACE WATER DRAIN WITH MANHOLE
 - BELOW GROUND ATTENUATION TANK
 - PROPOSED POROUS PAVING
 - PROPOSED SOAKAWAY

RESIDENTIAL PROPERTY

SURFACE WATER DRAINS VIA GRAVITY AND DISCHARGES INTO BELOW GROUND SOAKAWAY TANK INSTALLED NEXT TO THE PROPERTY. SOAKAWAY TO BE POSITIONED MINIMUM 5m FROM ANY STRUCTURE AND 2m FROM THE BOUNDARY

DESIGN BASED ON 1:100 YEAR + 40% CLIMATE CHANGE.

PROPOSED FOUL WATER TO CONNECT INTO EXISTING THAMES WATER SEWER. SUBJECT TO SECTION 106 AGREEMENT.

- PERMEABLE PAVING SOAKAWAY**
- PERMEABLE PAVING 290m²
 - AREA OF PAVING 263m³
 - LOWEST GROUND LEVEL 99.425m
 - TOP OF STORAGE 99.325m
 - LOWEST BASE LEVEL 98.925m
 - DEPTH OF STORAGE 400mm
 - STORAGE (30% VOIDS) 31.56m³
 - INFILTRATION RATE ALLOW FOR GEOTEXTILE AT BASE OF OGCR TO ALLOW FOR A DEGREE OF INFILTRATION.
 - DESIGN BASED ON 1:100 YEAR RETURN PERIOD + 40%CC.

P2	MFP	09/04/25	PHASE 2 AREA UPDATED, PHASE 1 SPLIT INTO PHASE 1A & 1B
P1	JU	21/06/23	PRELIMINARY ISSUE:
Rev	Issue	Drawn	Checked
HDR Berkhamsted Office Roume House Prince Edward Street Berkhamsted Herts. AL9 6EJ United Kingdom T: +44 (0)20 8689 1802 E: info@hadr.co.uk W: www.hadr.co.uk			
Client: THE TURVEY CORPORATION PLC			
Project Title: BARNES COURT AND FRIDAY FARM, COPTHORNE			
Drawing Title: PHASE 2 DRAINAGE STRATEGY			
Purpose of Issue: Information Preliminary ☒ Approval Tender Construction Revised Copy Check			
First Issue Date:	Drawn By:	Scale:	Checked:
JUNE 23	JU	1:500 @ A0	NDH
Drawing Number:	Rev:		
20-089D / 301			P2

APPENDIX H

PHASES 1 & 2 FRA



Flood Risk Assessment and Drainage Strategy Report

Barns Court, Copthorne

Date: January 2024

Issue: V5

Reference: 20-089_R01

Status: Planning

Prepared by: PWE

Authorised by: NRB

Issuing office: BKM

DOCUMENT CONTROL

Issue	Date	Status	Author	Approver	Notes
V1	23/09/2020	DRAFT	PWE	NRB	
V2	02/10/2020	Planning	PWE	NRB	
V3	13/10/2020	Planning	PWE	NRB	
V4	10/07/2023	Planning	PWE	NRB	
V5	09/01/2024	Planning	PWE	NRB	Updated drainage strategy drawing and detail.

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3. POLICY AND GUIDANCE	4
4. FLOOD PROBABILITY AND HAZARD	7
5. DRAINAGE STRATEGY AND SUDS	10
6. CONCLUSIONS	12

APPENDICES

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APPENDIX B	-	TOPOGRAPHICAL SURVEY
APPENDIX C	-	ARCHITECT'S PROPOSED DEVELOPMENT LAYOUT
APPENDIX D	-	DRAINAGE CALCULATIONS
APPENDIX E	-	DRAINAGE STRATEGY DRAWING
APPENDIX F	-	THAMES WATER PUBLIC SEWER RECORDS

1.0 INTRODUCTION

- 1.1 HDR Consulting Limited was commissioned by The Turvey Corporation (the Client) to produce a Flood Risk Assessment (FRA) and drainage strategy for a proposed development at Barns Court in Copthorne, West Sussex.
- 1.2 The relevant national planning guidance is set out by the National Planning Policy Framework (NPPF, updated in 2023). An FRA is required because the proposed development covers an area greater than 1 ha. The FRA must assess all sources of flood risk both to the development itself and the potential impact on people and property elsewhere within the catchment.
- 1.3 The overall objective of this study is to carry out an FRA that meets the requirements of the NPPF and West Sussex County Council flood risk policies. These consider surface water runoff management and the guidance published by the Environment Agency (EA), WSCC and Thames Water. The study is required to assess all aspects of flood risk to the proposed development, the potential impacts of the development on people and property elsewhere within the catchment and identify possible mitigation measures to ensure that the development is safe in the event of a flood. To achieve this aim, the following key actions were undertaken:
- Obtain publicly available flood data from the gov.uk website;
 - Review topographical and flood risk data to identify the existing flood risk posed to the site from all sources;
 - Assess the residual flood risk post-development;
 - Consider the vulnerability of the users and the development, taking account of the vulnerability classification;
 - Assess the safety of the route of access/egress from the site in a flood event;
 - Identify suitable mitigation measures to protect the development site against flooding; and
 - The production of a concept surface water drainage strategy for the proposed development.

2.0 PROJECT DETAILS AND ENVIRONMENTAL SETTING

2.1 LOCATION

2.1.1 The site is located west of Turners Hill Road and south of Copthorne Common Road (the A264) on the eastern edge of the village of Copthorne in West Sussex. Its post code is RH10 4HQ and it is approximately centred on Ordnance Survey National Grid Reference TQ 334 389.

2.1.2 A location plan is provided in Appendix A.

2.2 DESCRIPTION

2.2.1 The site is irregular in plan shape and covers a total area of about 6.75 hectares. It consists of various land uses which are described in broad terms below.

2.2.2 The central part of the site is occupied by Barns Court business park, comprising several single-story commercial properties used by retail businesses which are accessed from Turners Hill Road. Areas external to the buildings are predominantly a mix of macadam, concrete and compacted gravel surfacing for car parking, with occasional soft landscaping. Some of these buildings are to be retained within the new development.

2.2.3 The northern sector of Barns Court comprises a mix of open grass-covered fields, assumed to be in agricultural/grazing use, as well as two warehouse-type units and an area of open storage. A security ditch extends along the eastern and southern boundaries of this area. The property further to the north of this land and bounded by Copthorne Common Road is known as Firs Farm and is outside the proposed development demise.

2.2.4 The western part of the site comprises a mix of dense vegetation including mature trees, and a series of open ponds / lagoons, some of which are understood to be used for amenity fishing purposes. The three western-most ponds retain water year-round, whilst the two eastern ponds are seasonally dry.

2.2.5 A detached residential property is located towards the southern end of the site, accessed via a driveway extending towards the north-west from Turners Hill Road. Land either side of the driveway comprises grass fields and mature boundary planting.

2.2.6 A June 2020 topographical survey produced by APR Services indicates ground levels fall from about 100.5 mAOD at the southern tip to about 92.5 mAOD on the western boundary. The central Barns Court area lies at between about 95.7 and 95.0 mAOD, falling from east to west, and levels in the northern agricultural fields range between about 94 and 91 mAOD, also falling towards the west. A copy of the survey is provided in Appendix B.

2.3 SURROUNDING LAND USE

2.3.1 The site is situated in a generally rural environmental, with surrounding land use predominantly comprising agricultural land and sporadic residential properties.

2.4 PROPOSED DEVELOPMENT

- 2.4.1 An architect's drawings of the proposed layout is provided in Appendix C. This indicates an extension to the existing business park (which is predominantly B1c light industrial) comprising new commercial properties (B1c use class) with associated access, parking and soft landscaping.

2.5 MAPPED GEOLOGY

- 2.5.1 The site is mapped to be underlain by solid geology of the Upper Tunbridge Wells Sand. This lithology is described as thinly bedded silty mudstones, siltstones, silty sandstones and fine-grained sandstones.

2.6 HYDROGEOLOGY

- 2.6.1 The Upper Tunbridge Wells Sand is a Secondary 'A' aquifer however the site is not located within a groundwater source protection zone.

2.7 HYDROLOGY

- 2.7.1 The nearest surface water features are series of ponds are located in the site's western sector.
- 2.7.2 A south-north oriented drainage ditch is present to the west of these ponds and is assumed to receive outflows from them. Flows within this ditch are then directed westwards via the regional ditch network towards Copthorne, ultimately reaching Copthorne Brook about 1 km to the west.

3.0 POLICY AND GUIDANCE

3.1 NATIONAL PLANNING POLICY FRAMEWORK (DECEMBER 2023)

3.1.1 In determining an approach for the assessment of flood risk for the development proposal there is a need to review the policy context. Government guidance requires that consideration be given to flood risk in the planning process. The National Planning Policy Framework (NPPF) was last updated in December 2023 and outlines the national policy position on development and flood risk assessment.

3.1.2 The Framework states that inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk. Where development is necessary in flood risk areas, it can be permitted provided it is made safe without increasing flood risk elsewhere.

3.1.3 The essence of NPPF is that:

- Local Plans should be supported by Strategic Flood Risk Assessment and develop policies to manage flood risk from all sources, taking advice from the Environment Agency and other relevant flood risk management bodies, such as lead local flood authorities and internal drainage boards.
- Policies in development plans should outline the consideration, which will be given to flooding issues, recognising the uncertainties that are inherent in the prediction of flooding and that flood risk is expected to increase as a result of climate change.
- Planning authorities should apply the precautionary principle to the issue of flood risk, using a risk-based search sequence to avoid such risk where possible and managing it elsewhere;
- The vulnerability of a proposed land use should be considered when assessing flood risk;
- Opportunities offered by new developments should be used to reduce the causes and impacts of flooding;
- Planning authorities should recognise the importance of functional floodplains, where water flows or is held at times of flood, and avoid inappropriate development on undeveloped and undefended floodplains; and
- The concept of Flood Risk Reduction, particularly in circumstances where development has been sanctioned on the basis of the “Exception Test”.

3.2 FLOOD AND WATER MANAGEMENT ACT 2010

3.2.1 Combined with the Flood Risk Regulations 2009 (‘the Regulations’), (which enact the EU Floods Directive in the England and Wales) the Flood and Water Management Act 2010 (‘the Act’) places significantly greater responsibility on Local Authorities to manage and lead on local flooding issues.

- 3.2.2 The Act and the Regulations together raise the requirements and targets Local Authorities need to meet, including:
- Playing an active role leading Flood Risk Management;
 - Development of Local Flood Risk Management Strategies (LFRMS);
 - Implementing requirements of Flood and Water Management legislation;
 - Development and implementation of drainage and flooding management strategies;
 - Responsibility for first approval, then adopting, management and maintenance of Sustainable Drainage System (SuDS) where they service more than one property.

- 3.2.3 The Flood and Water Management Act also clarifies three key areas that influence development:
- Sustainable Drainage Systems (SuDS) - the Act makes provision for a national standard to be prepared on SuDS, and developers will be required to obtain local authority approval for SuDS in accordance with the standards, likely with conditions. Supporting this, the Act requires local authorities to adopt and maintain SuDS, removing any ongoing responsibility for developers to maintain SuDS if they are designed and constructed robustly.
 - Flood risk management structures - the Act enables the EA and local authorities to designate structures such as flood defences or embankments owned by third parties for protection if they affect flooding or coastal erosion. A developer or landowner will not be able to alter, remove or replace a designated structure or feature without first obtaining consent from the relevant authority.
 - Permitted flooding of third party land - The EA and local authorities have the power to carry out work which may cause flooding to third party land where the works are deemed to be in the interest of nature conservation, the preservation of cultural heritage or people's enjoyment of the environment or of cultural heritage.

3.3 PLANNING PRACTICE GUIDANCE FLOOD RISK AND COASTAL CHANGE

- 3.3.1 The Planning Practise Guidance (PPG) for Flood Risk and Coastal Change (last updated September 2018) sets strict tests to protect people and property from flooding which all local planning authorities are expected to follow. Where these tests are not met, national policy is clear that new development should not be allowed. A key aspect of the guidance is that if there are better sites in terms of flood risk, or a proposed development cannot be made safe, it should not be permitted.
- 3.3.2 The document provides guidance on how local planning authorities should:
- Assess flood risk;
 - Avoid flood risk; and

- Manage and Mitigate flood risk and coastal change.

3.3.3 There is also information on the requirements to consult the Environment Agency, on the role of lead local flood authorities and on flood risk in relation to minor developments.

3.3.4 The latest update provides additional guidance on SuDS, including:

- The importance of SuDS;
- When SuDS should be considered;
- The SuDS discharge hierarchy;
- Factors a local authority will address when considering SuDS as part of a planning application;
- When SuDS are inappropriate and relevant flood risk consultees;
- Applicability of Defra's Non-statutory Technical Standards for Sustainable Drainage Systems;
- Design and construction cost considerations;
- Operation and maintenance considerations; and
- Where to go for further SuDS advice.

3.4 SUDS MANUAL, CIRIA C753 (2015)

3.4.1 The CIRIA SuDS Manual provides advice on the implementation of sustainable drainage techniques in the UK. It provides guidance on:

- Initial planning;
- Design through to construction;
- The management of SuDS in the context of the current regulatory framework; and
- Advice on landscaping, waste management, cost, and community engagement.

3.5 LOCAL FLOOD RISK MANAGEMENT STRATEGY (2013/14)

3.5.1 The LFRMS sets out how WSCC carries out its responsibilities under the Flood and Water Management Act. WSCC is the Lead Local Flood Authority for the site area and is therefore required to produce such a strategy to define how flood risk will be properly managed within the county.

4.0 FLOOD PROBABILITY AND HAZARD

4.1 POTENTIAL SOURCES

4.1.1 The flood risk elements that need to be considered for any site are defined in BS 8533 as the “Forms of Flooding” and are listed as:

- flooding from Rivers (fluvial flood risk)
- flooding from the Sea (tidal flood risk)
- flooding from the Land
- flooding from Groundwater
- flooding from Sewers (sewer and drain exceedance, pumping station failure etc)
- flooding from Reservoirs, Canals and other Artificial Structures.

4.2 FLUVIAL FLOOD RISK AND EA FLOOD ZONE

4.2.1 Fluvial flooding occurs when the amount of water exceeds the flow capacity of the channel. Most rivers have a natural floodplain into which the water spills in times of flood.

4.2.2 As noted in the introduction, the study site falls within Flood Zone 1 and has less than 1 in 1,000 annual probability of river flooding.

4.3 FLOODING FROM THE SEA

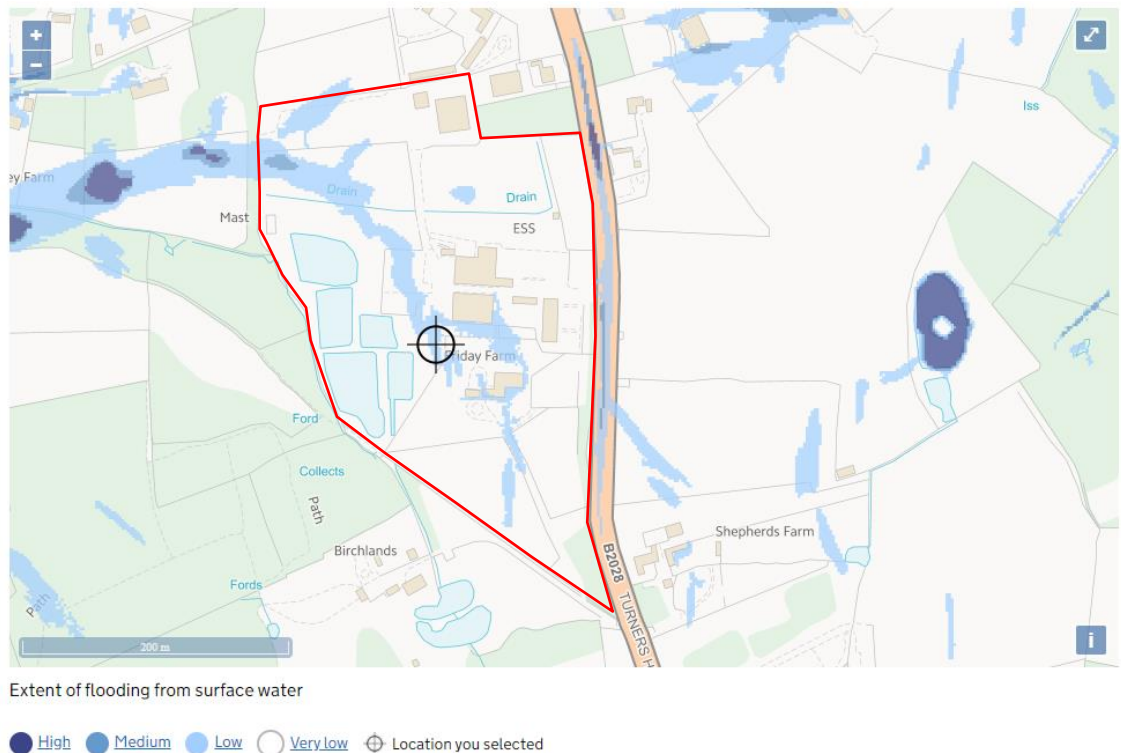
4.3.1 On the coast, storm surges and high tides can threaten low lying areas and can sometimes be large and rapid enough to overtop defences. However tidal flooding is not considered a risk to the site, due to its inland location.

4.4 PLUVIAL FLOOD RISK

4.4.1 If intense rain is unable to soak into the ground or be carried through manmade drainage systems, for a variety of reasons, it can run off over the surface causing localised floods before reaching a river or another watercourse.

4.4.2 Generally, where there is impermeable surfacing or where the ground infiltration capacity is exceeded, surface water runoff will occur.

4.4.3 The Environment Agency’s surface water flood map, reproduced below, shows that most of the site is at ‘very low’ risk of flooding, with some localised areas categorised ‘low’ risk:



- 4.4.4 It is recognised that the impermeable surfacing associated with the proposed development will increase the volume of surface water runoff generated, and so lead to a greater volume of surface water flow. A drainage strategy has been developed to mitigate the associated flood risk, as described in Section 5 below.

4.5 GROUNDWATER

- 4.5.1 Groundwater flooding tends to occur after prolonged periods of sustained high rainfall. Higher rainfall means more water will infiltrate into the ground and cause the water table to rise above normal levels. In low-lying areas, the water table may be at shallow depth, and during very wet periods, with additional groundwater flowing towards these areas, the water table can rise up to the surface causing groundwater flooding.
- 4.5.2 As noted above, the site is predominantly underlain by Upper Tunbridge Wells Sand which comprises mudstone and siltstones. These deposits are likely to be of relatively low porosity and permeability, such that groundwater is not expected to be present in significant volumes at shallow depth. The risk of flooding from this source is concluded to be relatively low.

4.6 FLOODING FROM SEWERS

- 4.6.1 Flooding from artificial drainage occurs when flow entering the system exceeds its conveyance capacity, the system becomes blocked, or it cannot discharge due to a high-water level in the receiving watercourse.
- 4.6.2 The proposed development will lead to an increase in impermeable area and therefore an associated increase in surface water runoff rates and volumes.

- 4.6.3 In this context, a surface water drainage scheme has been designed to accommodate the projected runoff, the details of which are set out in section 5 of this report.

4.7 CLIMATE CHANGE

- 4.7.1 Projections of the likely impact of climate change indicate that more frequent short-duration, high intensity rainfall events can be expected in the UK, as well as more frequent prolonged periods of rainfall.
- 4.7.2 For the surface water runoff assessment, an allowance of an increase in the rainfall intensity values by 20% has been included to account for the impact of climate change. This concurs with current EA / DEFRA guidance for the type of commercial properties proposed and the anticipated lifespan of the development (circa 40 years).

5.0 DRAINAGE STRATEGY AND SUDS

5.1 EXISTING RUNOFF

5.1.1 In accordance with DEFRA guidelines, it is proposed that surface water runoff from the development be restricted to the applicable greenfield runoff rates for the 1 in 1 year and 1 in 100 year rainfall events.

5.1.2 The theoretical greenfield run-off rates for the 1 in 1 year and 1 in 100 year return period storms have been calculated based on the FEH method, with a pro-rata value to account for the actual site area. These calculations can be found in Appendix D and are summarised as follows:

- 1 in 1 year: 4.7 l/s/ha
- 1 in 100 year: 17.6 l/s/ha

5.2 INFILTRATION DEVICES

5.2.1 As previously stated, the site is mapped to be underlain by soils anticipated to be of relatively low permeability with an insufficient infiltration coefficient, into which it may not be feasible to install functioning soakaways for the commercial areas of the new development.

5.2.2 However for the proposed residential property at the southern end of the site soakaway drainage may be feasible due to the significantly smaller impermeable area.

5.3 GREEN ROOFS

5.3.1 The majority of the site is proposed to be developed for new steel-framed industrial / commercial units. These buildings will be of lightweight and economic construction and the adoption of green roofs would require significant and costly modifications to the structural design, including significantly upgraded foundations and more extensive use of structural steelwork. It has been determined that such an option is not compatible within the proposed development.

5.4 PONDS / BASINS

5.4.1 Inclusion of above-ground attenuation storage in the form of detention basins/ponds, where feasible within the development layout constraints, would be a suitable and beneficial SuDS option.

5.5 SURFACE WATER DRAINAGE STRATEGY

5.5.1 The proposed surface water drainage strategy is provided on the drawings in Appendix E, with supporting calculations in Appendix D.

- 5.5.2 It is proposed that runoff from new commercial buildings and hard surfacing be directed into an existing basin on the western side of the site, and into below-ground cellular storage systems. The basin is to be re-shaped to accommodate the development proposals, as indicated on the drawing. The runoff will then ultimately outfall into the existing surface water ditch further to the west at a controlled greenfield rate.
- 5.5.3 Permeable paving is proposed to be installed to new car park areas - this will likely be a 'Type B' system, where the proportion of rainfall that exceeds the infiltration capacity of the subsoil will flow into the drainage network.
- 5.5.4 A flow control device (Hydrobrake or similar) will be used to control outflow from the development into the adjacent pond to the west. The on-site basin and below-ground storage have been sized to accommodate all runoff up to the 1 in 100 year return period storm plus 25% additional climate change allowance.
- 5.5.5 The gravity drainage system will be designed in accordance with the requirements of BS EN 752:2017 which stipulates that no surcharging should occur during a critical storm event of 1 in 2 years return period. It also requires that no exceedance flooding should occur during a critical storm event of 1 in 30 years return period. The drainage proposals are such that runoff from storm events up to 1 in 100 years return period plus a 25% allowance for climate change will be stored within the site.
- 5.5.6 It is proposed the runoff from the new residential property at the southern end of the site be directed into a suitably sized below-ground soakaway, designed based on 1 in 100 year storm plus 40% climate change given its anticipated longevity.

5.6 FOUL DRAINAGE

- 5.6.1 A Thames Water foul sewer currently passes below the site, approximately south-east to north-west. All foul effluent from the new commercial and residential development is proposed to be directed into this sewer, subject to a S106 public sewer connection agreement. Details are illustrated on the appended drainage drawing and the associated calculations are provided in Appendix E. Thames Water public sewer records are enclosed as Appendix F.

5.7 DRAINAGE MAINTENANCE

- 5.7.1 In general, sewers, manholes and drainage channels are unlikely to require maintenance other than periodic inspections, unless a blockage occurs. Sewers, manholes, drainage channels and silt pits should be inspected at 6 monthly intervals and cleaned out at 12 monthly intervals. A full CCTV survey should also be carried out at 10 yearly intervals.
- 5.7.2 Reference should be made to all manufacturer's information and maintenance requirements for recommended intervals and safe methods of cleaning for the following proprietary systems:
- drainage channels
 - oil separators

- flow controls

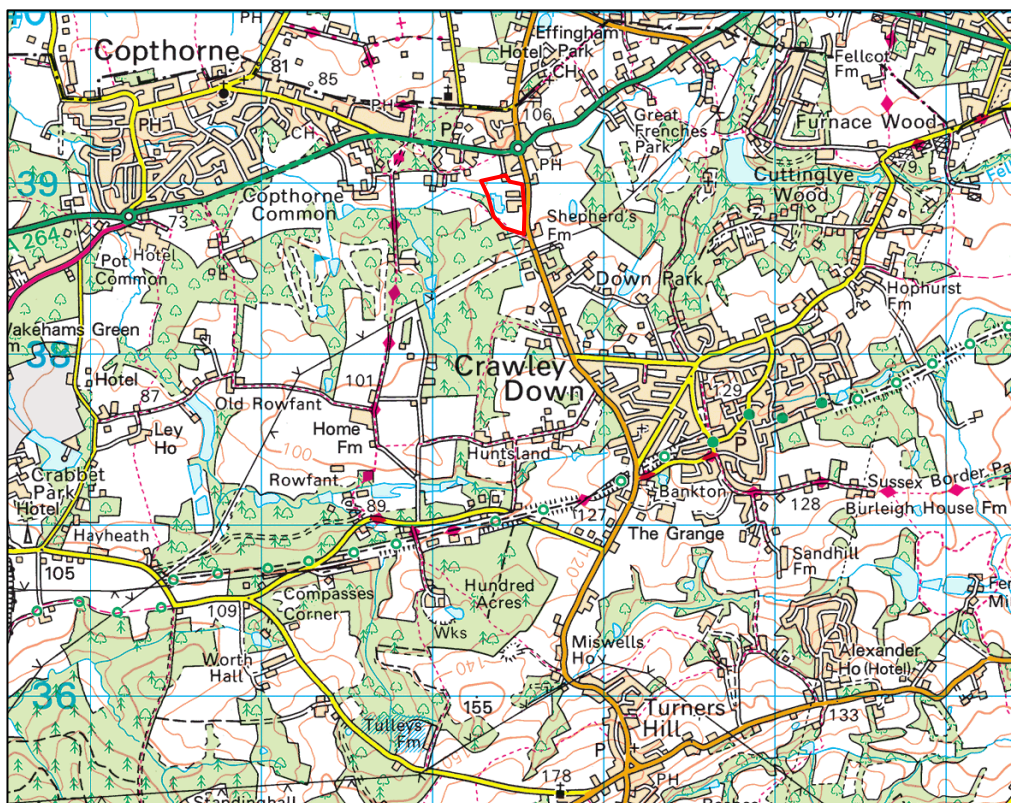
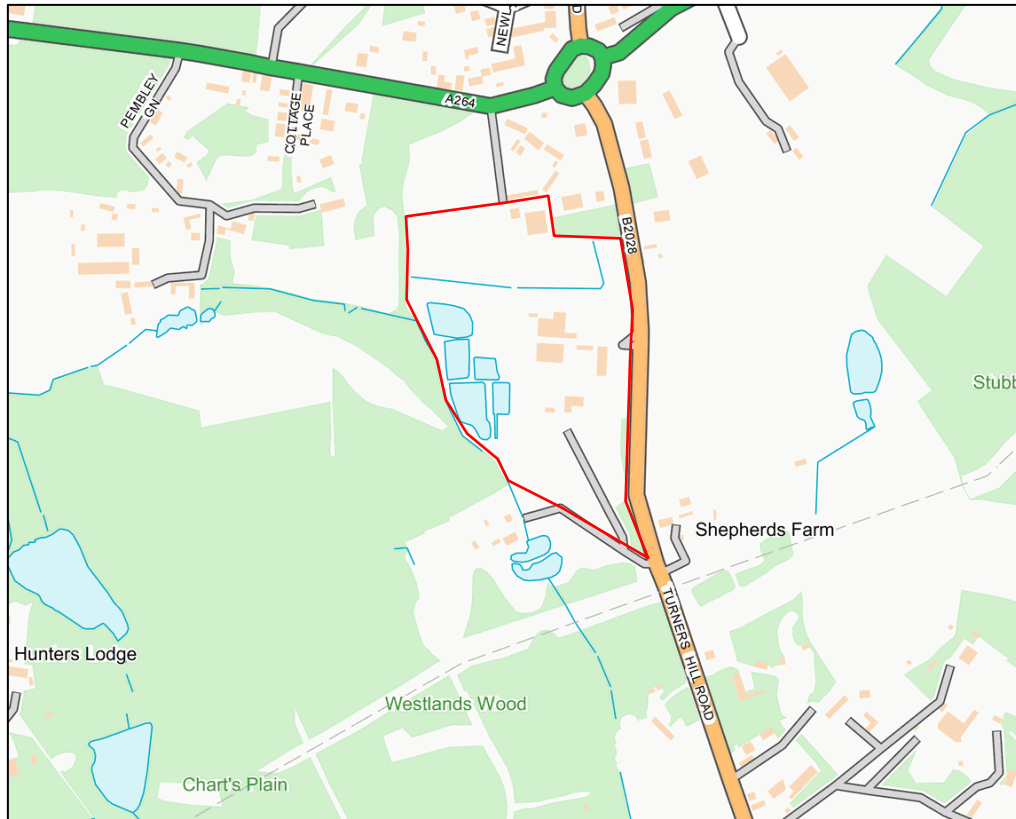
- 5.7.3 In all instances, inspection and cleaning is to be carried out only by a suitable Specialist Contractor, following the guidelines given in BE EN 752:2008 “Maintenance Considerations” and “Safe Working in Sewers and at Sewage Works”, published by the National Joint Health and Safety Committee for the Water Services.
- 5.7.4 All underground and under-floor drains and manholes (including oil separators) represent confined spaces. Appropriate precautions should be taken before entering drains and manholes. Access should only be undertaken by appropriately trained personnel.

6.0 CONCLUSIONS

- 6.1 HDR Consulting was appointed by The Turvey Corporation (the Client) to produce a Flood Risk Assessment and Drainage Strategy in connection with a proposed extension to Barns Court near Copthorne, West Sussex.
- 6.2 The site is located in Flood Zone 1 and is at low probability of flooding from fluvial or tidal sources. Future flood risk, both on and off-site, from site-generated runoff has been addressed via a surface water drainage strategy.
- 6.3 The strategy described in this report comprises the use of above-ground ponds/basins, below-ground storage, and permeable pavements to attenuate run-off and is designed to accommodate up to a 1 in 100 year return period storm, plus 25% for climate change. Off-site discharge will then be directed westwards into the existing local surface water basin network and will be restricted to greenfield run-off rate.
- 6.4 A single new residential property is proposed at the southern end of the site. Runoff from this property is to be directed into a soakaway sized to accommodate a 1 in 100 year storm plus 40% climate change.
- 6.4 This FRA demonstrates that appropriate attenuation measures and SuDS techniques can be incorporated into the development. The surface water strategy shows how the scheme can accommodate the critical storm event whilst still preventing on- and off-site flooding. The development is therefore considered to be at low risk from flooding and is not considered to increase flood risk to others.

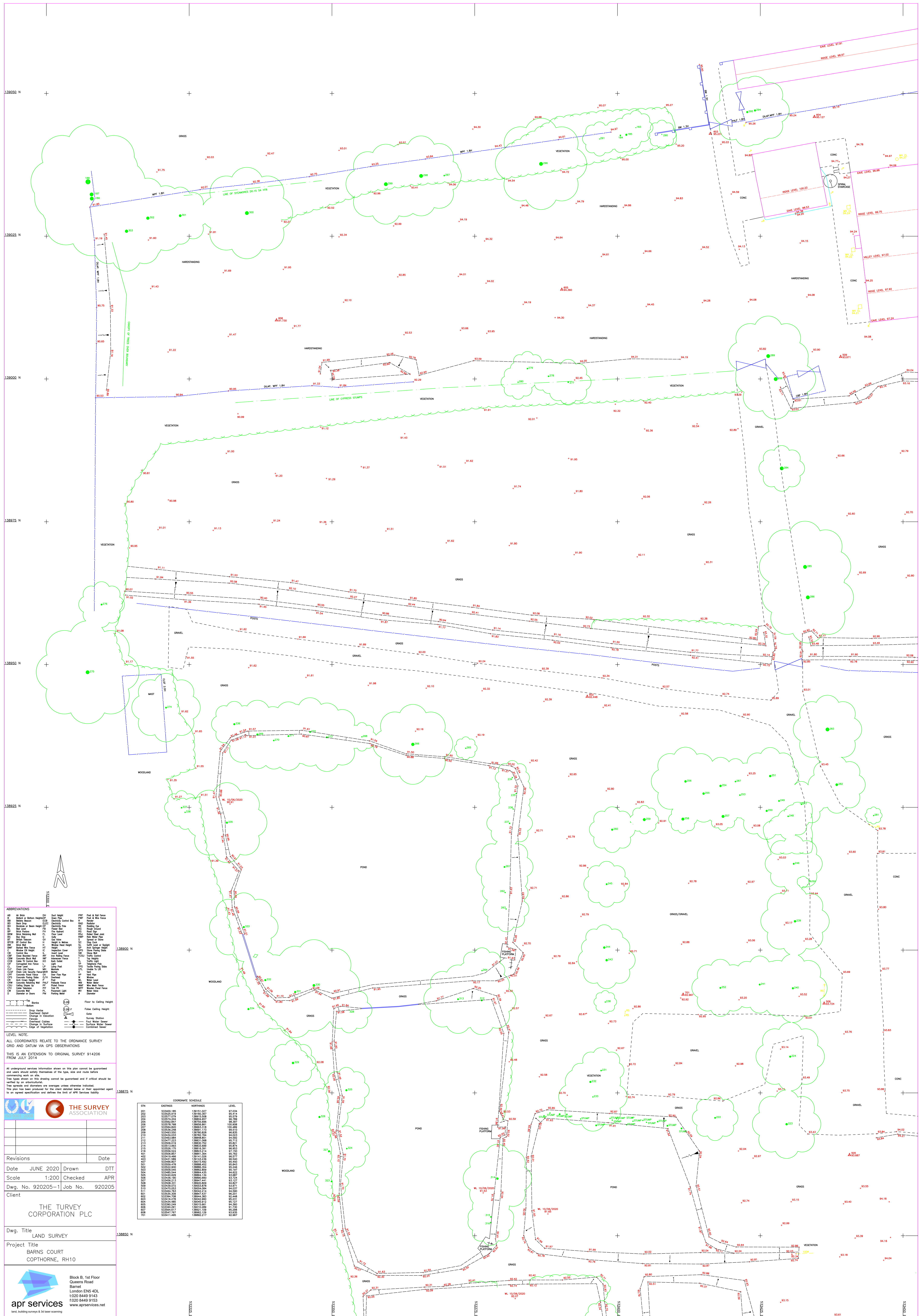
APPENDIX A

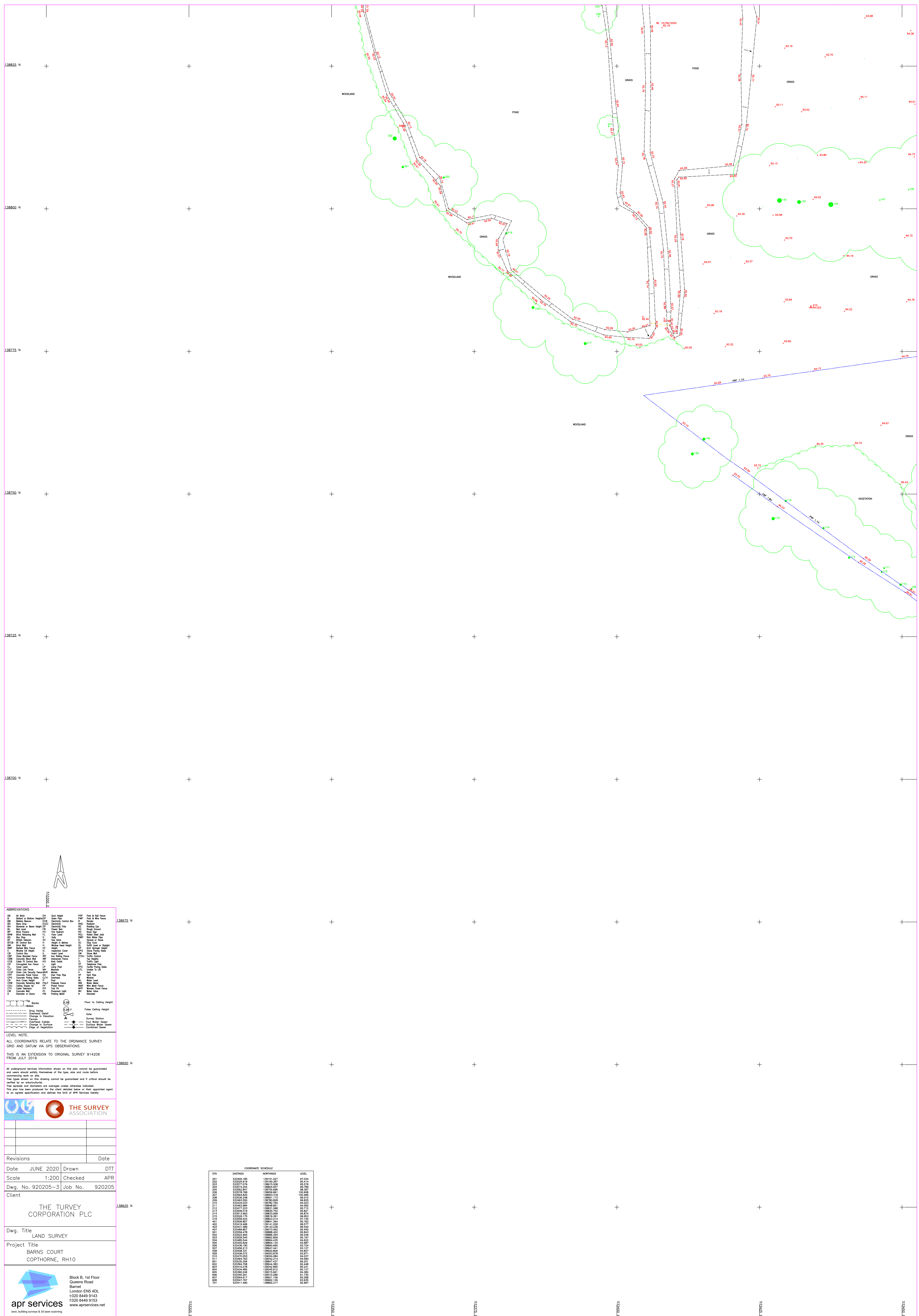
SITE LOCATION PLAN

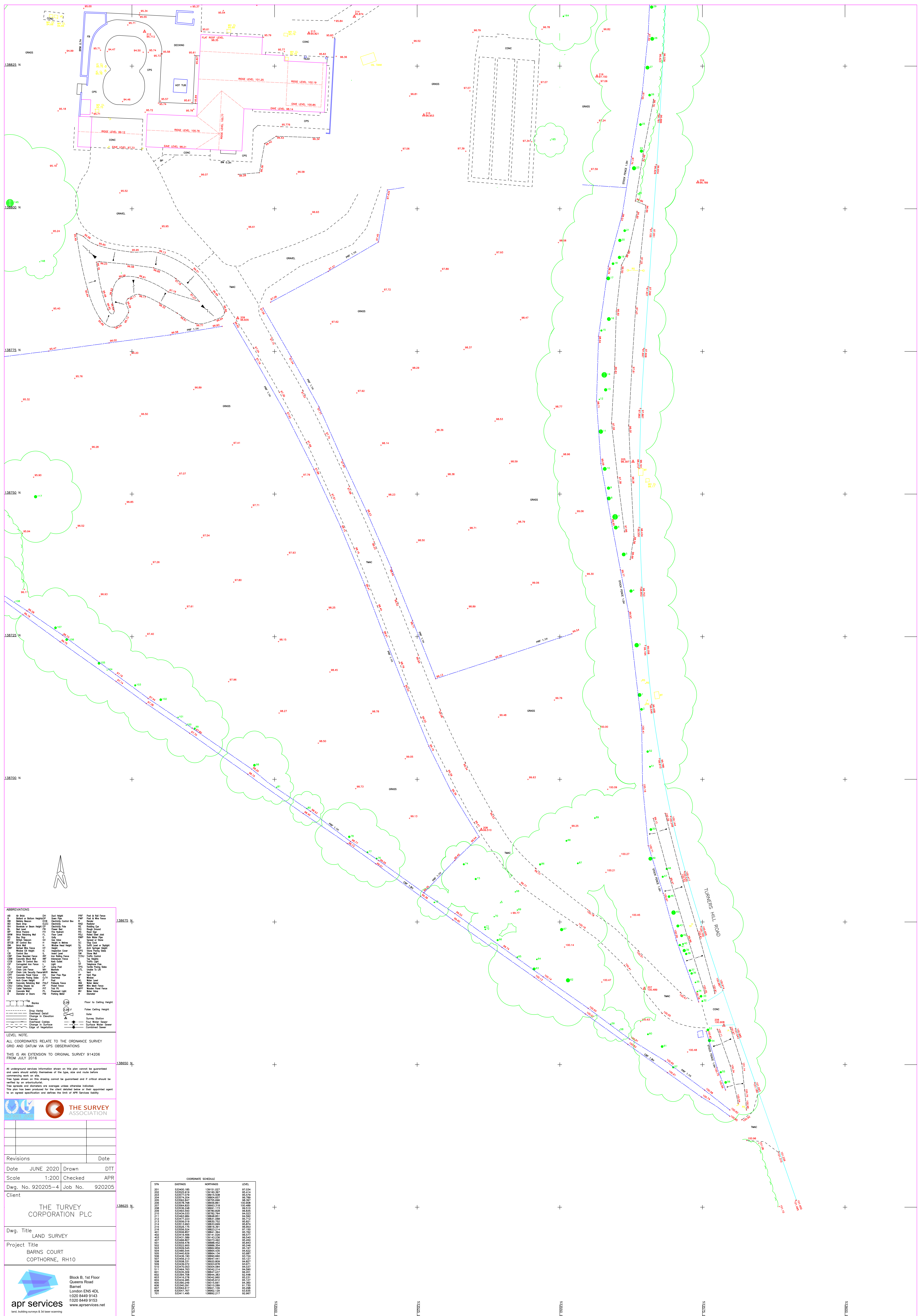


APPENDIX B

TOPOGRAPHICAL SURVEY







APPENDIX C

ARCHITECT'S PROPOSED DEVELOPMENT PLAN

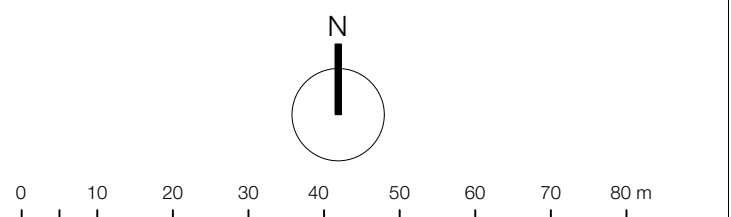


Building Code	Units
A	6
B	3
C	5
D	5
E	4
F	5
G	6
H	5
I	6
J	6
K	5
TOTAL	56

Parking	Units
Car - User	148
Car - Visitor	10
Disabled Spaces	9
Bicycle Spaces	34
Total Spaces	158

Notes: Do Not Scale
Check all dimensions on site
© Dunthorne Parker Architects

- Existing Sewage Drain
- Electrical Mast
- Rain Water Drainage
- Foul Drainage
- Proposed Work Storage
- Like for Like Replacement Dwelling Boundary
- Existing Buildings
- Screened, gravelled, parking area
- Existing Estate
- Phase 1 Development
- Phase 2 Development
- Phase 1 Habitat Enhancement
- Ancient Woodland Buffer Zone to South of Site



G	20/10/23	MK	Amended Pathway
F	18/10/23	MK	Amended Layouts
E	07/07/23	MK	Amended Landscaping
D	20/06/23	HN	Indicative footprint for residential property added
C	26/04/23	MK	Amended Turning Circles
B	25/04/23	MK	Amended Layout
A	03/03/23	HN	Annotations added

No	Date	By	Chkd	Revision
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Project
Barn Court, Crawley

Drawing
Proposed Site Plan

Job
1450

Dwg No.
201G

Scale
1:1000

By
MK

Date Drawn
31/08/22

DPA

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24 Southwark Street | London | SE1 1TY

APPENDIX D

DRAINAGE CALCULATIONS

HDR		Page 1
7th Floor 240 Blackfriars Road London, UK, SE1 8NW		
Date 15/05/2023 17:12 File GREENFIELD RUN OFF.SRCX	Designed by JJOHN Checked by	
Innovyze	Source Control 2020.1	
ICP SUDS Mean Annual Flood Input Return Period (years) 100 SAAR (mm) 860 Urban 0.000 Area (ha) 1.000 Soil 0.450 Region Number Region 6 Results 1/s QBAR Rural 5.6 QBAR Urban 5.6 Q100 years 17.8 Q1 year 4.8 Q30 years 12.7 Q100 years 17.8		
©1982-2020 Innovyze		

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.350	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S100	0.094	5.00	96.706	1200	60.810	663.505	0.981
S101			96.667	1200	63.180	663.505	0.962
S102	0.094	5.00	96.667	1200	98.160	666.015	0.782
S103			96.826	1500	98.160	663.505	1.431
S104	0.080	5.00	96.940	1200	136.260	667.845	0.980
SP1	0.036	5.00	96.900	1200	136.260	665.085	0.900
S105			96.928	1500	136.260	663.505	1.788
S106			95.984	1500	145.090	663.505	0.904
S107			97.038	1200	161.340	663.505	2.068
S108	0.076	5.00	97.087	1200	207.020	667.705	0.982
S109	0.170	5.00	96.365	1500	207.020	690.505	1.065
S110			97.016	1500	207.020	663.505	2.426
S111	0.076	5.00	97.087	1200	209.910	665.585	1.087
SP2	0.013	5.00	96.831	1200	209.910	665.745	1.031
S113	0.077	5.00	96.485	1200	209.910	688.665	1.010
S114	0.163	5.00	96.345	1500	224.280	672.195	1.050
PPIC2	0.036	5.00	96.161	1200	218.600	672.195	0.761
S115			96.708	1200	209.910	672.195	1.708
S112	0.076	5.00	96.750	1200	209.910	665.585	0.995
SP3	0.057	5.00	94.175	1200	209.910	665.015	0.985
SP7	0.079	5.00	95.630	1200	209.910	793.125	0.975
SP6	0.087	5.00	95.411	1200	217.130	783.205	0.976
S117			95.425	1500	209.910	783.205	1.115
S118	0.081	5.00	95.630	1200	217.010	755.235	0.990
S119			95.445	1500	209.910	755.235	1.395
S120	0.114	5.00	95.152	1500	214.040	732.325	1.042
S121			95.283	1200	209.910	732.325	1.388
S122			94.729	1500	209.910	718.375	1.004
SP5	0.030	5.00	93.540	1200	217.410	689.975	0.900
S123			93.025	1500	209.910	689.975	0.760
SP4	0.051	5.00	93.146	1200	216.430	679.725	0.976
S124			92.660	150	209.910	679.725	0.760
S116	0.066	5.00	94.217	1200	209.910	667.535	0.992
ATTENUATION			93.100	1200	209.910	663.505	1.450
S126			92.122	1500	213.830	663.505	0.532
HEADWALL			92.505		218.260	663.505	0.975

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	S100	S101	2.370	0.600	95.725	95.705	0.020	118.5	225	5.03	50.0
1.001	S101	S103	34.980	0.600	95.705	95.470	0.235	148.9	225	5.58	50.0
2.000	S102	S103	2.510	0.600	95.885	95.470	0.415	6.0	225	5.01	50.0
1.002	S103	S105	38.100	0.600	95.395	95.140	0.255	149.4	300	6.07	50.0
3.000	S104	S105	4.340	0.600	95.960	95.215	0.745	5.8	225	5.01	50.0
4.000	SP1	S105	1.580	0.600	96.000	95.290	0.710	2.2	150	5.00	50.0
1.003	S105	S106	8.830	0.600	95.140	95.080	0.060	147.2	300	6.19	50.0
1.004	S106	S107	16.250	0.600	95.080	94.970	0.110	147.7	300	6.40	50.0
1.005	S107	S110	45.680	0.600	94.970	94.665	0.305	149.8	300	6.99	50.0
5.000	S108	S110	4.200	0.600	96.105	94.740	1.365	3.1	225	5.01	50.0
6.000	S109	S110	27.000	0.600	95.300	94.665	0.635	42.5	300	5.19	50.0
1.006	S110	ATTENUATION	2.890	0.600	94.590	92.275	2.315	1.2	375	6.99	50.0
7.000	S111	ATTENUATION	2.080	0.600	96.000	92.425	3.575	0.6	225	5.00	50.0
8.000	SP2	ATTENUATION	2.240	0.600	95.800	92.300	3.500	0.6	150	5.00	50.0
9.000	S113	S115	16.470	0.600	95.475	95.075	0.400	41.2	225	5.13	50.0
10.000	S114	S115	14.370	0.600	95.295	95.000	0.295	48.7	300	5.11	50.0
11.000	PPIC2	S115	8.690	0.600	95.400	95.150	0.250	34.8	150	5.08	50.0
9.001	S115	ATTENUATION	8.690	0.600	95.000	92.350	2.650	3.3	300	5.15	50.0
12.000	S112	ATTENUATION	2.080	0.600	95.755	92.225	3.530	0.6	225	5.00	50.0
13.000	SP3	ATTENUATION	1.510	0.600	93.190	92.425	0.765	2.0	225	5.00	50.0
14.000	SP7	S117	9.920	0.600	94.655	94.385	0.270	36.7	225	5.08	50.0
15.000	SP6	S117	7.220	0.600	94.435	94.385	0.050	144.4	225	5.11	50.0
14.001	S117	S119	27.970	0.600	94.310	94.125	0.185	151.2	300	5.48	50.0
16.000	S118	S119	7.100	0.600	94.640	94.200	0.440	16.1	225	5.04	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.000	1.200	47.7	12.7	0.756	0.737	0.094	0.0
1.001	1.069	42.5	12.7	0.737	1.131	0.094	0.0
2.000	5.355	212.9	12.7	0.557	1.131	0.094	0.0
1.002	1.284	90.7	25.5	1.131	1.488	0.188	0.0
3.000	5.456	216.9	10.8	0.755	1.488	0.080	0.0
4.000	6.808	120.3	4.9	0.750	1.488	0.036	0.0
1.003	1.294	91.4	41.2	1.488	0.604	0.304	0.0
1.004	1.291	91.3	41.2	0.604	1.768	0.304	0.0
1.005	1.282	90.6	41.2	1.768	2.051	0.304	0.0
5.000	7.513	298.7	10.3	0.757	2.051	0.076	0.0
6.000	2.418	170.9	23.0	0.765	2.051	0.170	0.0
1.006	16.318	1802.2	74.5	2.051	0.450	0.550	0.0
7.000	17.294	687.6	10.3	0.862	0.450	0.076	0.0
8.000	12.706	224.5	1.8	0.881	0.650	0.013	0.0
9.000	2.044	81.3	10.4	0.785	1.408	0.077	0.0
10.000	2.258	159.6	22.1	0.750	1.408	0.163	0.0
11.000	1.713	30.3	4.9	0.611	1.408	0.036	0.0
9.001	8.739	617.8	37.4	1.408	0.450	0.276	0.0
12.000	17.185	683.3	10.3	0.770	0.650	0.076	0.0
13.000	9.383	373.1	7.7	0.760	0.450	0.057	0.0
14.000	2.165	86.1	10.7	0.750	0.815	0.079	0.0
15.000	1.086	43.2	11.8	0.751	0.815	0.087	0.0
14.001	1.276	90.2	22.5	0.815	1.020	0.166	0.0
16.000	3.273	130.1	11.0	0.765	1.020	0.081	0.0

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
14.002	S119	S121	22.910	0.600	94.050	93.895	0.155	147.8	375	5.73	50.0
17.000	S120	S121	4.130	0.600	94.110	94.045	0.065	63.5	225	5.04	50.0
14.003	S121	S122	13.950	0.600	93.895	93.800	0.095	146.8	375	5.89	50.0
14.004	S122	S123	28.400	0.600	93.725	92.265	1.460	19.5	450	5.99	50.0
18.000	SP5	S123	7.500	0.600	92.640	92.565	0.075	100.0	150	5.12	50.0
14.005	S123	S124	10.250	0.600	92.265	91.900	0.365	28.1	450	6.04	50.0
19.000	SP4	S124	6.520	0.600	92.170	92.125	0.045	144.9	225	5.10	50.0
14.006	S124	ATTENUATION	16.220	0.600	91.900	91.800	0.100	162.2	450	6.20	50.0
20.000	S116	ATTENUATION	4.030	0.600	93.225	92.425	0.800	5.0	225	5.01	50.0
1.007	ATTENUATION	S126	3.920	0.600	91.650	91.590	0.060	65.3	225	7.03	50.0
1.008	S126	HEADWALL	4.430	0.600	91.590	91.530	0.060	73.8	225	7.08	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
14.002	1.488	164.3	33.5	1.020	1.013	0.247	0.0
17.000	1.643	65.3	15.4	0.817	1.013	0.114	0.0
14.003	1.493	164.9	48.9	1.013	0.554	0.361	0.0
14.004	4.625	735.6	48.9	0.554	0.310	0.361	0.0
18.000	1.005	17.8	4.1	0.750	0.310	0.030	0.0
14.005	3.847	611.9	53.0	0.310	0.310	0.391	0.0
19.000	1.084	43.1	6.9	0.751	0.310	0.051	0.0
14.006	1.593	253.4	59.9	0.310	0.850	0.442	0.0
20.000	5.869	233.3	8.9	0.767	0.450	0.066	0.0
1.007	1.620	64.4	210.9	1.225	0.307	1.556	0.0
1.008	1.523	60.6	210.9	0.307	0.750	1.556	0.0

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	2.370	118.5	225	1 STANDARD	96.706	95.725	0.756	96.667	95.705	0.737
1.001	34.980	148.9	225	1 STANDARD	96.667	95.705	0.737	96.826	95.470	1.131
2.000	2.510	6.0	225	1 STANDARD	96.667	95.885	0.557	96.826	95.470	1.131
1.002	38.100	149.4	300	1 STANDARD	96.826	95.395	1.131	96.928	95.140	1.488
3.000	4.340	5.8	225	1 STANDARD	96.940	95.960	0.755	96.928	95.215	1.488
4.000	1.580	2.2	150	1 STANDARD	96.900	96.000	0.750	96.928	95.290	1.488
1.003	8.830	147.2	300	1 STANDARD	96.928	95.140	1.488	95.984	95.080	0.604
1.004	16.250	147.7	300	1 STANDARD	95.984	95.080	0.604	97.038	94.970	1.768
1.005	45.680	149.8	300	1 STANDARD	97.038	94.970	1.768	97.016	94.665	2.051

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	S100	1200	Manhole	1 STANDARD	S101	1200	Manhole	1 STANDARD
1.001	S101	1200	Manhole	1 STANDARD	S103	1500	Manhole	1 STANDARD
2.000	S102	1200	Manhole	1 STANDARD	S103	1500	Manhole	1 STANDARD
1.002	S103	1500	Manhole	1 STANDARD	S105	1500	Manhole	1 STANDARD
3.000	S104	1200	Manhole	1 STANDARD	S105	1500	Manhole	1 STANDARD
4.000	SP1	1200	Manhole	1 STANDARD	S105	1500	Manhole	1 STANDARD
1.003	S105	1500	Manhole	1 STANDARD	S106	1500	Manhole	1 STANDARD
1.004	S106	1500	Manhole	1 STANDARD	S107	1200	Manhole	1 STANDARD
1.005	S107	1200	Manhole	1 STANDARD	S110	1500	Manhole	1 STANDARD

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
5.000	4.200	3.1	225	1 STANDARD	97.087	96.105	0.757	97.016	94.740	2.051
6.000	27.000	42.5	300	1 STANDARD	96.365	95.300	0.765	97.016	94.665	2.051
1.006	2.890	1.2	375	1 STANDARD	97.016	94.590	2.051	93.100	92.275	0.450
7.000	2.080	0.6	225	1 STANDARD	97.087	96.000	0.862	93.100	92.425	0.450
8.000	2.240	0.6	150	1 STANDARD	96.831	95.800	0.881	93.100	92.300	0.650
9.000	16.470	41.2	225	1 STANDARD	96.485	95.475	0.785	96.708	95.075	1.408
10.000	14.370	48.7	300	1 STANDARD	96.345	95.295	0.750	96.708	95.000	1.408
11.000	8.690	34.8	150	1 STANDARD	96.161	95.400	0.611	96.708	95.150	1.408
9.001	8.690	3.3	300	1 STANDARD	96.708	95.000	1.408	93.100	92.350	0.450
12.000	2.080	0.6	225	1 STANDARD	96.750	95.755	0.770	93.100	92.225	0.650
13.000	1.510	2.0	225	1 STANDARD	94.175	93.190	0.760	93.100	92.425	0.450
14.000	9.920	36.7	225	1 STANDARD	95.630	94.655	0.750	95.425	94.385	0.815
15.000	7.220	144.4	225	1 STANDARD	95.411	94.435	0.751	95.425	94.385	0.815
14.001	27.970	151.2	300	1 STANDARD	95.425	94.310	0.815	95.445	94.125	1.020
16.000	7.100	16.1	225	1 STANDARD	95.630	94.640	0.765	95.445	94.200	1.020
14.002	22.910	147.8	375	1 STANDARD	95.445	94.050	1.020	95.283	93.895	1.013
17.000	4.130	63.5	225	1 STANDARD	95.152	94.110	0.817	95.283	94.045	1.013
14.003	13.950	146.8	375	1 STANDARD	95.283	93.895	1.013	94.729	93.800	0.554
14.004	28.400	19.5	450	1 STANDARD	94.729	93.725	0.554	93.025	92.265	0.310
18.000	7.500	100.0	150	1 STANDARD	93.540	92.640	0.750	93.025	92.565	0.310
14.005	10.250	28.1	450	1 STANDARD	93.025	92.265	0.310	92.660	91.900	0.310
19.000	6.520	144.9	225	1 STANDARD	93.146	92.170	0.751	92.660	92.125	0.310
14.006	16.220	162.2	450	1 STANDARD	92.660	91.900	0.310	93.100	91.800	0.850
20.000	4.030	5.0	225	1 STANDARD	94.217	93.225	0.767	93.100	92.425	0.450
1.007	3.920	65.3	225	1 STANDARD	93.100	91.650	1.225	92.122	91.590	0.307

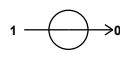
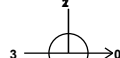
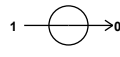
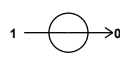
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
5.000	S108	1200	Manhole	1 STANDARD	S110	1500	Manhole	1 STANDARD
6.000	S109	1500	Manhole	1 STANDARD	S110	1500	Manhole	1 STANDARD
1.006	S110	1500	Manhole	1 STANDARD	ATTENUATION	1200	Manhole	1 STANDARD
7.000	S111	1200	Manhole	1 STANDARD	ATTENUATION	1200	Manhole	1 STANDARD
8.000	SP2	1200	Manhole	1 STANDARD	ATTENUATION	1200	Manhole	1 STANDARD
9.000	S113	1200	Manhole	1 STANDARD	S115	1200	Manhole	1 STANDARD
10.000	S114	1500	Manhole	1 STANDARD	S115	1200	Manhole	1 STANDARD
11.000	PPIC2	1200	Manhole	1 STANDARD	S115	1200	Manhole	1 STANDARD
9.001	S115	1200	Manhole	1 STANDARD	ATTENUATION	1200	Manhole	1 STANDARD
12.000	S112	1200	Manhole	1 STANDARD	ATTENUATION	1200	Manhole	1 STANDARD
13.000	SP3	1200	Manhole	1 STANDARD	ATTENUATION	1200	Manhole	1 STANDARD
14.000	SP7	1200	Manhole	1 STANDARD	S117	1500	Manhole	1 STANDARD
15.000	SP6	1200	Manhole	1 STANDARD	S117	1500	Manhole	1 STANDARD
14.001	S117	1500	Manhole	1 STANDARD	S119	1500	Manhole	1 STANDARD
16.000	S118	1200	Manhole	1 STANDARD	S119	1500	Manhole	1 STANDARD
14.002	S119	1500	Manhole	1 STANDARD	S121	1200	Manhole	1 STANDARD
17.000	S120	1500	Manhole	1 STANDARD	S121	1200	Manhole	1 STANDARD
14.003	S121	1200	Manhole	1 STANDARD	S122	1500	Manhole	1 STANDARD
14.004	S122	1500	Manhole	1 STANDARD	S123	1500	Manhole	1 STANDARD
18.000	SP5	1200	Manhole	1 STANDARD	S123	1500	Manhole	1 STANDARD
14.005	S123	1500	Manhole	1 STANDARD	S124	150	Manhole	1 STANDARD
19.000	SP4	1200	Manhole	1 STANDARD	S124	150	Manhole	1 STANDARD
14.006	S124	150	Manhole	1 STANDARD	ATTENUATION	1200	Manhole	1 STANDARD
20.000	S116	1200	Manhole	1 STANDARD	ATTENUATION	1200	Manhole	1 STANDARD
1.007	ATTENUATION	1200	Manhole	1 STANDARD	S126	1500	Manhole	1 STANDARD

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.008	4.430	73.8	225	1 STANDARD	92.122	91.590	0.307	92.505	91.530	0.750

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.008	S126	1500	Manhole	1 STANDARD	HEADWALL		Manhole	1 STANDARD

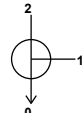
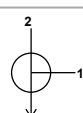
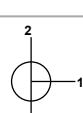
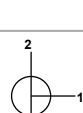
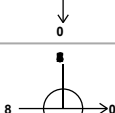
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
S100	60.810	663.505	96.706	0.981	1200					
						0	1.000	95.725	225	
S101	63.180	663.505	96.667	0.962	1200		1	1.000	95.705	225
						0	1.001	95.705	225	
S102	98.160	666.015	96.667	0.782	1200					
						0	2.000	95.885	225	
S103	98.160	663.505	96.826	1.431	1500		1	2.000	95.470	225
						2	1.001	95.470	225	
						0	1.002	95.395	300	
S104	136.260	667.845	96.940	0.980	1200					
						0	3.000	95.960	225	
SP1	136.260	665.085	96.900	0.900	1200					
						0	4.000	96.000	150	
S105	136.260	663.505	96.928	1.788	1500		1	4.000	95.290	150
						2	3.000	95.215	225	
						3	1.002	95.140	300	
						0	1.003	95.140	300	
S106	145.090	663.505	95.984	0.904	1500		1	1.003	95.080	300
						0	1.004	95.080	300	
S107	161.340	663.505	97.038	2.068	1200		1	1.004	94.970	300
						0	1.005	94.970	300	
S108	207.020	667.705	97.087	0.982	1200					
						0	5.000	96.105	225	

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
S109	207.020	690.505	96.365	1.065	1500		0	6.000	95.300	300
S110	207.020	663.505	97.016	2.426	1500		1 2 3 0	6.000 5.000 1.005 1.006	94.665 94.740 94.665 94.590	300 225 300 375
S111	209.910	665.585	97.087	1.087	1200		0	7.000	96.000	225
SP2	209.910	665.745	96.831	1.031	1200		0	8.000	95.800	150
S113	209.910	688.665	96.485	1.010	1200		0	9.000	95.475	225
S114	224.280	672.195	96.345	1.050	1500		0	10.000	95.295	300
PPIC2	218.600	672.195	96.161	0.761	1200		0	11.000	95.400	150
S115	209.910	672.195	96.708	1.708	1200		1 2 3 0	11.000 10.000 9.000 9.001	95.150 95.000 95.075 95.000	150 300 225 300
S112	209.910	665.585	96.750	0.995	1200		0	12.000	95.755	225
SP3	209.910	665.015	94.175	0.985	1200		0	13.000	93.190	225
SP7	209.910	793.125	95.630	0.975	1200		0	14.000	94.655	225
SP6	217.130	783.205	95.411	0.976	1200		0	15.000	94.435	225
S117	209.910	783.205	95.425	1.115	1500		1 2 0	15.000 14.000 14.001	94.385 94.385 94.310	225 225 300

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S118	217.010	755.235	95.630	0.990	1200	 0	16.000	94.640	225
S119	209.910	755.235	95.445	1.395	1500	 1 2 0	16.000 14.001 14.002	94.200 94.125 94.050	225 300 375
S120	214.040	732.325	95.152	1.042	1500	 0	17.000	94.110	225
S121	209.910	732.325	95.283	1.388	1200	 2 1 0	17.000 14.002 14.003	94.045 93.895 93.895	225 375 375
S122	209.910	718.375	94.729	1.004	1500	 1 0	14.003 14.004	93.800 93.725	375 450
SP5	217.410	689.975	93.540	0.900	1200	 0	18.000	92.640	150
S123	209.910	689.975	93.025	0.760	1500	 2 1 0	18.000 14.004 14.005	92.565 92.265 92.265	150 450 450
SP4	216.430	679.725	93.146	0.976	1200	 0	19.000	92.170	225
S124	209.910	679.725	92.660	0.760	150	 2 1 0	19.000 14.005 14.006	92.125 91.900 91.900	225 450 450
S116	209.910	667.535	94.217	0.992	1200	 0	20.000	93.225	225
ATTENUATION	209.910	663.505	93.100	1.450	1200	 1 2 3 4 5 6 7 8 0	20.000 14.006 13.000 12.000 9.001 8.000 7.000 1.006 1.007	92.425 91.800 92.425 92.225 92.350 92.300 92.425 92.275 91.650	225 450 225 225 300 150 225 375 225
S126	213.830	663.505	92.122	0.532	1500	 1 0	1.007 1.008	91.590 91.590	225 225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
HEADWALL	218.260	663.505	92.505	0.975		1	1.008	91.530	225
									

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.350	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	20	0	0
100	25	0	0

Node S126 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	91.590	Product Number	CTL-SHE-0150-1180-1510-1180
Design Depth (m)	1.510	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	11.8	Min Node Diameter (mm)	1500

Node S100 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	96.270	Slope (1:X)	60.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	0.350
Safety Factor	2.0	Width (m)	32.800	Inf Depth (m)	
Porosity	0.30	Length (m)	4.800		

Node S102 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	96.430	Slope (1:X)	60.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.350
Safety Factor	2.0	Width (m)	32.800	Inf Depth (m)	
Porosity	0.30	Length (m)	4.800		

Node S104 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	96.505	Slope (1:X)	63.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	0.350
Safety Factor	2.0	Width (m)	32.500	Inf Depth (m)	
Porosity	0.30	Length (m)	4.800		

Node S108 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	96.650	Slope (1:X)	59.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	0.350
Safety Factor	2.0	Width (m)	39.200	Inf Depth (m)	
Porosity	0.30	Length (m)	4.500		

Node S109 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	95.920	Slope (1:X)	35.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	0.350
Safety Factor	2.0	Width (m)	26.800	Inf Depth (m)	
Porosity	0.30	Length (m)	24.000		

Node S111 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	96.650	Slope (1:X)	59.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	0.350
Safety Factor	2.0	Width (m)	39.200	Inf Depth (m)	
Porosity	0.30	Length (m)	4.800		

Node S113 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	96.020	Slope (1:X)	60.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	0.350
Safety Factor	2.0	Width (m)	39.000	Inf Depth (m)	
Porosity	0.30	Length (m)	4.800		

Node S114 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	95.935	Slope (1:X)	60.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	0.350
Safety Factor	2.0	Width (m)	38.500	Inf Depth (m)	
Porosity	0.30	Length (m)	4.800		

Node PPIC2 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	95.730	Slope (1:X)	24.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	0.350
Safety Factor	2.0	Width (m)	22.000	Inf Depth (m)	
Porosity	0.30	Length (m)	9.500		

Node S112 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	96.300	Slope (1:X)	61.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	0.350
Safety Factor	2.0	Width (m)	39.200	Inf Depth (m)	
Porosity	0.30	Length (m)	4.800		

Node S118 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	95.185	Slope (1:X)	40.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	0.350
Safety Factor	2.0	Width (m)	45.000	Inf Depth (m)	
Porosity	0.30	Length (m)	4.800		

Node S120 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	94.720	Slope (1:X)	40.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	0.350
Safety Factor	2.0	Width (m)	36.000	Inf Depth (m)	
Porosity	0.30	Length (m)	4.800		

Node S116 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	93.770	Slope (1:X)	60.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	0.350
Safety Factor	2.0	Width (m)	45.800	Inf Depth (m)	
Porosity	0.30	Length (m)	4.800		

Node ATTENUATION Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	91.650
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.60	Time to half empty (mins)	80

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	670.0	0.0	1.150	670.0	0.0	1.151	0.0	0.0

Node ATTENUATION Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	91.650
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	48

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	180.6	0.0	1.450	485.0	0.0	1.451	0.0	0.0

Node ATTENUATION Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	91.650
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	80

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	342.0	0.0	1.200	342.0	0.0	1.210	0.0	0.0

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 15 minute summer	104.776	29.648
1 year 15 minute winter	73.527	29.648
1 year 30 minute summer	69.713	19.726
1 year 30 minute winter	48.921	19.726
1 year 60 minute summer	48.435	12.800
1 year 60 minute winter	32.179	12.800
1 year 120 minute summer	30.864	8.156
1 year 120 minute winter	20.505	8.156
1 year 180 minute summer	24.256	6.242
1 year 180 minute winter	15.767	6.242
1 year 240 minute summer	19.505	5.155

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 240 minute winter	12.959	5.155
1 year 360 minute summer	15.148	3.898
1 year 360 minute winter	9.846	3.898
1 year 480 minute summer	12.095	3.196
1 year 480 minute winter	8.036	3.196
1 year 600 minute summer	10.019	2.740
1 year 600 minute winter	6.846	2.740
1 year 720 minute summer	9.018	2.417
1 year 720 minute winter	6.061	2.417
1 year 960 minute summer	7.530	1.983
1 year 960 minute winter	4.988	1.983
1 year 1440 minute summer	5.600	1.501
1 year 1440 minute winter	3.764	1.501
1 year 2160 minute summer	4.103	1.134
1 year 2160 minute winter	2.827	1.134
1 year 2880 minute summer	3.470	0.930
1 year 2880 minute winter	2.332	0.930
1 year 4320 minute summer	2.692	0.704
1 year 4320 minute winter	1.773	0.704
1 year 5760 minute summer	2.259	0.578
1 year 5760 minute winter	1.462	0.578
1 year 7200 minute summer	1.941	0.495
1 year 7200 minute winter	1.253	0.495
1 year 8640 minute summer	1.708	0.436
1 year 8640 minute winter	1.102	0.436
1 year 10080 minute summer	1.533	0.391
1 year 10080 minute winter	0.989	0.391
30 year +20% CC 15 minute summer	308.229	87.218
30 year +20% CC 15 minute winter	216.301	87.218
30 year +20% CC 30 minute summer	205.098	58.036
30 year +20% CC 30 minute winter	143.928	58.036
30 year +20% CC 60 minute summer	139.907	36.973
30 year +20% CC 60 minute winter	92.951	36.973
30 year +20% CC 120 minute summer	86.440	22.843
30 year +20% CC 120 minute winter	57.429	22.843
30 year +20% CC 180 minute summer	66.176	17.029
30 year +20% CC 180 minute winter	43.016	17.029
30 year +20% CC 240 minute summer	52.070	13.761
30 year +20% CC 240 minute winter	34.594	13.761
30 year +20% CC 360 minute summer	39.606	10.192
30 year +20% CC 360 minute winter	25.745	10.192
30 year +20% CC 480 minute summer	31.125	8.226
30 year +20% CC 480 minute winter	20.679	8.226
30 year +20% CC 600 minute summer	25.449	6.961
30 year +20% CC 600 minute winter	17.388	6.961
30 year +20% CC 720 minute summer	22.651	6.071
30 year +20% CC 720 minute winter	15.223	6.071
30 year +20% CC 960 minute summer	18.565	4.889
30 year +20% CC 960 minute winter	12.298	4.889
30 year +20% CC 1440 minute summer	13.425	3.598
30 year +20% CC 1440 minute winter	9.022	3.598
30 year +20% CC 2160 minute summer	9.567	2.644

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
30 year +20% CC 2160 minute winter	6.592	2.644
30 year +20% CC 2880 minute summer	7.922	2.123
30 year +20% CC 2880 minute winter	5.324	2.123
30 year +20% CC 4320 minute summer	5.954	1.557
30 year +20% CC 4320 minute winter	3.921	1.557
30 year +20% CC 5760 minute summer	4.875	1.248
30 year +20% CC 5760 minute winter	3.155	1.248
30 year +20% CC 7200 minute summer	4.123	1.052
30 year +20% CC 7200 minute winter	2.661	1.052
30 year +20% CC 8640 minute summer	3.586	0.915
30 year +20% CC 8640 minute winter	2.314	0.915
30 year +20% CC 10080 minute summer	3.187	0.813
30 year +20% CC 10080 minute winter	2.057	0.813
100 year +25% CC 15 minute summer	416.036	117.724
100 year +25% CC 15 minute winter	291.955	117.724
100 year +25% CC 30 minute summer	279.456	79.076
100 year +25% CC 30 minute winter	196.109	79.076
100 year +25% CC 60 minute summer	191.610	50.637
100 year +25% CC 60 minute winter	127.301	50.637
100 year +25% CC 120 minute summer	118.262	31.253
100 year +25% CC 120 minute winter	78.571	31.253
100 year +25% CC 180 minute summer	90.117	23.190
100 year +25% CC 180 minute winter	58.578	23.190
100 year +25% CC 240 minute summer	70.534	18.640
100 year +25% CC 240 minute winter	46.861	18.640
100 year +25% CC 360 minute summer	53.312	13.719
100 year +25% CC 360 minute winter	34.654	13.719
100 year +25% CC 480 minute summer	41.695	11.019
100 year +25% CC 480 minute winter	27.701	11.019
100 year +25% CC 600 minute summer	33.956	9.288
100 year +25% CC 600 minute winter	23.201	9.288
100 year +25% CC 720 minute summer	30.122	8.073
100 year +25% CC 720 minute winter	20.244	8.073
100 year +25% CC 960 minute summer	24.551	6.465
100 year +25% CC 960 minute winter	16.263	6.465
100 year +25% CC 1440 minute summer	17.604	4.718
100 year +25% CC 1440 minute winter	11.831	4.718
100 year +25% CC 2160 minute summer	12.431	3.435
100 year +25% CC 2160 minute winter	8.565	3.435
100 year +25% CC 2880 minute summer	10.222	2.739
100 year +25% CC 2880 minute winter	6.870	2.739
100 year +25% CC 4320 minute summer	7.602	1.988
100 year +25% CC 4320 minute winter	5.006	1.988
100 year +25% CC 5760 minute summer	6.175	1.581
100 year +25% CC 5760 minute winter	3.997	1.581
100 year +25% CC 7200 minute summer	5.192	1.324
100 year +25% CC 7200 minute winter	3.351	1.324
100 year +25% CC 8640 minute summer	4.495	1.147
100 year +25% CC 8640 minute winter	2.901	1.147
100 year +25% CC 10080 minute summer	3.979	1.015
100 year +25% CC 10080 minute winter	2.568	1.015

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.87%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S100	10	95.818	0.093	12.7	0.2825	0.0000	OK
15 minute winter	S101	11	95.789	0.084	12.5	0.0953	0.0000	OK
15 minute winter	S102	10	95.928	0.043	12.7	0.1513	0.0000	OK
15 minute winter	S103	11	95.500	0.105	24.4	0.1859	0.0000	OK
15 minute winter	S104	10	95.994	0.034	10.8	0.0938	0.0000	OK
15 minute winter	SP1	10	96.023	0.023	4.9	0.0449	0.0000	OK
15 minute winter	S105	11	95.297	0.157	39.4	0.2769	0.0000	OK
15 minute winter	S106	11	95.229	0.149	39.6	0.2630	0.0000	OK
15 minute winter	S107	12	95.111	0.141	39.5	0.1590	0.0000	OK
15 minute winter	S108	10	96.136	0.031	10.3	0.0818	0.0000	OK
15 minute winter	S109	10	95.376	0.076	22.9	0.3746	0.0000	OK
15 minute winter	S110	11	94.652	0.062	69.8	0.1098	0.0000	OK
15 minute winter	S111	10	96.021	0.021	10.3	0.0527	0.0000	OK
15 minute winter	SP2	10	95.810	0.010	1.8	0.0138	0.0000	OK
15 minute winter	S113	10	95.531	0.056	10.4	0.1482	0.0000	OK
15 minute winter	S114	10	95.378	0.083	22.0	0.4034	0.0000	OK
15 minute winter	PPIC2	10	95.442	0.042	4.9	0.0883	0.0000	OK
15 minute winter	S115	10	95.053	0.053	36.8	0.0597	0.0000	OK
15 minute winter	S112	10	95.776	0.021	10.3	0.0556	0.0000	OK
15 minute winter	SP3	10	93.216	0.026	7.7	0.0586	0.0000	OK
15 minute winter	SP7	10	94.711	0.056	10.7	0.1547	0.0000	OK
15 minute winter	SP6	10	94.521	0.086	11.7	0.2500	0.0000	OK
15 minute winter	S117	11	94.413	0.103	22.0	0.1827	0.0000	OK
15 minute winter	S118	10	94.687	0.047	10.9	0.1292	0.0000	OK
15 minute winter	S119	11	94.168	0.118	32.3	0.2080	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S100	1.000	S101	12.5	0.871	0.261	0.0341	
15 minute winter	S101	1.001	S103	12.3	0.922	0.289	0.4661	
15 minute winter	S102	2.000	S103	12.6	2.662	0.059	0.0119	
15 minute winter	S103	1.002	S105	24.5	0.829	0.270	1.1286	
15 minute winter	S104	3.000	S105	10.8	2.295	0.050	0.0361	
15 minute winter	SP1	4.000	S105	4.9	3.111	0.041	0.0025	
15 minute winter	S105	1.003	S106	39.6	1.098	0.433	0.3183	
15 minute winter	S106	1.004	S107	39.5	1.181	0.433	0.5458	
15 minute winter	S107	1.005	S110	38.9	1.230	0.430	1.4468	
15 minute winter	S108	5.000	S110	10.2	3.381	0.034	0.0128	
15 minute winter	S109	6.000	S110	22.4	1.657	0.131	0.3655	
15 minute winter	S110	1.006	ATTENUATION	69.8	7.326	0.039	0.0278	
15 minute winter	S111	7.000	ATTENUATION	10.3	5.950	0.015	0.0036	
15 minute winter	SP2	8.000	ATTENUATION	1.8	3.706	0.008	0.0011	
15 minute winter	S113	9.000	S115	10.2	1.374	0.126	0.1227	
15 minute winter	S114	10.000	S115	21.7	1.822	0.136	0.1733	
15 minute winter	PPIC2	11.000	S115	4.8	1.217	0.159	0.0344	
15 minute winter	S115	9.001	ATTENUATION	36.6	4.654	0.059	0.0684	
15 minute winter	S112	12.000	ATTENUATION	10.3	5.921	0.015	0.0036	
15 minute winter	SP3	13.000	ATTENUATION	7.7	3.480	0.021	0.0033	
15 minute winter	SP7	14.000	S117	10.5	1.422	0.123	0.0736	
15 minute winter	SP6	15.000	S117	11.5	0.876	0.266	0.0947	
15 minute winter	S117	14.001	S119	21.9	1.044	0.242	0.5859	
15 minute winter	S118	16.000	S119	10.8	1.907	0.083	0.0403	
15 minute winter	S119	14.002	S121	32.5	0.927	0.198	0.8061	

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.87%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S120	10	94.195	0.085	15.4	0.3354	0.0000	OK
15 minute winter	S121	11	94.044	0.149	47.3	0.1687	0.0000	OK
15 minute winter	S122	11	93.814	0.089	63.8	0.6519	0.0000	OK
15 minute winter	SP5	10	92.691	0.051	4.0	0.0912	0.0000	OK
15 minute winter	S123	11	92.371	0.106	67.5	0.1876	0.0000	OK
15 minute winter	SP4	10	92.235	0.065	6.9	0.1406	0.0000	OK
15 minute winter	S124	11	92.080	0.180	73.9	0.0032	0.0000	OK
15 minute winter	S116	10	93.257	0.032	8.9	0.0792	0.0000	OK
360 minute winter	ATTENUATION	280	91.928	0.278	45.9	261.0033	0.0000	SURCHARGED
360 minute winter	S126	280	91.924	0.334	11.2	0.5895	0.0000	FLOOD RISK
360 minute winter	HEADWALL	280	91.595	0.065	11.2	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S120	17.000	S121	15.2	1.220	0.232	0.0514	
15 minute winter	S121	14.003	S122	47.7	1.241	0.289	0.5359	
15 minute winter	S122	14.004	S123	63.7	2.524	0.087	0.7177	
15 minute winter	SP5	18.000	S123	3.9	0.781	0.221	0.0378	
15 minute winter	S123	14.005	S124	67.3	1.555	0.110	0.4492	
15 minute winter	SP4	19.000	S124	6.8	0.759	0.157	0.0582	
15 minute winter	S124	14.006	ATTENUATION	73.4	1.329	0.290	0.8990	
15 minute winter	S116	20.000	ATTENUATION	8.9	2.695	0.038	0.0132	
360 minute winter	ATTENUATION	1.007	S126	11.2	0.514	0.174	0.1559	
360 minute winter	S126	1.008	HEADWALL	11.2	1.080	0.185	0.0461	288.2

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 99.87%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S100	12	95.956	0.231	37.3	0.7039	0.0000	SURCHARGED
15 minute winter	S101	12	95.933	0.228	36.6	0.2584	0.0000	SURCHARGED
15 minute winter	S102	11	95.960	0.075	37.3	0.2649	0.0000	OK
15 minute winter	S103	11	95.795	0.400	73.1	0.7068	0.0000	SURCHARGED
15 minute winter	S104	10	96.018	0.058	31.7	0.1595	0.0000	OK
15 minute winter	SP1	11	96.037	0.037	14.3	0.0706	0.0000	OK
15 minute winter	S105	11	95.651	0.511	106.8	0.9021	0.0000	SURCHARGED
15 minute winter	S106	12	95.520	0.440	105.2	0.7768	0.0000	SURCHARGED
15 minute winter	S107	12	95.328	0.358	103.4	0.4047	0.0000	SURCHARGED
15 minute winter	S108	10	96.160	0.055	30.2	0.1464	0.0000	OK
15 minute winter	S109	10	95.438	0.138	67.5	0.6834	0.0000	OK
15 minute winter	S110	11	94.708	0.118	192.1	0.2080	0.0000	OK
15 minute winter	S111	10	96.037	0.037	30.2	0.0940	0.0000	OK
15 minute winter	SP2	10	95.817	0.017	5.2	0.0232	0.0000	OK
15 minute winter	S113	10	95.577	0.102	30.6	0.2697	0.0000	OK
15 minute winter	S114	10	95.447	0.152	64.7	0.7381	0.0000	OK
15 minute winter	PPIC2	10	95.479	0.079	14.3	0.1638	0.0000	OK
15 minute winter	S115	10	95.096	0.096	108.4	0.1084	0.0000	OK
15 minute winter	S112	10	95.792	0.037	30.2	0.0992	0.0000	OK
15 minute winter	SP3	10	93.238	0.048	22.6	0.1090	0.0000	OK
15 minute winter	SP7	10	94.757	0.102	31.4	0.2793	0.0000	OK
15 minute winter	SP6	10	94.605	0.170	34.5	0.4953	0.0000	OK
15 minute winter	S117	10	94.509	0.199	65.1	0.3512	0.0000	OK
15 minute winter	S118	10	94.724	0.084	32.1	0.2335	0.0000	OK
15 minute winter	S119	11	94.284	0.234	95.6	0.4135	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S100	1.000	S101	36.6	1.098	0.768	0.0943	
15 minute winter	S101	1.001	S103	36.1	1.134	0.849	1.3912	
15 minute winter	S102	2.000	S103	37.0	2.882	0.174	0.0644	
15 minute winter	S103	1.002	S105	63.4	0.963	0.699	2.6830	
15 minute winter	S104	3.000	S105	31.6	2.304	0.146	0.1037	
15 minute winter	SP1	4.000	S105	14.2	3.213	0.118	0.0165	
15 minute winter	S105	1.003	S106	105.2	1.493	1.150	0.6218	
15 minute winter	S106	1.004	S107	103.4	1.468	1.133	1.1443	
15 minute winter	S107	1.005	S110	102.2	1.469	1.127	3.0285	
15 minute winter	S108	5.000	S110	30.1	4.459	0.101	0.0284	
15 minute winter	S109	6.000	S110	66.4	2.200	0.389	0.8155	
15 minute winter	S110	1.006	ATTENUATION	192.1	8.780	0.107	0.0641	
15 minute winter	S111	7.000	ATTENUATION	30.1	7.815	0.044	0.0080	
15 minute winter	SP2	8.000	ATTENUATION	5.2	5.031	0.023	0.0023	
15 minute winter	S113	9.000	S115	30.2	1.822	0.372	0.2732	
15 minute winter	S114	10.000	S115	64.1	2.340	0.401	0.3955	
15 minute winter	PPIC2	11.000	S115	14.1	1.592	0.467	0.0771	
15 minute winter	S115	9.001	ATTENUATION	108.1	6.125	0.175	0.1535	
15 minute winter	S112	12.000	ATTENUATION	30.1	7.777	0.044	0.0081	
15 minute winter	SP3	13.000	ATTENUATION	22.5	4.431	0.060	0.0077	
15 minute winter	SP7	14.000	S117	31.2	1.706	0.362	0.1971	
15 minute winter	SP6	15.000	S117	33.9	1.129	0.785	0.2164	
15 minute winter	S117	14.001	S119	64.2	1.356	0.712	1.3244	
15 minute winter	S118	16.000	S119	32.1	2.456	0.246	0.0954	
15 minute winter	S119	14.002	S121	95.6	1.143	0.582	1.9068	

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 99.87%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S120	10	94.280	0.170	45.2	0.6708	0.0000	OK
15 minute winter	S121	11	94.194	0.299	138.7	0.3379	0.0000	OK
15 minute winter	S122	11	93.878	0.153	187.3	1.1272	0.0000	OK
15 minute winter	SP5	10	92.738	0.098	11.9	0.1762	0.0000	OK
15 minute winter	S123	11	92.491	0.226	198.7	0.3991	0.0000	OK
15 minute winter	SP4	11	92.296	0.126	20.2	0.2746	0.0000	OK
240 minute winter	S124	168	92.268	0.368	57.6	0.0066	0.0000	OK
15 minute winter	S116	10	93.283	0.058	26.2	0.1430	0.0000	OK
240 minute winter	ATTENUATION	172	92.267	0.617	160.7	602.3911	0.0000	SURCHARGED
600 minute winter	S126	315	92.122	0.532	57.7	0.9400	403.7776	FLOOD
120 minute summer	HEADWALL	186	91.597	0.067	11.8	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S120	17.000	S121	44.3	1.536	0.679	0.1234	
15 minute winter	S121	14.003	S122	139.9	1.591	0.849	1.2233	
15 minute winter	S122	14.004	S123	187.3	2.952	0.255	1.8076	
15 minute winter	SP5	18.000	S123	11.7	1.017	0.659	0.0863	
15 minute winter	S123	14.005	S124	198.2	1.811	0.324	1.1082	
15 minute winter	SP4	19.000	S124	19.4	0.978	0.451	0.1571	
240 minute winter	S124	14.006	ATTENUATION	56.9	1.159	0.225	2.4108	
15 minute winter	S116	20.000	ATTENUATION	26.1	3.548	0.112	0.0297	
240 minute winter	ATTENUATION	1.007	S126	68.1	1.712	1.057	0.1559	
600 minute winter	S126	1.008	HEADWALL	11.8	1.093	0.194	0.0478	487.4

Results for 100 year +25% CC Critical Storm Duration. Lowest mass balance: 99.87%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S100	13	96.346	0.621	50.4	3.5813	0.0000	SURCHARGED
15 minute winter	S101	12	96.320	0.615	40.6	0.6958	0.0000	SURCHARGED
15 minute winter	S102	12	96.236	0.351	50.4	1.2410	0.0000	SURCHARGED
15 minute winter	S103	12	96.193	0.798	73.6	1.4093	0.0000	SURCHARGED
15 minute winter	S104	11	96.070	0.110	42.9	0.3031	0.0000	OK
15 minute winter	SP1	11	96.082	0.082	19.3	0.1576	0.0000	OK
15 minute winter	S105	12	96.006	0.866	127.5	1.5308	0.0000	SURCHARGED
15 minute winter	S106	12	95.819	0.739	124.7	1.3058	0.0000	FLOOD RISK
15 minute winter	S107	12	95.536	0.566	122.7	0.6396	0.0000	SURCHARGED
15 minute winter	S108	10	96.170	0.065	40.7	0.1739	0.0000	OK
15 minute winter	S109	10	95.466	0.166	91.1	0.8241	0.0000	OK
15 minute winter	S110	11	94.730	0.140	245.8	0.2468	0.0000	OK
15 minute winter	S111	10	96.044	0.044	40.7	0.1116	0.0000	OK
15 minute winter	SP2	10	95.820	0.020	7.0	0.0270	0.0000	OK
15 minute winter	S113	10	95.597	0.122	41.2	0.3244	0.0000	OK
15 minute winter	S114	10	95.478	0.183	87.3	0.8911	0.0000	OK
15 minute winter	PPIC2	10	95.497	0.097	19.3	0.2007	0.0000	OK
15 minute winter	S115	10	95.115	0.115	146.3	0.1297	0.0000	OK
15 minute winter	S112	10	95.799	0.044	40.7	0.1178	0.0000	OK
15 minute winter	SP3	10	93.247	0.057	30.5	0.1315	0.0000	OK
15 minute winter	SP7	10	94.780	0.125	42.3	0.3439	0.0000	OK
15 minute winter	SP6	11	94.671	0.236	46.6	0.6884	0.0000	SURCHARGED
15 minute winter	S117	11	94.593	0.283	87.1	0.5007	0.0000	OK
15 minute winter	S118	10	94.735	0.095	43.4	0.2636	0.0000	OK
15 minute winter	S119	11	94.427	0.377	128.1	0.6665	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S100	1.000	S101	40.6	1.139	0.851	0.0943	
15 minute winter	S101	1.001	S103	46.9	1.179	1.103	1.3912	
15 minute winter	S102	2.000	S103	43.1	2.930	0.203	0.0998	
15 minute winter	S103	1.002	S105	76.6	1.088	0.844	2.6830	
15 minute winter	S104	3.000	S105	41.6	2.418	0.192	0.1280	
15 minute winter	SP1	4.000	S105	18.5	3.216	0.154	0.0216	
15 minute winter	S105	1.003	S106	124.7	1.770	1.363	0.6218	
15 minute winter	S106	1.004	S107	122.7	1.743	1.345	1.1443	
15 minute winter	S107	1.005	S110	123.0	1.749	1.357	3.1187	
15 minute winter	S108	5.000	S110	40.6	4.782	0.136	0.0357	
15 minute winter	S109	6.000	S110	89.7	2.358	0.525	1.0272	
15 minute winter	S110	1.006	ATTENUATION	245.8	9.072	0.136	0.0794	
15 minute winter	S111	7.000	ATTENUATION	40.6	8.360	0.059	0.0101	
15 minute winter	SP2	8.000	ATTENUATION	7.0	5.457	0.031	0.0029	
15 minute winter	S113	9.000	S115	40.7	1.952	0.501	0.3434	
15 minute winter	S114	10.000	S115	86.5	2.481	0.542	0.5010	
15 minute winter	PPIC2	11.000	S115	19.1	1.696	0.630	0.0977	
15 minute winter	S115	9.001	ATTENUATION	145.9	6.557	0.236	0.1935	
15 minute winter	S112	12.000	ATTENUATION	40.6	8.318	0.059	0.0102	
15 minute winter	SP3	13.000	ATTENUATION	30.4	4.691	0.082	0.0099	
15 minute winter	SP7	14.000	S117	41.9	1.713	0.487	0.3001	
15 minute winter	SP6	15.000	S117	45.2	1.182	1.047	0.2822	
15 minute winter	S117	14.001	S119	84.8	1.374	0.940	1.9484	
15 minute winter	S118	16.000	S119	43.3	2.511	0.333	0.1952	
15 minute winter	S119	14.002	S121	123.7	1.155	0.753	2.5263	

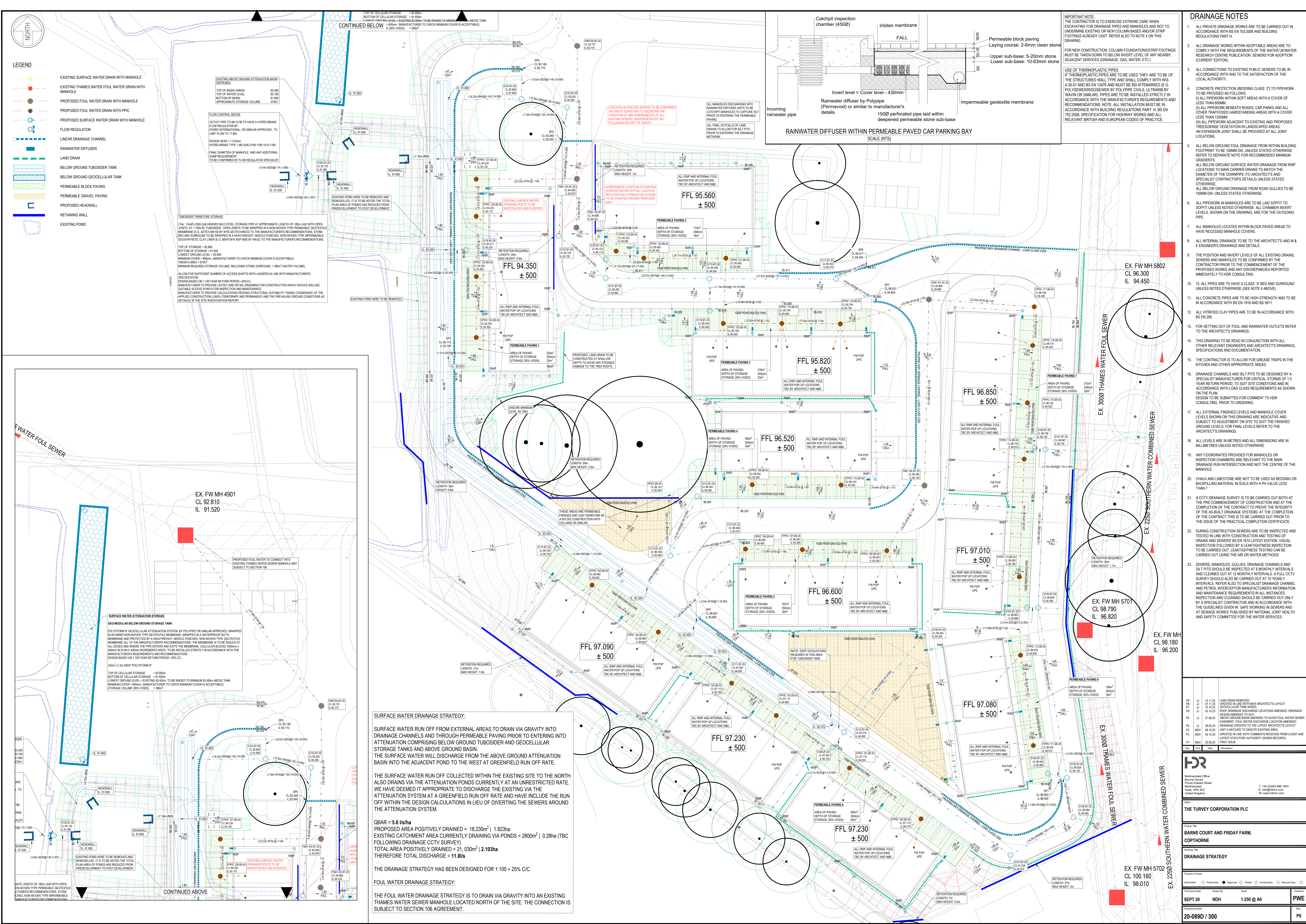
Results for 100 year +25% CC Critical Storm Duration. Lowest mass balance: 99.87%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S120	11	94.418	0.308	61.1	1.2188	0.0000	SURCHARGED
15 minute winter	S121	11	94.310	0.415	181.6	0.4697	0.0000	SURCHARGED
15 minute winter	S122	11	93.904	0.179	245.7	1.3151	0.0000	OK
15 minute winter	SP5	10	92.764	0.124	16.1	0.2231	0.0000	OK
15 minute winter	S123	11	92.542	0.277	261.1	0.4900	0.0000	OK
180 minute winter	SP4	132	92.433	0.263	6.9	0.5720	0.0000	SURCHARGED
240 minute winter	S124	160	92.468	0.568	78.1	0.0102	0.0000	FLOOD RISK
15 minute winter	S116	10	93.294	0.069	35.4	0.1707	0.0000	OK
180 minute winter	ATTENUATION	132	92.429	0.779	269.4	774.0272	0.0000	SURCHARGED
720 minute winter	S126	330	92.122	0.532	75.1	0.9400	778.7590	FLOOD
2160 minute winter	HEADWALL	1740	91.597	0.067	11.8	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S120	17.000	S121	57.8	1.564	0.885	0.1643	
15 minute winter	S121	14.003	S122	181.8	1.666	1.103	1.4530	
15 minute winter	S122	14.004	S123	245.7	3.048	0.334	2.2896	
15 minute winter	SP5	18.000	S123	15.8	1.072	0.888	0.1101	
15 minute winter	S123	14.005	S124	258.6	1.811	0.423	1.3373	
180 minute winter	SP4	19.000	S124	6.9	0.763	0.160	0.2593	
240 minute winter	S124	14.006	ATTENUATION	76.9	1.194	0.304	2.5700	
15 minute winter	S116	20.000	ATTENUATION	35.3	3.800	0.151	0.0375	
180 minute winter	ATTENUATION	1.007	S126	99.1	2.492	1.538	0.1559	
720 minute winter	S126	1.008	HEADWALL	11.8	1.093	0.194	0.0478	575.8

APPENDIX E

DRAINAGE STRATEGY DRAWINGS



LEGEND

- EXISTING SURFACE WATER DRAIN WITH MANHOLE
- EXISTING THAMES WATER FOL WATER DRAIN WITH MANHOLE
- PROPOSED FOUL WATER DRAIN WITH MANHOLE
- PROPOSED FOUL WATER DRAIN WITH PPIC
- PROPOSED SURFACE WATER DRAIN WITH MANHOLE
- FLOW REGULATOR
- LINEAR DRAINAGE CHANNEL
- RAINWATER DIFFUSER
- LAND DRAIN
- BELOW GROUND TUBSIDER TANK
- BELOW GROUND GEOCELLULAR TANK
- PERMEABLE BLOCK PAVING
- PERMEABLE GRAVEL PAVING
- PROPOSED HEADWALL
- RETAINING WALL
- EXISTING POND

DRAINAGE NOTES

- ALL PRIVATE DRAINAGE WORKS ARE TO BE CARRIED OUT IN ACCORDANCE WITH BS EN 752:2008 AND BUILDING REGULATIONS PART 4.
- ALL DRAINAGE WORKS WITHIN ADAPTABLE AREAS ARE TO COMPLY WITH THE REQUIREMENTS OF THE WATER UK/UKWATER RESEARCH CENTRE PUBLICATION 'SEWERS FOR ADOPTION' (CURRENT EDITION).
- ALL CONNECTIONS TO EXISTING PUBLIC SEWERS TO BE IN ACCORDANCE WITH AND TO THE SATISFACTION OF THE LOCAL AUTHORITY.
- CONCRETE PROTECTION (BEDDING CLASS 2) TO PIPEWORK TO BE PROVIDED AS FOLLOWS:
 - (i) ALL PIPEWORK WITHIN SOFT AREAS WITH A COVER OF LESS THAN 600MM.
 - (ii) ALL PIPEWORK BENEATH ROADS, CAR PARKS AND ALL OTHER TRAFFICED HARDSTANDING AREAS WITH A COVER LESS THAN 1200MM.
 - (iii) ALL PIPEWORK ADJACENT TO EXISTING AND PROPOSED TREES/VEGETATION IN LANDSCAPED AREAS.AN EXPANSION JOINT SHALL BE PROVIDED AT ALL JOINT LOCATIONS.
- ALL BELOW GROUND FOUL DRAINAGE FROM WITHIN BUILDING FOOTPRINT TO BE 100MM DIA. UNLESS STATED OTHERWISE. REFER TO SEPARATE NOTE FOR RECOMMENDED MINIMUM GRADIENTS.
- ALL BELOW GROUND SURFACE WATER DRAINAGE FROM RWP LOCATIONS TO MAIN CARRIER DRAINS TO MATCH THE DIAMETER OF THE DOWNPIPE (TO ARCHITECTS AND SPECIALIST CONTRACTORS DETAILS) UNLESS STATED OTHERWISE.
- ALL BELOW GROUND DRAINAGE FROM ROAD GULLIES TO BE 150MM DIA. UNLESS STATED OTHERWISE.
- ALL MANHOLES LOCATED WITHIN BLOCK PAVED AREAS TO HAVE RECESSED MANHOLE COVERS.
- ALL INTERNAL DRAINAGE TO BE TO THE ARCHITECTS AND M & E ENGINEERS DRAWINGS AND DETAILS.
- THE POSITION AND INVERT LEVELS OF ALL EXISTING DRAINS, SEWERS AND MANHOLES TO BE CONFIRMED BY THE CONTRACTOR PRIOR TO THE COMMENCEMENT OF THE PROPOSED WORKS AND ANY DISCREPANCIES REPORTED IMMEDIATELY TO HDR CONSULTING.
- ALL PIPES ARE TO HAVE A CLASS 'S' BED AND SURROUND UNLESS NOTED OTHERWISE (SEE NOTE ABOVE).
- ALL CONCRETE PIPES ARE TO BE HIGH STRENGTH AND TO BE IN ACCORDANCE WITH BS EN 1516 AND BS 5911.
- FOR SETTING OUT OF FOUL AND RAINWATER OUTLETS REFER TO THE ARCHITECTS DRAWINGS.
- THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEERS AND ARCHITECTS DRAWINGS, SPECIFICATIONS AND DOCUMENTATION.
- THE CONTRACTOR IS TO ALLOW FOR GREASE TRAPS IN THE KITCHEN AND OTHER APPROPRIATE AREAS.
- DRAINAGE CHANNELS AND SILT PITS TO BE DESIGNED BY A SPECIALIST MANUFACTURER FOR CRITICAL STORMS OF 1:5 YEAR RETURN PERIOD, TO SUIT SITE CONDITIONS AND IN ACCORDANCE WITH LOAD CLASS REQUIREMENTS AS SHOWN ON THE PLAN. DESIGN TO BE SUBMITTED FOR COMMENT TO HDR CONSULTING PRIOR TO ORDERING.
- ALL EXTERNAL FINISHED LEVELS AND MANHOLE COVER LEVELS SHOWN ON THIS DRAWING ARE INDICATIVE AND SUBJECT TO ADJUSTMENT ON SITE TO SUIT THE FINISHED GROUND LEVELS. FOR FINAL LEVELS REFER TO THE ARCHITECTS DRAWINGS.
- ALL LEVELS ARE IN METRES AND ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
- ANY COORDINATES PROVIDED FOR MANHOLES OR INSPECTION CHAMBERS ARE RELEVANT TO THE MAIN DRAINAGE RUN INTERSECTION AND NOT THE CENTRE OF THE MANHOLE.
- CHALK AND LIMESTONE ARE NOT TO BE USED AS BEDDING OR BACKFILLING MATERIAL IN SOILS WITH A PH VALUE LESS THAN 7.
- A CCTV DRAINAGE SURVEY IS TO BE CARRIED OUT BOTH AT THE PRE-COMMENCEMENT OF CONSTRUCTION AND AT THE COMPLETION OF THE CONTRACT TO PROVE THE INTEGRITY OF THE AS-BUILT DRAINAGE SYSTEMS. AT THE COMPLETION OF THE CONTRACT THIS IS TO BE CARRIED OUT PRIOR TO THE ISSUE OF THE PRACTICAL COMPLETION CERTIFICATE.
- DURING CONSTRUCTION SEWERS ARE TO BE INSPECTED AND TESTED IN LINE WITH CONSTRUCTION AND TESTING OF DRAINS AND SEWERS BS EN 1610 LATEST EDITION. VISUAL INSPECTION FOLLOWED BY A LEAKTIGHTNESS INSPECTION TO BE CARRIED OUT USING THE AIR OR WATER METHODS.
- SEWERS, MANHOLES, GULLIES, DRAINAGE CHANNELS AND SILT PITS SHOULD BE INSPECTED AT 6 MONTHLY INTERVALS AND CLEANED OUT AT 12 MONTHLY INTERVALS. A FULL CCTV SURVEY SHOULD ALSO BE CARRIED OUT AT 10 YEARLY INTERVALS. REFER ALSO TO SPECIALIST DRAINAGE CHANNEL AND PETROL INTERCEPTOR MANUFACTURERS INFORMATION AND MAINTENANCE REQUIREMENTS IN ALL INSTANCES. INSPECTION AND CLEANING SHOULD BE CARRIED OUT ONLY BY A SPECIALIST CONTRACTOR AND IN ACCORDANCE WITH THE GUIDELINES GIVEN IN 'SAFE WORKING IN SEWERS AND AT SEWAGE WORKS' PUBLISHED BY NATIONAL JOURNAL HEALTH AND SAFETY COMMITTEE FOR THE WATER SERVICES.

THE SURVEY CORPORATION PLC

DRAINAGE STRATEGY

Proposed of Issue

Information Preliminary Approved Tender Construction Record Copy

Drawn By: SEPT 20 NDH 1:250 @ A0 PWE

Scale: 1:250 @ A0

Page: P9

APPENDIX F

THAMES WATER PUBLIC SEWER RECORDS

Asset location search



Property Searches

HDR
Bourne House
Prince Edward Street
BERKHAMSTED
HP4 3EZ

Search address supplied Barns Court
Turners Hill Road
Crawley Down
Crawley
RH10 4HQ

Your reference 20-089

Our reference ALS/ALS Standard/2020_4264691

Search date 28 September 2020

Knowledge of features below the surface is essential for every development

The benefits of this knowledge not only include ensuring due diligence and avoiding risk, but also being able to ascertain the feasibility of any development.

Did you know that Thames Water Property Searches can also provide a variety of utility searches including a more comprehensive view of utility providers' assets (across up to 35-45 different providers), as well as more focused searches relating to specific major utility companies such as National Grid (gas and electric).

Contact us to find out more.



Thames Water Utilities Ltd
Property Searches, PO Box 3189, Slough SL1 4WW
DX 151280 Slough 13



searches@thameswater.co.uk
www.thameswater-propertysearches.co.uk



0845 070 9148

Search address supplied: Barns Court, Turners Hill Road, Crawley Down, Crawley, RH10 4HQ

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 search provides 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

Waste Water Services

Please provide a copy extract from the public sewer map.

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.

With regard to the fresh water supply, this site falls within the boundary of another water company. For more information, please redirect your enquiry to the following address:

South East Water
Rocfort Road
Snodland



Kent
ME6 5AH

Tel: 0845 301 0845

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.

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

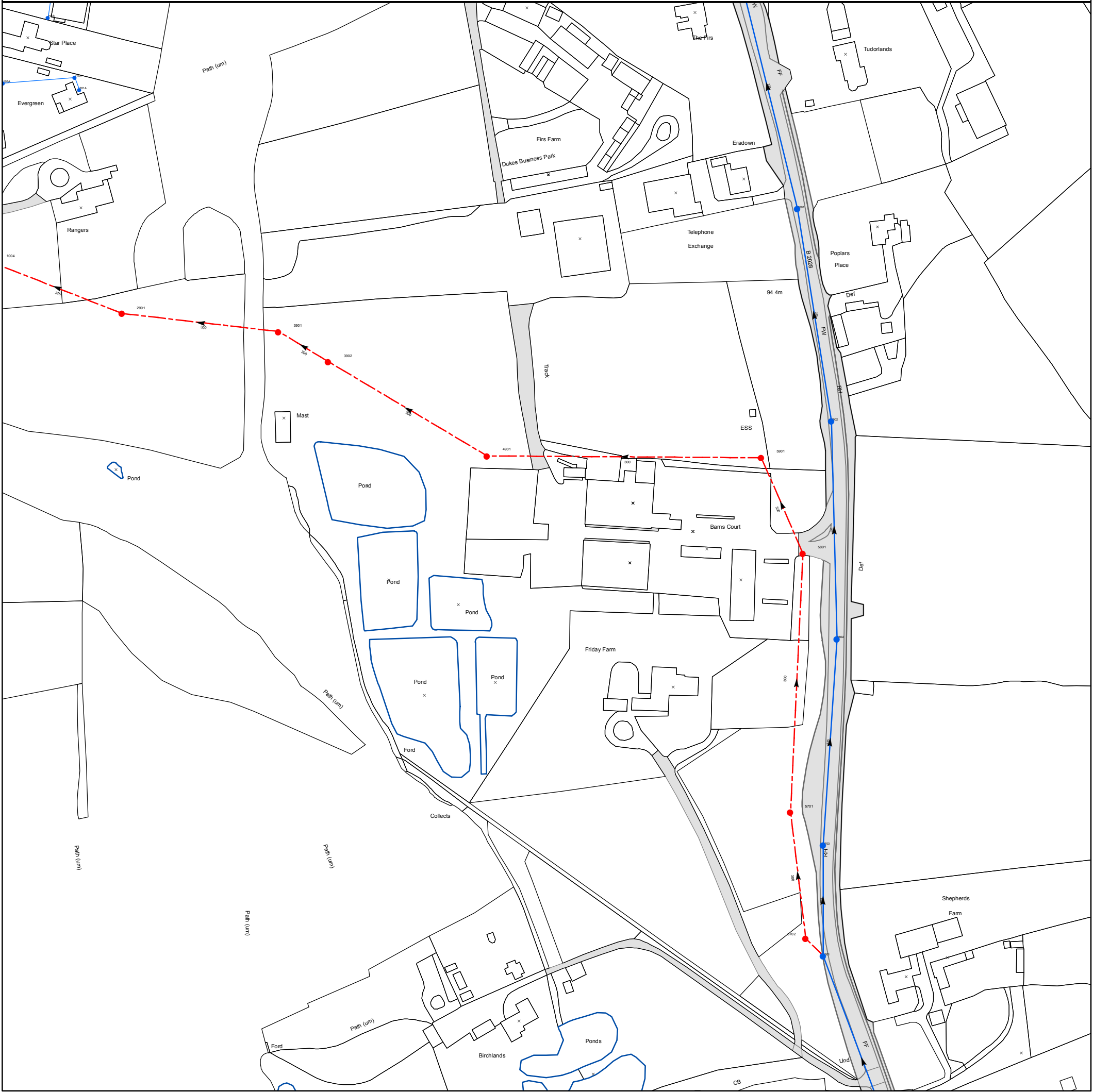
Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

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: 0800 009 3921
Email: developer.services@thameswater.co.uk



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 before any works are undertaken. Crown copyright Reserved

Scale: 1:1792
Width: 500m
Printed By: G1KANAGA
Print Date: 29/09/2020
Map Centre: 533438,138886
Grid Reference: TQ3338NW

Comments:

ALS/ALS Standard/2020_4264691

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL
5701	98.79	96.82
5702	100.16	98.01
2901	89.42	87.69
3902	91.28	89.44
101A		
5001	94.59	91.69
5902	95.11	92.29
5601	100.21	98.12
211B		

REFERENCE	COVER LEVEL	INVERT LEVEL
5801	95.92	94.62
5901	94.71	93.05
3901	90.94	88.95
4901	92.81	91.52
211A		
5703	98.18	96.2
5802	96.3	94.45
201A		



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

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.

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
	Gully
	Culverted Watercourse
	Proposed
	Abandoned Sewer

- 6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in millimetres. 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.

Terms and Conditions

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 0800 316 9800

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 her 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 / OSS	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.