



Flood Risk Assessment and Drainage Strategy

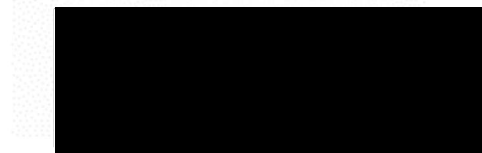
Project: Victoria Nurseries
Victoria Road
Wargrave
RG10 8AG

Client: Palatine Homes

Reference: S12488-JNP-XX-XX-RP-C-1001 P03

Date: December 2024

DOCUMENT CONTROL SHEET

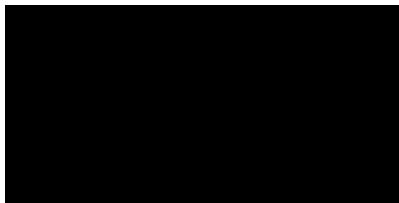


Prepared by.....

Sarah Longstaff

BSc (Hons) MSc FGS

Associate /



Approved by.....

Joe Tinsley-Hewson

BSc (Hons)

Engineer

FOR AND ON BEHALF OF JNP GROUP

Date: June 2025

Document Issue Record

Rev	Date	Description	Prepared	Checked	Approved
P01	November 24	First Issue	SLL	CS	JTH
P02	December 24	Updated for comments	JM	CS	SLL
P03	June 25	Site layout and drainage layout updated	CS	SLL	SLL

This document is for the sole use and reliance of JNP Group's Client and has been prepared in accordance with the scope of the appointment of JNP Group and is subject to the terms of that appointment.

JNP Group accepts no liability for any use of this document other than by its Client and only for the purposes for which it has been prepared.

No person other than the Client may copy (in whole or in part) or use the contents of this document, without the prior written permission of JNP Group.

Any advice, opinions or recommendations within this document should be read and relied upon only in the context of this document as a whole.

Any comments given within this document are based on the understanding that the proposed works to be undertaken will be as described in the introduction. The information referred to and provided by others and will be assumed to be correct and will not have been checked by JNP Group, JNP Group will not accept any liability or responsibility for any inaccuracy in such information.

Any deviation from the recommendations or conclusions contained in this document should be referred to JNP Group in writing for comment and JNP Group reserve the right to reconsider their recommendations and conclusions contained

within. JNP Group will not accept any liability or responsibility for any changes or deviations from the recommendations noted in this document without prior consultation and our full approval.

Contents

1	INTRODUCTION	1
1.1	Terms of Reference	1
1.2	Policy Framework and Key Stakeholders	1
1.3	Sources of Information.....	2
2	DEVELOPMENT SITE	4
2.1	Location	4
2.2	Current and historic land use	4
2.3	Topography	5
2.4	Geology.....	5
2.5	Hydrology	6
3	PROPOSED DEVELOPMENT.....	7
4	FLOOD RISK ASSESSMENT	8
4.1	Overview.....	8
4.2	Climate Change.....	8
4.3	Surface Water Flood Risk	8
4.4	Sewer Flood Risk.....	9
5	FLOOD RISK MANAGEMENT	11
5.1	Sequential and Exception Tests.....	11
5.2	Surface Water and Sewer Flood Risk	12
6	SURFACE WATER DRAINAGE STRATEGY	13
6.1	Existing Drainage	13
6.2	Hierarchy for Surface Water Disposal	13
6.3	Proposed Drainage Strategy.....	13
6.4	Sustainable Drainage Systems (SuDS)	14
6.5	Exceedance Events	17
6.6	Water Quality Management	17
6.7	Operation and Maintenance	17
6.8	Drainage During Construction.....	18
7	FOUL WATER DRAINAGE STRATEGY.....	20
8	CONCLUSIONS AND RECOMMENDATIONS.....	21
9	LIMITATIONS	23
APPENDIX A:	TOPOGRAPHICAL SURVEY	24
APPENDIX B:	PROPOSED DEVELOPMENT.....	25
APPENDIX C:	SEWER RECORDS.....	26
APPENDIX D:	FLOW RESULTS	27
APPENDIX E:	DRAINAGE LAYOUT – OPTION A (TO GROUND)	28
APPENDIX F:	OVERLAND FLOWS	29

1 INTRODUCTION

1.1 Terms of Reference

- 1.1.1 JNP Group has been commissioned by Palatine Homes to prepare a flood risk assessment and drainage strategy for the proposed residential development at Victoria Nurseries, Victoria Road, Wargrave.
- 1.1.2 This report assesses flood risk at the development site from all potential sources and describes the measures adopted in the master planning process to manage such risks. It has been prepared in compliance with current policies and best practices.
- 1.1.3 This report reviews the surface and foul water drainage hierarchy and proposes a drainage strategy. It describes the surface water drainage system and identifies management and maintenance tasks for the system. It also outlines a Surface Water Construction Management Plan for drainage during construction.

1.2 Policy Framework and Key Stakeholders

- 1.2.1 The *National Planning Policy Framework* (NPPF) 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.
- 1.2.2 The NPPF refers to the flood zones which are shown on the Environment Agency Flood Map, and establishes the range of uses which are appropriate, or comparable, land uses for each flood zone.
- 1.2.3 In decision making, local planning authorities must ensure a sequential approach to site selection and master planning is followed so that development is, as far as reasonably possible, located where the risk of flooding (from all sources) is lowest, taking account of climate change and the vulnerability of future users to flood risk.
- 1.2.4 Where development needs to be in locations where there is a risk of flooding, local planning authorities and developers must ensure development is appropriately flood resilient and resistant, safe for its users for the development's lifetime, and will not increase flood risk elsewhere.
- 1.2.5 The Environment Agency (EA) is a statutory consultee on applications where there is a risk of flooding from the sea or main rivers.
- 1.2.6 Lead local flood authorities (LLFAs) are responsible for managing local flood risk from ordinary watercourses, surface water or groundwater, and for preparing local flood risk management strategies. Local planning authorities (LPAs) work with lead local flood authorities to ensure local planning policies are compatible with the local flood risk management strategy.
- 1.2.7 Wokingham Brough Council is the LLFA and the local planning authority (LPA).
- 1.2.8 At the time of reporting, pre-planning advice has not been formally received from Thames Water however an informal telephone conversation had been undertaken.
- 1.2.9 Where relevant, local planning authorities and developers must also take advice from:

- Sewerage undertakers; to ensure they can assess the impact of new development on their assets and plan any required improvements. Thames Water (TW) is the local sewerage undertaker.
- Reservoir undertakers; to avoid an intensification of development within areas at risk from reservoir failure and ensure they can assess the cost implications of any reservoir safety improvements required due to change in land use downstream of their assets.
- Navigation authorities; in relation to developments adjacent to, or which discharge into, canals (especially where these are impounded above natural ground level).

1.3 Sources of Information

1.3.1 This flood risk assessment has been based on the following sources of information:

- Bespoke topographic survey undertaken by Compass Surveys in July 2024;
- British Geological Survey's GeoIndex Tool;
<http://mapapps2.bgs.ac.uk/geoindex/home.html>
- DEFRA / EA's aquifer and source protection data;
<https://magic.defra.gov.uk/MagicMap.aspx>
- Cranfield University's soils data;
[\(http://www.landis.org.uk/soilscapes/\)](http://www.landis.org.uk/soilscapes/)
- FEH's catchment data;
<https://fehweb.ceh.ac.uk/>
- EA's Flood Map for Planning;
<https://flood-map-for-planning.service.gov.uk/>
- EA's Long Term Flood Risk Information;
<https://flood-warning-information.service.gov.uk/long-term-flood-risk/map>
- Flood risk vulnerability classification
<https://www.gov.uk/guidance/national-planning-policy-framework/annex-3-flood-risk-vulnerability-classification>
- Flood risk assessments: climate change allowances
<https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>
- EA's Historic Flood Outlines;
<https://environment.data.gov.uk/DefraDataDownload/?mapService=EA/RecordedFloodOutlines&Mode=spatial>
<https://environment.data.gov.uk/DefraDataDownload/?mapService=EA/HistoricFloodMap&Mode=spatial>
- Non-Statutory Technical Standards for Sustainable Drainage Systems (March 2015) and The SuDS Manual (2015);

- Design and Construction Guidance (DCG) for foul and surface water sewers offered for adoption under the Code for adoption agreements for water and sewerage companies operating wholly or mainly in England (May 2021);
- Wokingham Borough Council Strategic Flood Risk Assessment
[Wokingham Borough Council Level 1 Strategic Flood Risk Assessment May 2023](#)

2 DEVELOPMENT SITE

2.1 Location

2.1.1 The site is located on Victoria Road, Wargrave as shown in Figure 2.1 and Table 2.1.

Figure 2.1: Site Location



Table 2.1: Site Location

OS X	OS Y	Site Area (ha)	Nearest Postcode
479262	178774	0.27	RG10 8AG

2.1.2 The site is currently utilised as a nursery with some sheds, a greenhouse and planting beds. All four boundaries of the site are residential or commercial buildings. To the south of the site is Victoria Road with further residential buildings beyond. The site generally slopes from the site entrance which is approximately 55.45m aOD to the north-west of the development at around 52.90m aOD.

2.1.3 The surrounding land uses are summarised in the following table.

Table 2.2: Surrounding Land Use

Direction	Land Use
North	Residential properties on Purfield Drive
East	Residential / commercial properties
South	Victoria Road, properties beyond
West	Residential / commercial properties

2.2 Current and historic land use

2.2.1 The site was undeveloped agricultural land throughout the 1870s until around the 1890s when Victoria Road was constructed and a small number of houses erected. By the 1910s

more houses had been built on Victoria Road and more development had taken place around Upper Wargrave.

- 2.2.2 In the 1960s the site is recorded as being used as a milk depot before then being used in its current capacity as a nursery.

2.3 Topography

- 2.3.1 Regionally, the topography is falling towards the west and the River Thames.
- 2.3.2 The available site topographical information is provided in **Appendix A** and shows that ground levels within the development site range between 55.45m aOD (above Ordnance Datum) and 52.87m aOD, falling with an average slope of 1:18 towards one prominent overland flow path across the north of the site. This flows from east to west along the northmost boundary of the site before joining the River Thames.

2.4 Geology

- 2.4.1 The geology of the site has been determined by reference to the 1:50,000 scale British Geological Survey (BGS) online Geoindex Tool.
- 2.4.2 No artificial or made ground is indicated to be present underlying the site. There are no superficial deposits beneath the site.
- 2.4.3 The underlying geology is indicated to be the Seaford and Newhaven Chalk Formation, which is described by the BGS as *"firm white chalk with conspicuous semi-continuous nodular and tabular flint seam"*.
- 2.4.4 Cranfield University's soils data indicates that soils on the site are classified as a freely draining slightly acidic but base-rich soils.
- 2.4.5 JNP Group have consulted online borehole records held by the BGS. There are no nearby boreholes with pertinent data.
- 2.4.6 The EA's Aquifer Maps indicate that the site is underlain by a Principal Aquifer. This refers to the Seaford and Newhaven Chalk Formation.
- 2.4.7 The EA define a Principal Aquifer as:
"Layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer."
- 2.4.8 The site's proximity to groundwater Source Protection Zones (SPZs) was determined by reference to the EA's website. These zones show the risk of contamination from any activities that might cause pollution in the area, with the closer the activity, the greater the associated risk. The maps show three main zones (inner, outer and total catchment) to a groundwater source.
- 2.4.9 The site lies within Zone II (Outer Protection) Source Protection Zone.
- 2.4.10 The definition of a SPZ II is:

“Defined by a 400-day travel time from a point below the water table. The previous methodology gave an option to define SPZII as the minimum recharge area required to support 25 per cent of the protected yield. This option is no longer available in defining new SPZs and instead this zone has a minimum radius of 250 or 500 metres around the source, depending on the size of the abstraction.”

2.4.11 Details on groundwater levels are not available.

2.4.12 Based on the available geological and hydrogeological information, namely soil and bedrock lithology, infiltration drainage may be feasible at the development site. Ground investigation will need to be completed to determine infiltration rates in the Chalk, whether there is sufficient unsaturated zone, and the strength of the Chalk and required offsets for soakaways from buildings and boundaries, to confirm if infiltration is a viable option.

2.5 Hydrology

2.5.1 The River Thames flows south to north approximately 750m to the west of the development site. It is classified by the EA as a ‘Main River’.

2.5.2 Based on the available hydrological information, discharge to a surface watercourse is deemed unfeasible at the development site.

3 PROPOSED DEVELOPMENT

- 3.1.1 The proposed development (as shown in Figure 3.1 and **Appendix B**) comprises 0.27 ha of residential development, including 0.14 ha of hard paved / impermeable surfaces (e.g. roofs, roads, driveways, parking areas, etc.) and 0.13 ha of soft paved / permeable surfaces (e.g. gardens, green corridors, public open spaces, etc.).
- 3.1.2 Under the Flood Risk and Coastal Change – Annexe 3: Flood Risk Vulnerability Classification, the proposed residential development is classified as more vulnerable.

Figure 3.1: Proposed Development



4 FLOOD RISK ASSESSMENT

4.1 Overview

- 4.1.1 All potential sources of flood risk at the development site have been assessed based on the information listed in Section 1.3 and are summarised below. The key sources of flood risk to the proposed development are further described in the ensuing sections.

Table 4.1: Potential Sources of Flood Risk

Source	Flood Risk
<i>Coastal</i>	<i>No risk, site elevation approximately 53m aOD.</i>
<i>Fluvial</i>	<i>Low risk. Flood zone 1 across the whole of the site.</i>
Surface Water	Low to medium risk across the majority of the site with high risk along the overland flow path in the north of the site. Refer to Section 4.3.
<i>Groundwater</i>	<i>Low risk. Wokingham SFRA states there is a <25% susceptibility to ground water emergence, the EA state that groundwater flooding is unlikely in this area.</i>
Sewers	Existing 675mm surface water sewer crossing the north of the site. DG5 register indicates no sewer flooding incidents in the area. Refer to Section 4.4.
<i>Infrastructure Failure</i>	<i>EA indicate very low risk, flooding from reservoirs is unlikely in this area.</i>

4.2 Climate Change

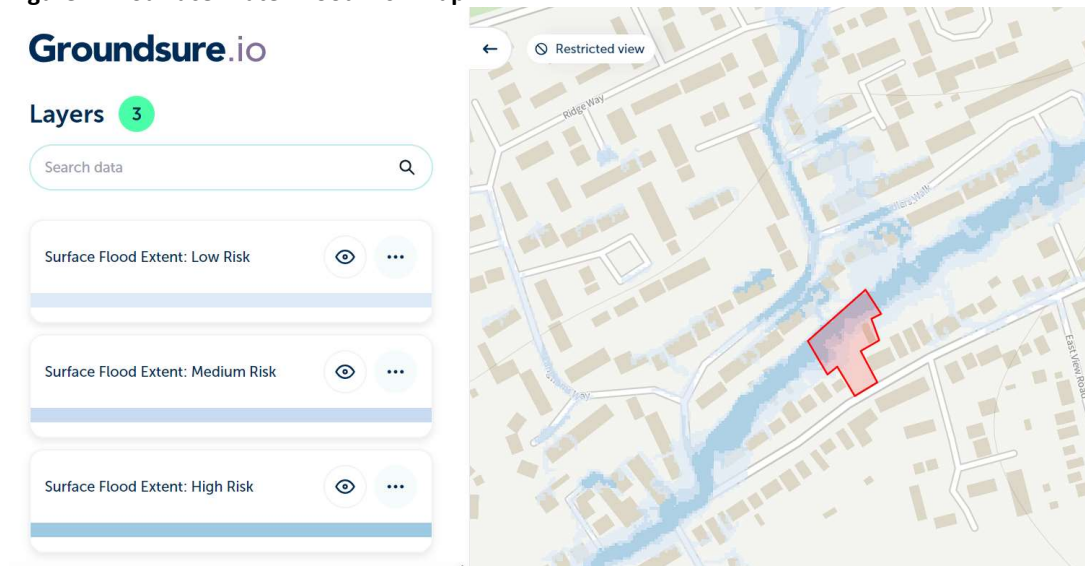
- 4.2.1 The NPPF sets out how the planning system should help minimise vulnerability and provide resilience to the impacts of climate change. This includes demonstrating how flood risk will be managed now and over the development's lifetime, taking climate change into account.
- 4.2.2 In accordance with the EA's climate change guidance, the proposed development must take account of the following allowances:
- Peak Rainfall Intensity (Thames and South Chilterns Management Catchment, 2070s).
 - Central 25%
 - Upper End 40%

4.3 Surface Water Flood Risk

- 4.3.1 Surface water flooding is a description for excessive overland flows that have yet to enter a natural or manmade receptor (e.g. aquifer, watercourse or sewer). Surface water flooding also occurs when the amount of runoff exceeds the capacity of the collecting system and spills onto overland flow routes.
- 4.3.2 Surface water flooding is usually the result of intense, short lived rainfall events, but can also occur during milder, longer lived rainfall events, when collecting systems are at or near capacity or the ground is saturated. It often results in the inundation of low points in the terrain.
- 4.3.3 In accordance with the EA's *Long Term Flood Risk Information* (Figure 4.1) the development site is mostly at very low (< 0.1% AEP) risk of surface water flooding. However, there is a

prominent overland flow path in the north of the site at low (0.1% to 1.0% AEP), medium (1.0% to 3.3% AEP) and high (> 3.3% AEP) risk of surface water flooding.

Figure 4.1: Surface Water Flood Risk Map



4.3.4 Wokingham Brough Council's Strategic Flood Risk Assessment is based on the EA's *Long Term Flood Risk Information* and does not provide any additional information regarding surface water flood risk.

4.3.5 The available information suggests off-site overland flows are expected to reach the development site from higher ground to the east, posing some flood risk across the northernmost part of the site before leaving the site towards the Thames.

4.3.6 The management measures proposed to deal with off-site overland flows reaching the site are described in Section 5.

4.3.7 The risk of surface water flooding from runoff generated from the proposed development site will be managed by the drainage strategy described in Section 5.

4.4 Sewer Flood Risk

4.4.1 Sewer flooding occurs when a manmade drainage system receives greater than usual amounts of water and the overwhelmed system starts overflowing at gullies and manholes, thus generating overland flows.

4.4.2 Sewer flooding is usually the result of very intense, short lived rainfall events, but can also occur during milder, longer lived rainfall events, when outfalls become surcharged / locked by high water levels in the receiving feature.

4.4.3 In addition to a flood risk, overflowing combined sewers also pose a significant public health and environmental risk.

4.4.4 Thames Water's asset location plans (**Appendix C**) show several public sewers near the development site as follows:

- 675mm surface water sewer flowing to the west along the northern site boundary.

- 225mm surface water sewer flowing to the west in Victoria Road to the south.
 - 150mm found sewer flowing to the west in Vicotria Road to the south.
- 4.4.5 We are not aware of any flooding incidents associated with these sewers impacting the site. Refer to Section 5.2.2 for further information.
- 4.4.6 The management measures proposed to deal with sewer flood risk at the development site are described in Section 5.

5 FLOOD RISK MANAGEMENT

5.1 Sequential and Exception Tests

- 5.1.1 The sequential, risk-based approach to the location of development is designed to ensure that areas at little or no risk of flooding from any source are developed in preference to areas at higher risk. The aim is to keep development out of medium and high flood risk areas (Flood Zones 2 and 3) and other areas affected by other sources of flooding where possible.
- 5.1.2 Application of the sequential approach in the master planning process, in particular application of the *Sequential Test*, helps ensure that development can be safely and sustainably delivered, and developers do not waste resources promoting proposals which are inappropriate on flood risk grounds.
- 5.1.3 The *Sequential Test* ensures that a sequential approach is followed to steer new development to areas with the lowest probability of flooding. The aim is to steer new development to Flood Zone 1 (areas with a low probability of sea or river flooding). Where there are no reasonably available sites in Flood Zone 1, local planning authorities in their decision making should take into account the flood risk vulnerability of land uses and consider reasonably available sites in Flood Zone 2 (areas with a medium probability of sea or river flooding), applying the *Exception Test* if required. Only where there are no reasonably available sites in Flood Zones 1 or 2 should the suitability of sites in Flood Zone 3 (areas with a high probability of sea or river flooding) be considered, taking into account the flood risk vulnerability of land uses and applying the *Exception Test* if required.
- 5.1.4 [Table 2](#) of the *Flood Risk and Coastal Change Guidance* categorises different types of uses and development according to their vulnerability to flood risk. [Table 3](#) of the *Flood Risk and Coastal Change Guidance* (Table 5.1) maps these vulnerability classes against flood zones to indicate where development is appropriate and where it should not be permitted.

Table 5.1: Flood Risk Vulnerability and Flood Zone Compatibility

Flood Zone	Flood Risk Vulnerability				
	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test	✓	✓	✓
Zone 3a	Exception Test	✗	Exception Test	✓	✓
Zone 3b	Exception Test	✗	✗	✗	✓

Key:

✓ Development is appropriate

✗ Development should not be permitted

- 5.1.5 The site is located in Flood Zone 1 and at no significant risk of flooding from any potential source, thus following a sequential approach to steer development away from flood risk. The Exception Test is not required for more vulnerable developments in Flood Zone 1.

5.2 Surface Water and Sewer Flood Risk

- 5.2.1 There is an overland flow route crossing the northern part of the site. In the same area is a large diameter sewer (675mm) shown on the Thames Water sewer map as a surface water sewer. JNP Group contacted Thames Water to ascertain the function of this sewer which appears to be anomalously large to be purely a surface water sewer in this location. Thames Water verbally indicated that the sewer had been installed to mitigate surface water flooding along the overland flow route.
- 5.2.2 JNP has calculated the likely volume of the surface water flow and the large diameter sewer as follows:
- Greenfield runoff from the upstream catchment of the overland flow (100yr + 40%) calculated as **1,753.6 l/s**
 - Culvert capacity based on 1:361 fall = **491.5 l/s**
 - Therefore, **1262.1 l/s** flooding / overland flow is anticipated during a 1 in 100 year + climate change (CC) storm event.
- 5.2.3 The following surface water flood risk management measures have been incorporated in the proposed development's master plan.
- Swale along the northern side of the site with capacity of 1294.2 l/s (i.e. sufficient to accommodate the anticipated excess flow during the 1 in 100yr + CC storm).
 - The culvert below the visitor parking areas is designed to have a capacity of 1,328.2 l/s which also has the capacity to accommodate the anticipated flows).
- 5.2.4 In addition, the development (classified as less or more vulnerable under the *Flood Risk and Coastal Change Guidance*) will be set at least 300mm above maximum water level in the swale (100yr + 40%), which will be designed to safely route overland flows away from buildings and towards the swale, using less vulnerable parts of the proposed development such as public open spaces, parking areas and roads to convey and attenuate overland flows.
- 5.2.5 Flooding from the 675mm sewer in the north of the site will be conveyed across the site via a proposed swale and culvert. Setting the development at least 300mm above maximum water level in the swale and directing excess flows through less vulnerable parts of the site will also mitigate flooding risks from sewers proposed on the site and those already in Victoria Road.
- 5.2.6 The proposed surface water drainage strategy (Section 6) has been designed so that flooding does not occur on any part of the site for all events up to 3.3% AEP and flooding does not occur in any part of a building or utility plant susceptible to water for all events up to 1.0% AEP and 40% climate change allowance.

6 SURFACE WATER DRAINAGE STRATEGY

6.1 Existing Drainage

- 6.1.1 The development site does not benefit from a formal surface water drainage system. Runoff generated within the site is expected to infiltrate into the ground or flow overland towards the overland flow route crossing the north of the development.
- 6.1.2 Greenfield and existing runoff rates have been established for the development site using the *IH124* methodology with *ICP SuDS* correction for small catchments (**Appendix D and Table 6.1**).

Table 6.1 Greenfield Run-off Rates

	Site rate (l/s) – 0.140ha
Q1	0.20
Qbar	0.24
Q30	0.55
Q100	0.76

6.2 Hierarchy for Surface Water Disposal

- 6.2.1 The National Standards for Sustainable Drainage Systems (Defra, 2011) state that the following options must be considered in accordance with the hierarchy for surface water disposal:
- 6.2.2 Discharge to Ground (Infiltration)
- 6.2.3 Based on the available geological and hydrogeological information (Section 2 of this report), infiltration drainage may be feasible at the development site. Ground investigation will need to be completed to determine infiltration rates in the Chalk, whether there is sufficient unsaturated zone, and the strength of the Chalk and required offsets for soakaways from buildings and boundaries, to confirm if infiltration is a viable option. Should the testing indicate that soakaways are viable, these can be accommodated within the open areas of the site. Should infiltration drainage not be viable, an alternative solution is also proposed.
- 6.2.4 Discharge to Surface Water Body
- 6.2.5 As detailed in Section 2, there are not appropriate surface water bodies near the site. Therefore, an alternative solution is also proposed.
- 6.2.6 Discharge to Sewer
- 6.2.7 As discharge to surface water is not proposed, and the feasibility of discharge to ground needs to be proven, discharge to sewer is also considered.

6.3 Proposed Drainage Strategy

- 6.3.1 The proposed surface water drainage strategy has been designed in accordance with the *DCG* and in compliance with the *NPPF*, local requirements and current best practices, to collect, convey and attenuate runoff from all impermeable areas (0.14 ha) before discharging into the TW sewer in the north of the site.

- 6.3.2 Two strategies are proposed; Option A, to ground should testing indicate this is viable, or Option B, to sewer should discharge to ground not be feasible.
- 6.3.3 Option A - to ground:
- 6.3.4 The proposed drainage strategy (**Appendix E**) intends to collect runoff via a series of rainwater pipes and permeable paving before discharging into a below ground drainage network and then to ground via a downstream defender and infiltration tank. In accordance with the surface water hierarchy, infiltration has been deemed unfeasible, as was discharging to a watercourse, therefore discharging to the local sewer network is proposed.
- 6.3.5 Option B – to sewer:
- 6.3.6 The proposed drainage strategy intends to collect runoff via a series of rainwater pipes and permeable paving before discharging into a below ground drainage network and then to the TW sewer in the north of the site via a downstream defender and attenuation tank.
- 6.3.7 In this option, as the volume of runoff leaving the proposed development cannot be reduced to greenfield values through infiltration, the proposed drainage strategy has been designed to limit off-site discharges to 2.0 l/s; a pragmatic minimum rate which will reduce the risk of flooding from blockage of the flow control. Note this option has not been included in the appendices.
- 6.3.8 The proposed drainage strategies have been designed so that:
- Flooding does not occur on any part of the site for all events up to 3.3% AEP (1 in 30 years);
 - Flooding does not occur in any part of a building or utility plant susceptible to water for all events up to 1.0% AEP (1 in 100 years) + 40% climate change allowance.
- 6.3.9 The performance of the proposed surface water drainage strategy has been tested for storm events with 100.0% AEP, 3.3% AEP and 1.0% AEP + 40% climate change and durations of 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640 and 10080 minutes.
- 6.3.10 The results of the simulations are included in **Appendices D** and demonstrate how the proposed surface water drainage strategy can manage surface water flood risk at the development site without increasing flood risk elsewhere for storm events up to the 1.0% AEP + 40% climate change allowance.
- 6.3.11 A pre-development enquiry will need to be undertaken with TW following confirmation of which strategy will be pursued.
- 6.4 Sustainable Drainage Systems (SuDS)**
- 6.4.1 In accordance with the *NPPF*, (major) developments should incorporate sustainable drainage systems (SuDS) unless there is clear evidence that this would be inappropriate. In addition to water quantity control, SuDS should consider opportunities to provide water quality and amenity / biodiversity benefits (i.e. multifunctionality approach).
- 6.4.2 While the proposed drainage strategy is largely reliant on permeable paving and an attenuation / infiltration tank to manage runoff quantity, the table below shortlists other

SuDS deemed compatible with the site's characteristics and which inclusion in the proposed development must be continuously assessed as the design progresses.

- 6.4.3 It is important to note the need to remove silt from runoff prior to discharge into SuDS features. SuDS such as filter drains, swales, bioretention systems and pervious pavements are sustainable alternatives to proprietary treatment systems otherwise required to manage silt.

Table 6.2: Sustainable Drainage Systems (SuDS)

SuDS Component	Description and Opportunities
Green / Blue Roofs	Green roofs are areas of living vegetation installed on the top of buildings for a range of reasons including visual benefit, ecological value, enhanced building performance and reduction of surface water runoff. A blue roof is a roof designed explicitly to store water for use within the building (rainwater harvesting) or controlled discharge. Green roofs that include reservoir storage zones beneath the growing medium could also be considered blue roofs. Green roofs can improve the thermal performance of buildings, help combat the urban heat island effect and contribute to improved air quality. Through evapotranspiration, green roofs can reduce peak flow rates to a site drainage system (principally for small and medium-sized events) but are unlikely to have a significant impact on downstream attenuation storage requirements. Blue roofs can be designed to provide significant attenuation (and evapotranspiration). No considered feasible as there are no easily accessible flat roofs.
Filter Drains/Strips	Filter drains are trenches filled with stone/gravel that create temporary subsurface storage for the filtration, attenuation and conveyance of surface water runoff. Ideally, filter drains receive lateral inflow from adjacent impermeable surfaces pre-treated over a filter strip. Filter drains can help manage peak flows by naturally limiting rates of conveyance through the filter medium and by providing attenuation storage when the rate of flow at the outlet is controlled. Filter drains can be effectively incorporated into the landscape and public open spaces and can have minimal land-take requirements. The use of filter drains is typically restricted to flat sites (unless placed parallel to contours). Filter drains are best located adjacent to (small) impermeable surfaces such as car parks and roads / highways. The site is too small to incorporate such systems.
Swales	Swales are shallow, flat bottomed, vegetated open channels designed to treat, convey and often attenuate surface water runoff. Swales can also provide aesthetic and biodiversity benefits. Swales can help reduce flow rates by facilitating infiltration and / or providing attenuation storage when flow at the outlet is controlled. Coarse to medium sediments and associated pollutants can be removed by filtration through surface vegetation and ground cover. Swales are well suited for managing runoff from linear features such as main roads / highways. Swales are generally difficult to incorporate into dense urban developments, where space is limited. Although a swale is proposed on site, this is not part of the proposed drainage system. The site is too small to incorporate swales elsewhere.

SuDS Component	Description and Opportunities
Bioretention Systems Tree Pits	Bioretention systems (including rain gardens) are shallow landscaped depressions that can reduce runoff rates and volumes and treat pollution. They also provide attractive landscape features and biodiversity. Bioretention systems can help reduce flow rates from a site by promoting infiltration / evapotranspiration and providing some attenuation storage. Bioretention systems can also provide very effective treatment functionality. Bioretention systems are a very flexible surface water management component that can be integrated into a wide variety of developments / densities using different shapes, materials, planting and dimensions. Tree pits could be considered for trees in communal areas. .
Pervious Pavements	Pervious pavements provide a pavement suitable for pedestrian and / or vehicular traffic, while allowing rainwater to infiltrate through the surface and into the underlying structural layers. The water is temporarily stored beneath the overlying surface before use, infiltration to the ground or controlled discharge downstream. Pervious pavements help reduce flow rates from a site by providing attenuation storage. A flow control structure is required to constrain the rate of water discharged from the sub-base via an outlet pipe. Pervious pavement drainage has been shown to have decreased concentrations of a range of surface water pollutants, including heavy metals, oil and grease, sediment and some nutrients. Pervious pavements are typically built as an alternative to impermeable surfaces and therefore require no extra development space for their construction. Permeable paving is proposed for driveways.
Detention Basins	Detention basins are landscaped depressions that are normally dry except during and immediately following storm events. They can be on-line components where surface runoff from regular events is routed through the basin or off-line components into which runoff is diverted once flows reach a specific threshold. Detention basins can be vegetated depressions (providing treatment in on-line components) or hard landscaped storage areas. Off-line basins will normally have an alternative principal use (e.g. amenity or recreational facility or urban (hard) landscaping). The site is too small and steep for a basin.
Attenuation Storage Tanks	Attenuation storage tanks are used to create a below-ground void space for the temporary storage of surface water before use, infiltration or controlled release. Attenuation storage tanks can help reduce flow rates from a site by providing significant attenuation storage. Storage tanks do not provide any form of treatment of surface water runoff and therefore need to be combined in a "management train" with other methods that do provide suitable treatment of all relevant pollutants (coarse sediment must always be removed upstream of a storage tank). The inherent flexibility in size and shape of the typical attenuation storage tank systems means that they can be tailored to suit the specific characteristics and requirements of any site. However, the lack of amenity and biodiversity benefits means that storage tanks should be a last resource in any surface water drainage strategy for a major development. An attenuation tank is proposed beneath the road should Option B be progressed.

6.5 Exceedance Events

- 6.5.1 In the event of a storm event greater than the 1.0% AEP + 40% climate change, or a failure of the drainage system, exceedance flows may be generated from the drainage network. The mitigation measures to protect more vulnerable parts of the site are discussed in Section 5.
- 6.5.2 The exceedance flow routes will be towards the swale in the north of the site and are shown on the drainage layout in **Appendix F**.

6.6 Water Quality Management

- 6.6.1 The suitability of the proposed drainage strategy to manage the development's pollution risk has been assessed using the simple index approach in *The SuDS Manual* (2015), as summarized in the table below.

Table 6.3: Water Quality Management (Simple Index Approach)

Runoff Route / Treatment Train Options A & B				
Land Use / SuDS	Hazard Level	TSS	Metals	Hydrocarbons
Pollution Hazard Indices				
Residential roofs	Very Low	0.2	0.2	0.05
Driveways, residential car parks and low traffic roads	Low	0.5	0.4	0.4
SuDS Mitigation Indices				
Permeable pavement		0.7	0.6	0.7
Downstream defender	-	0.5	0.4	0.8
Total SuDS Mitigation Index $\geq$ Pollution Hazard Index (for each contaminant type)				

6.7 Operation and Maintenance

- 6.7.1 The function of the surface water drainage system must be understood by those responsible for maintenance, regardless of whether individual components are below ground or on the surface. In any system properly designed, monitored and maintained, performance deterioration can usually be minimised.
- 6.7.2 The long-term operation and maintenance of the proposed surface water drainage strategy will be the responsibility of entities, as detailed in the table below. Appropriate legal agreements defining maintenance responsibilities and access rights over the lifetime of the proposed development must be established prior to construction.
- 6.7.3 Whilst not part of the drainage system, the swale will also need to be maintained to maintain its functionality.

Table 6.4: Entities Responsible for SuDS Maintenance

SuDS Component	Location	Function	Responsible Entity
Swale	Northern edge of the site	Convey overland flows	Private management company

SuDS Component	Location	Function	Responsible Entity
Pervious Pavement	Driveways	Store & treat runoff	Owner
Attenuation Storage / Infiltration Tank	Beneath the road	Store runoff	Private management company

- 6.7.4 Where the user / benefiter of a system is not responsible for maintenance, then it is important to ensure that they know when the SuDS is not functioning correctly and who to contact if any issue arises.
- 6.7.5 Maintenance plans are often required to clearly identify who is responsible for maintaining proposed SuDS as well as the maintenance regime to be applied. Maintenance plans can also form a useful tool for public engagement with SuDS and understanding their wider benefits. The maintenance requirements of the proposed surface water drainage strategy are summarised in the table below.

Table 6.5: Typical Operation and Maintenance Requirements

Operation and Maintenance Activity	SuDS Component		
	Swale	Pervious Pavement	Attenuation Storage / Infiltration Tank
Inspection	■	■	■
Litter and debris removal	■	■	□
Grass cutting	■	□	□
Weed and invasive plant control		□	
Shrub management (including pruning)	□	□	
Sediment management	■	■	■
Vegetation replacement	□		
Vacuum sweeping and brushing		■	
Structure rehabilitation/repair	□	□	□
Infiltration surface reconditioning	□	□	
Key: ■ Will be require □ May be required			

6.8 Drainage During Construction

- 6.8.1 Drainage is typically an early activity in the construction of a development, taking form during the earthworks phase as it is the responsibility of the contractor to manage all construction runoff rates and water quality. However, the connection of piped drainage system to SuDS components should not take place until the end of construction works, unless a robust strategy for silt removal prior to occupation of the site is implemented.

- 6.8.2 Silt-laden runoff from construction sites represents a common form of waterborne pollution and cannot enter SuDS components not specifically designed to manage this, as it can overwhelm the system and pollute receiving water features. Any gullies and piped systems should be capped off during construction and fully jetted and cleaned prior to connection to SuDS components.
- 6.8.3 The three principal aspects of drainage during construction are conveying runoff, controlling runoff and trapping sediments:
- Conveyance of runoff can be achieved through small ditches / swales, channels and drains. Runoff control measures should be implemented to ensure that runoff does not overwhelm the temporary drainage system causing flooding on site or elsewhere.
 - Control of runoff can be achieved through perimeter ditches or appropriate grading to ensure that any runoff from the construction site stays on site. Runoff rates leaving the site should be managed so they do not exceed the proposed rates stated in this report, based on pre-development conditions.
 - Construction runoff should be directed to dedicated settlement basins with adequate upstream sediment and pollution control such as sediment basins, silt fences and straw bales prior to infiltration or off-site discharge.
- 6.8.4 Additional conveyance, control and treatment measures should be installed as needed during grading. Slope stability needs to be considered when using open water features to convey, control and treat runoff across the site. Any necessary surface stabilisation measures should be applied immediately on all disturbed areas where construction work is either delayed or incomplete.
- 6.8.5 Maintenance inspections should be performed weekly, and maintenance repairs should be made immediately after periods of rainfall.
- 6.8.6 All drainage infrastructure (namely underground features) must be protected from damage by construction traffic and heavy machinery through the implementation of measures such as protective barriers and storing construction materials away from the drainage infrastructure.

7 FOUL WATER DRAINAGE STRATEGY

- 7.1.1 Sewerage undertakers have a legal obligation under the Water Industries Act 1991 to provide developers with the right to connect to public (foul) networks. The Water Industries Act 1991 also contains safeguards to ensure that flows resulting from new developments do not cause detriment to the existing public sewerage networks by imposing a duty on sewerage undertakers to carry out works required to accommodate additional flows into their networks.
- 7.1.2 The existing site does not benefit from a formal foul water drainage system, but in accordance with records obtained from TW, there is a foul water sewer in Victoria Road to the south of the site (**Appendix C**).
- 7.1.3 A pre-development enquiry will need to be undertaken with TW (once the surface water drainage strategy is finalised).
- 7.1.4 As invert levels of the existing public foul drainage network are not deep enough to allow gravity drainage from the site, on site pumping of foul flows will be required. The proposed foul water drainage strategy envisages a private pumping station in the access road.
- 7.1.5 Once planning consent has been granted, it is recommended that this is forwarded to the water company to ensure that they are aware of the additional capacity required for the development.

8 CONCLUSIONS AND RECOMMENDATIONS

- 8.1.1 JNP Group has been commissioned by Palatine Homes to prepare a Flood Risk Assessment and Drainage Strategy for the proposed residential development at Victoria Nurseries, Victoria Road, Wargrave.
- 8.1.2 The site is approximately 0.27 ha and is located on Victoria Road, Wargrave.
- 8.1.3 The site is not underlain by artificial ground or superficial deposits. The underlying geology is the Seaford and Newhaven Chalk Formation which is a Principal Aquifer. The site is located within a Zone II (Outer Protection) Source Protection Zone.
- 8.1.4 Infiltration drainage may be feasible at the development site however ground investigation will need to be completed to determine infiltration rates in the Chalk, whether there is sufficient unsaturated zone, and the strength of the Chalk and required offsets for soakaways from buildings and boundaries, to confirm if infiltration is a viable option.
- 8.1.5 The River Thames flows is 750m to the west of the development site. Therefore discharge to a surface watercourse is deemed unfeasible at the development site.
- 8.1.6 The Flood Risk Assessment section of this report demonstrates that the risk of flooding from most sources (fluvial, tidal, groundwater and reservoir) is very low or low.
- 8.1.7 There is an overland flow route crossing the northern part of the site and surface water flood risk in this area is predicted to be between low and high risk. In the same area is a large diameter sewer (675mm) shown on the Thames Water sewer map as a surface water sewer which appears to be have been installed to mitigate surface water flooding along the overland flow route.
- 8.1.8 Surface water flooding risk across the northern part of the site is therefore mitigated by the sewer accommodating flows to the 1 in 100 year storm and a proposed swale to accommodate additional flows resulting from increased run off due to climate change.
- 8.1.9 Two drainage strategies have been proposed; Option A, to ground should testing indicate this is viable, or Option B, to sewer should discharge to ground not be feasible.
- 8.1.10 Both drainage strategy intends to collect runoff via a series of rainwater pipes and permeable paving before discharging into a below ground drainage network with Option A discharging to ground via a downstream defender and storage tank and Option B via a downstream defender, attenuation tank and hydrobrake limited to 2.0 l/s.
- 8.1.11 The proposed drainage strategy incorporates the following SuDS features:
- Permeable paving
 - Infiltration / attenuation tank.
- 8.1.12 The proposed surface water drainage strategies can manage surface water flood risk at the development site without increasing flood risk elsewhere for storm events up to the 1.0% AEP plus 40% climate change allowance.
- 8.1.13 Overland flows resulting from exceedance events are expected to leave the developed site to the north, as currently occurs.

- 8.1.14 Water quality management is to be achieved through the treatment potential of the permeable paving and downstream defender. The hazard level is very low, and the water quality treatment is considered acceptable following the completion of the simple index approach from the SuDS Manual.
- 8.1.15 The proposed foul water drainage strategy is to drain into the foul sewer network in the surrounding highway network. The TW records suggest the surrounding foul water network is not deep enough and therefore this will need to be pumped up to Victoria Road.
- 8.1.16 An operation and maintenance plan has been provided as part of this report in accordance with the SuDS Manual, which includes a review of all drainage elements and the swale,.
- 8.1.17 It is expected that the surrounding network will have enough capacity for the proposed development. The proposed foul water outfall is indicated to outfall to the sewer in Victoria Road to the south.
- 8.1.18 A pre-development enquiry will need to be undertaken with TW (once the surface water drainage strategy is finalised).
- 8.1.19 Once planning consent has been granted, it is recommended that this is forwarded to the water company to ensure that the foul network remains to have enough capacity for the development.
- 8.1.20 Any connection to the public sewer is subject to a Section 106 application.
- 8.1.21 This report is intended for the use of the developer of the site in support of their planning application for the site only.

9 LIMITATIONS

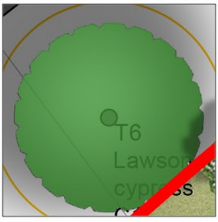
- 9.1.1 The information, conclusions and recommendations presented within this report are deemed to be current at the time of issue. No guarantee can be given to the status of this information other than at the time of issuing. Where necessary, the user shall confirm the status of any applicable assessments and consents.
- 9.1.2 This report has been commissioned by Palatine Homes. No third party may receive a copy of this report without first obtaining our permission in writing.
- 9.1.3 This report is confidential and has been prepared solely for the benefit of Palatine Homes and those parties with whom a warranty agreement has been executed or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of this report, written approval must be sought from JNP Group and a charge may be levied against such approval. JNP Group accepts no responsibility or liability for the consequences of this document being used for any purpose or project other than for which it was commissioned, or this document being used by any third party with whom an agreement has not been executed.
- 9.1.4 The copyright of this report remains with JNP Group at all times.

APPENDIX A: TOPOGRAPHICAL SURVEY

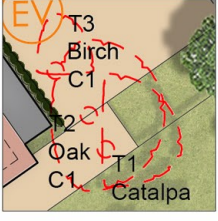
APPENDIX B: PROPOSED DEVELOPMENT



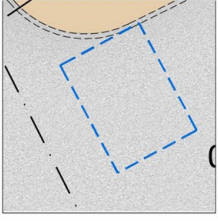
© This drawing is copyright and is not to be reproduced or disclosed to third parties without hparchitectures prior permission.
Do not scale from this drawing, other than for Local Authority Planning purposes.
This drawing is to be read in conjunction with all relevant consultants, specialist manufacturers drawings and specifications.
Any discrepancies in dimensions or details on or between these drawings should be drawn to our attention.
All dimensions are in millimetres unless noted otherwise.
Any surveyed information incorporated within this drawing cannot be guaranteed as accurate unless confirmed by fixed dimension.



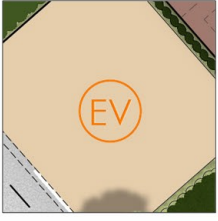
TREES TO BE
RETAINED



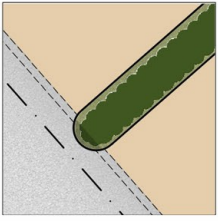
TREES TO BE
REMOVED / PRUNED
(RED DASHED).



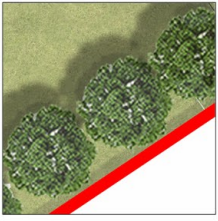
BUILDINGS TO BE
REMOVED (BLUE DASHED).



ELECTRIC VEHICLE CHARGING



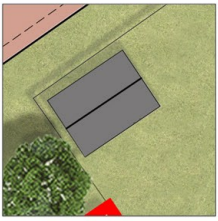
INDICATIVE PROPOSED PLANTING
(LH - LOW HEIGHT HEDGING)



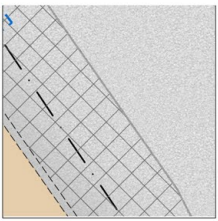
INDICATIVE PROPOSED TREES



DROPPED KERB FOOTPATH



SECURE BIKE STORAGE



SERVICE STRIP



PROPOSED SWALE

P3	12.06.25	SWALE ADDED - ISSUED FOR PLANNING.	GJD
P2	12.03.25	ISSUED FOR PLANNING.	GJD
P1	27.11.24	ISSUED FOR PLANNING.	GJD
Rev	Date	Description	By

PLANNING



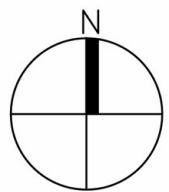
hparchitecture.co.uk / 01344 752 271
Manhattan House, 140 High Street, Crowthorne, Berkshire RG45 7AY

Client
PALATINE HOMES

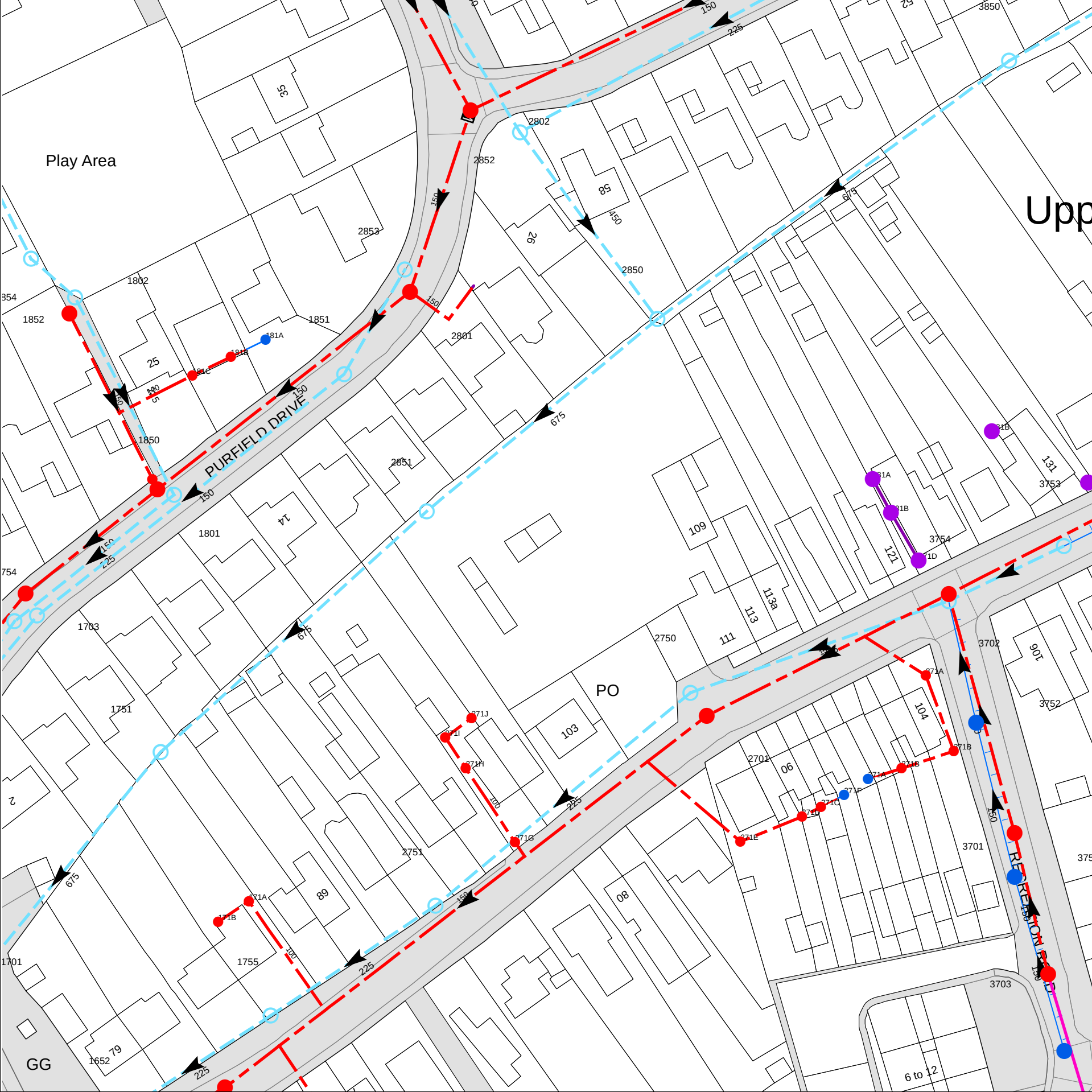
Project
**VICTORIA NURSERIES, WARGRAVE,
RG10 8AG**

Drawing
PROPOSED SITE PLAN

Scale	Date	Drawn By	Checked By
1:200@A1	09.08.24	GJD	SS
Project No.	Drawing No.	Revision	
24.419	02	P3	



APPENDIX C: SEWER RECORDS



The width of the displayed area is 200m

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

Based on the Ordnance Survey Map (2020) with the Sanction of the controller of H.M. Stationery Office, License no. 100019345 Crown Copyright Reserved.

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

Manhole Reference	Manhole Cover Level	Manhole Invert Level
271I	n/a	n/a
271H	n/a	n/a
271J	n/a	n/a
2750	55.6	54.65
2701	55.77	53.43
271C	n/a	n/a
271F	n/a	n/a
271A	n/a	n/a
271B	n/a	n/a
371A	n/a	n/a
371B	n/a	n/a
3752	58.08	56.88
2851	n/a	n/a
2802	56.21	54.05
2852	56.07	53.19
2850	n/a	n/a
281A	n/a	n/a
281B	n/a	n/a
371D	n/a	n/a
3754	57.12	56.32
3702	n/a	n/a
381B	n/a	n/a
3850	n/a	n/a
3753	58	56.63
381A	n/a	n/a
3750	60.74	59.72
3703	60.2	58.18
2751	54.33	53.47
3751	59.5	58.5
271G	n/a	n/a
271E	n/a	n/a
3701	59.21	57.71
271D	n/a	n/a
1703	55.68	52.7
1854	n/a	n/a
1802	57.88	56.49
1852	58.01	56.59
1801	55.58	53.09
1850	55.58	54.32
181C	n/a	n/a
181B	n/a	n/a
181A	n/a	n/a
1851	55.32	54.06
2853	55.4	54.24
2801	55.45	53.7
1753	55.61	53.56
1754	n/a	n/a
1751	52.92	51.17
171B	n/a	n/a
1603	52.93	50.32
171A	n/a	n/a
1755	53.37	52.42

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



Con29DW Commercial Drainage and Water Search - Sewer Key

Public Sewer Types (Operated and maintained by Thames Water)

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

Other Sewer Types (Not operated and maintained by Thames Water)

	Sewer		Culverted Watercourse
	Proposed		Decommissioned Sewer
	Content of this drainage network is currently unknown		Ownership of this drainage network is currently unknown

Notes:

- 1) All levels associated with the plans are to Ordnance Datum Newlyn.
- 2) All measurements on the plan are metric.
- 3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate the direction of flow.
- 4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.

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		Meter
	Dam Chase		Vent
	Fitting		

Operational Controls

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

	Ancillary		Drop Pipe
	Control Valve		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.

	Inlet		Outfall
	Undefined End		

Other Symbols

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

	Change of Characteristic Indicator		Public / Private Pumping Station
	Invert Level		Summit

Areas

Lines denoting areas of underground surveys, etc.

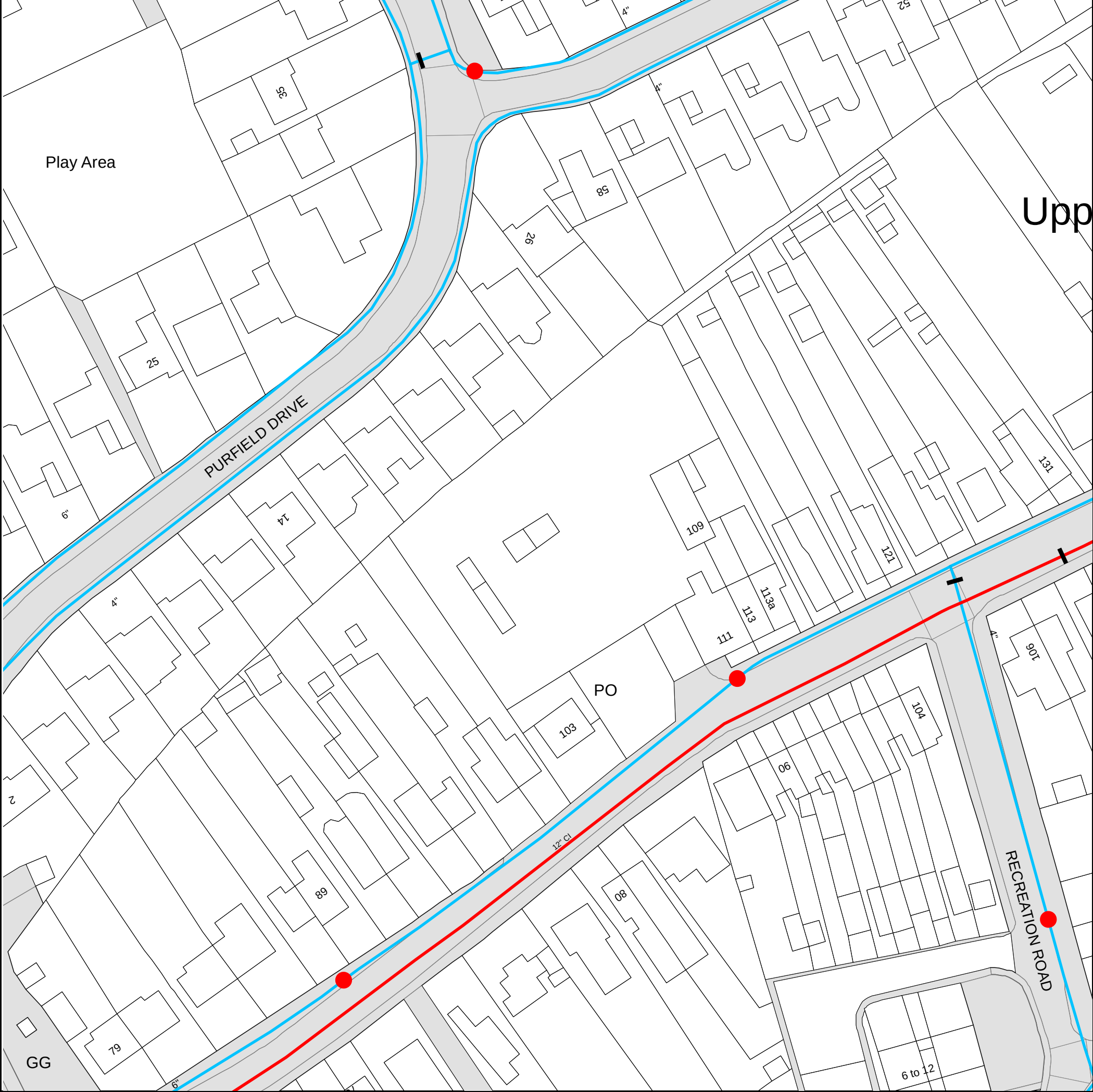
	Agreement
	Chamber
	Operational Site

Ducts or Crossings

	Casement	Ducts may contain high voltage cables. Please check with Thames Water.
	Conduit Bridge	
	Subway	
	Tunnel	

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

6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in millimeters. 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, please contact Property Searches on 0800 009 4540.



The width of the displayed area is 200m

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

Based on the Ordnance Survey Map (2020) with the Sanction of the controller of H.M. Stationery Office, License no. 100019345 Crown Copyright Reserved.



Con29DW Commercial Drainage and Water Search - Water Key

Water Pipes (Operated & Maintained by Thames Water)

-

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

Valves

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

Hydrants

- Single Hydrant

Meters

- Meter

End Items

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

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

Operational Sites

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

Other Symbols

- Data Logger
- Caseament:** Ducts may contain high voltage cables. Please check with Thames Water.

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

- Other Water Company Main:** Occasionally other water company water pipes may overlap the border of our clean water coverage area. These mains are denoted in purple and in most cases have the owner of the pipe displayed along them.
- Private Main:** Indicates that the water main in question is not owned by Thames Water. These mains normally have text associated with them indicating the diameter and owner of the pipe.

APPENDIX D: FLOW RESULTS



Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	5	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.030	5.00	55.500	1200	479261.158	178772.845	1.350
2	0.110	5.00	54.700	1200	479249.586	178790.431	2.379
3			53.600	1200	479235.097	178810.976	1.447
4			53.500	1200	479229.507	178813.134	1.387

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	1	2	21.052	0.600	54.150	52.396	1.754	12.0	150	5.12	50.0
1.001	2	3	25.140	0.600	52.321	52.153	0.168	150.0	225	5.51	50.0
1.002	3	4	5.992	0.600	52.153	52.113	0.040	149.8	225	5.61	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)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	2.924	51.7	5.4	1.200	2.154	0.030	0.0	33	1.898
1.001	1.065	42.3	25.3	2.154	1.222	0.140	0.0	125	1.110
1.002	1.066	42.4	25.3	1.222	1.162	0.140	0.0	125	1.111

Simulation Settings

Rainfall Methodology	FEH-22	Skip Steady State	x	Check Discharge Rate(s)	x
Summer CV	1.000	Drain Down Time (mins)	240	Check Discharge Volume	x
Analysis Speed	Normal	Additional Storage (m³/ha)	20.0		

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440
----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	------

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
100	40	0	0

Node 3 Online Depth/Flow Control

Flap Valve	x	Invert Level (m)	52.153	Design Flow (l/s)	2.0
Replaces Downstream Link	✓	Design Depth (m)	0.960		

Depth (m)	Flow (l/s)
4.000	0.000

Node 3 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.03600	Safety Factor	2.0	Invert Level (m)	51.500
Side Inf Coefficient (m/hr)	0.03600	Porosity	1.00	Time to half empty (mins)	

Depth	Area	Inf Area	Depth	Area	Inf Area	Depth	Area	Inf Area
(m)	(m ²)	(m ²)	(m)	(m ²)	(m ²)	(m)	(m ²)	(m ²)
0.000	105.8	0.0	1.400	105.8	0.0	1.401	0.0	0.0

Node 3 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	52.153	Slope (1:X)	100.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.400
Safety Factor	2.0	Width (m)	5.000	Inf Depth (m)	
Porosity	0.30	Length (m)	24.000		

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.46%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	10	54.182	0.032	5.0	0.0496	0.0000	OK
15 minute summer	2	10	52.444	0.123	23.3	0.2525	0.0000	OK
1440 minute summer	3	1590	51.982	-0.171	2.2	51.0268	0.0000	OK
15 minute summer	4	1	52.113	0.000	0.0	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 summer	1	1.000	2	5.0	1.660	0.096	0.0790	
15 minute summer	2	1.001	3	22.7	1.067	0.536	0.5375	
1440 minute summer	3	Depth/Flow	4	0.0				0.0
1440 minute summer	3	Infiltration		0.0				

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.46%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	10	54.204	0.054	14.5	0.0855	0.0000	OK
15 minute summer	2	11	52.819	0.498	67.7	1.0235	0.0000	SURCHARGED
1440 minute summer	3	1680	52.375	0.222	4.2	96.4794	0.0000	OK
15 minute summer	4	1	52.113	0.000	0.0	0.0000	0.0000	OK

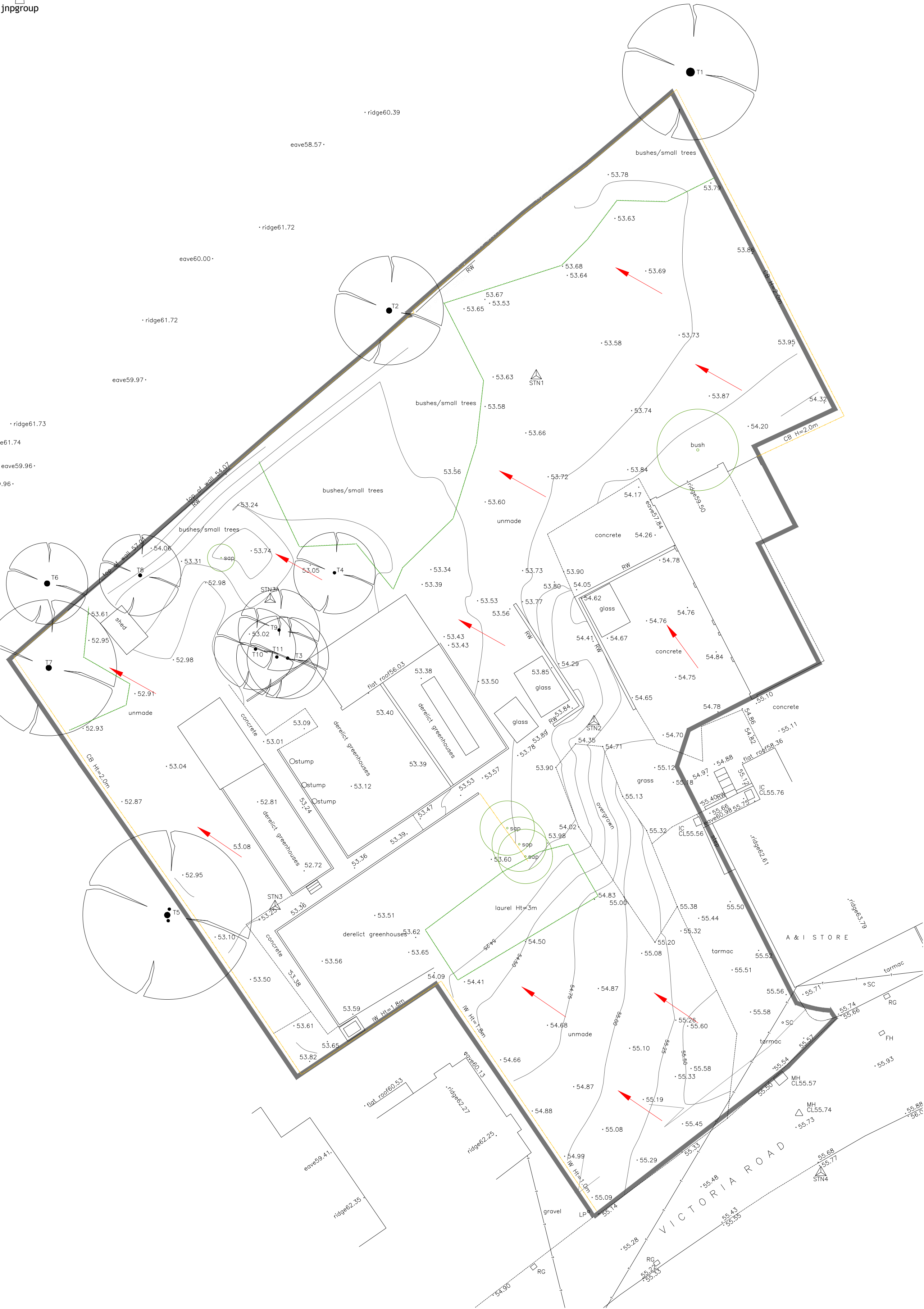
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	2	14.4	1.648	0.280	0.2458	
15 minute summer	2	1.001	3	65.5	1.647	1.546	0.9783	
1440 minute summer	3	Depth/Flow	4	0.0				0.0
1440 minute summer	3	Infiltration		0.0				

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.46%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	11	54.271	0.121	26.3	0.1912	0.0000	OK
15 minute summer	2	11	53.850	1.529	121.3	3.1430	0.0000	SURCHARGED
1440 minute summer	3	1320	53.600	1.447	7.4	159.9201	5.9185	FLOOD
15 minute summer	4	1	52.113	0.000	0.0	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 summer	1	1.000	2	25.0	1.682	0.484	0.3461	
15 minute summer	2	1.001	3	116.5	2.930	2.752	0.9897	
1440 minute summer	3	Depth/Flow	4	0.0				0.0
1440 minute summer	3	Infiltration		0.0				

APPENDIX E: DRAINAGE LAYOUT – OPTION A (TO GROUND)

APPENDIX F: OVERLAND FLOWS



Existing Exceedance Routes



Proposed Exceedance Routes

General Notes

- Where this drawing has been issued in electronic .dwg format, it has been done so in good faith. JNP Group do not take any responsibility for any inaccuracies in the electronic data, which should be checked against the paper (or .pdf) drawing issue. Any apparent discrepancies should be immediately reported to JNP Group. The electronic .dwg file should not be assumed to be to scale and should not be used for 'overlying', setting out or checking of any third party information. All dimensions should be taken from the paper (or .pdf) version of the drawing. Electronic drawings may contain third party information. JNP Group take no responsibility for this information, which should be checked against the originators paper drawing(s).
- All dimensions are millimetres (mm), and levels are in metres (m) unless noted otherwise and should be checked on site prior to construction/fabrication.
- Do not scale from this drawing. Only figured dimensions are to be relied upon. Don't hesitate to get in touch with JNP Group if additional information is required.
- Any discrepancies between drawings of different scales and between drawings and specifications, where appropriate, to be reported to JNP Group for decision.
- Copyright reserved. This drawing may only be used for The Client and location specified in the title block. It may not be copied or disclosed to any third party without the prior written consent of JNP Group.
- This drawing should only be used for construction if the drawing status is "A4 - Approved/Stage Complete". JNP Group takes no responsibility for construction works undertaken to drawings that are not marked with this status.

Health & Safety Note

The details on this drawing have been prepared on the assumption that a competent contractor will be carrying out the works. If the contractor(s) considers that there is insufficient Health and Safety information on this drawing, this should immediately be brought to the attention of the designer.

HAZARD IDENTIFICATION BOX			
This table is provided to assist the Principal Contractor to fulfil their obligations under the CDM Regulations 2015			
Hazard Ref	Hazard Type (Construction/Maintenance/ Cleaning/Obstruction/Asbestos)	Hazard Description	Mitigation Measures/ Residual Risk
▲			

Rev	Date	Description	Drawn / Checked / Approved
P04	24/06/2025	Site Layout updated	CS / CS / CS
P03	02/12/2024	Topo updated	JM / CS / CS
P02	28/11/2024	Site layout updated	CS/SL/UTH
P01	08/11/2024	Draft Issue	CS/CS/SL
Submittal			

S3 - Suitable for Review & Comment

JNP GROUP
CONSULTING ENGINEERS

Amersham • Brighouse • Bristol • Glasgow
Hartlepool • Sheffield • Warwick

www.jnpgroup.co.uk

Client: Palatine Homes

Job: Victoria Nurseries, Wargrave, RG10 8AG

Title: Exceedance Routes

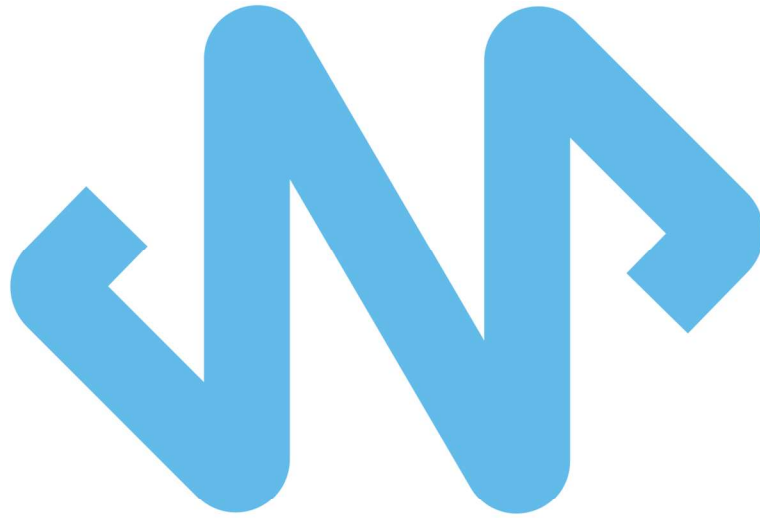
Classification: FI_60_20
Scale @ A1: 1:200

Project - Originator - Volume/System - Level/Location - Type - Discipline - Number
S12488-JNP-XX-XX-DR-C-2002

Reason: P04

Document/Drawing Number

© Copyright JNP Group Ltd. 2023 JNP Group Internal Project Number: H12134



JNP GROUP

CONSULTING ENGINEERS

Amersham (HQ)

Sycamore House
1 Woodside Road
Amersham
Buckinghamshire
HP6 6AA

telephone

01494 771221

more info

www.jnpgroup.co.uk/contact

Hartlepool

The Innovation Centre
Venture Court
Queens Meadow Business Park
Hartlepool
TS25 5TG

telephone

01429 800711

more info

www.jnpgroup.co.uk/contact

Brighouse

Woodvale House
Woodvale Road
Brighouse
West Yorkshire
HD6 4AB

telephone

01484 400691

more info

www.jnpgroup.co.uk/contact

Sheffield

MBP2 Meadowhall Business Park
Carbrook Hall Road
Sheffield
South Yorkshire
S9 2EQ

telephone

0114 244 3500

more info

www.jnpgroup.co.uk/contact

Bristol

Whitefriars,
Lewins Mead,
Bristol

BS1 2NT

telephone

01174 721705

more info

www.jnpgroup.co.uk/contact

Warwick

Portobello House
Portobello Way
Warwick
Warwickshire
CV34 5GJ

telephone

01926 889955

more info

www.jnpgroup.co.uk/contact

Glasgow

Clydesdale House
300 Springhill Parkway
Glasgow Business Park
Baillieston, Glasgow
G69 6GA

telephone

0141 378 0808

more info

www.jnpgroup.co.uk/contact