Flood Risk Assessment and Drainage Strategy

Project: Copsewood,
Lye Lane,
Hertfordshire,
AL2 2DU

Client: 51 Pegasus

Reference: S11880-JNP-XX-XX-RP-C-0001

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1 INTRODUCTION

1.1 Terms of Reference

1.1.1 JNP Group has been commissioned by 51 Pegasus to prepare a flood risk assessment and drainage strategy for the proposed development at Copsewood, Lye Lane in Chiswell Green, St Albans, Hertfordshire.

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 site 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.

1.2 Policy Framework and Key Stakeholders

1.2.1 The *National Planning Policy Framework* (NPPF) (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.

1.2.2 In areas at risk of flooding or for sites of one hectare (ha) or more, developers must undertake a site-specific flood risk assessment to accompany applications for planning permission (or prior approval for certain types of permitted development).

1.2.3 In decision-taking, 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 uses 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 (unitary authorities or county councils) 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 work with lead local flood authorities to ensure local planning policies are compatible with the local flood risk management strategy.

1.2.7 South West Hertfordshire is the lead local flood authority (LLFA) and its strategy for managing local flood risk is set out in Strategic Flood Risk Assessment (October 2018) and SuDS Design Guidance (March 2015).

1.2.8 St Albans District Council is the local planning authority (LPA) and its policies on flood risk management are set out in Strategic Flood Risk Assessment, Volume I (August 2007).

1.2.9 Where relevant, local planning authorities and developers must also take advice from:

- Internal drainage boards; to identify the scope of their interests.

- Sewerage undertakers; to ensure they can assess the impact of new development on their assets and plan any required improvements. Thames Water 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:

- DEFRA / EA's LiDAR topographic data (1 m resolution);
(https://environment.data.gov.uk/DefraDataDownload/?Mode=survey)
- Bespoke topographic survey undertaken by mk surveys in July 2018;
- 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)
- Bespoke ground investigation undertaken by Soils Limited in 2015;
- Bespoke ground investigation undertaken by JNP (Ref. S11880-JNP-XX-XX-RP-G-1001, March 2023);
- Phase I Geo-environmental Desk Study Report - S11880-JNP-XX-XX-RP-G-0001 P01, November 2022;
- 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)
- St Albans District Council – Strategic Flood Risk Assessment, Volume I (August 2007);
- South West Hertfordshire, Strategic Flood Risk Assessment (October 2018);
- Hertfordshire SuDS Policy Statement (March 2015);
- Bespoke FRA undertaken by JNP Group in July 2010.

2 DEVELOPMENT SITE

2.1 Location

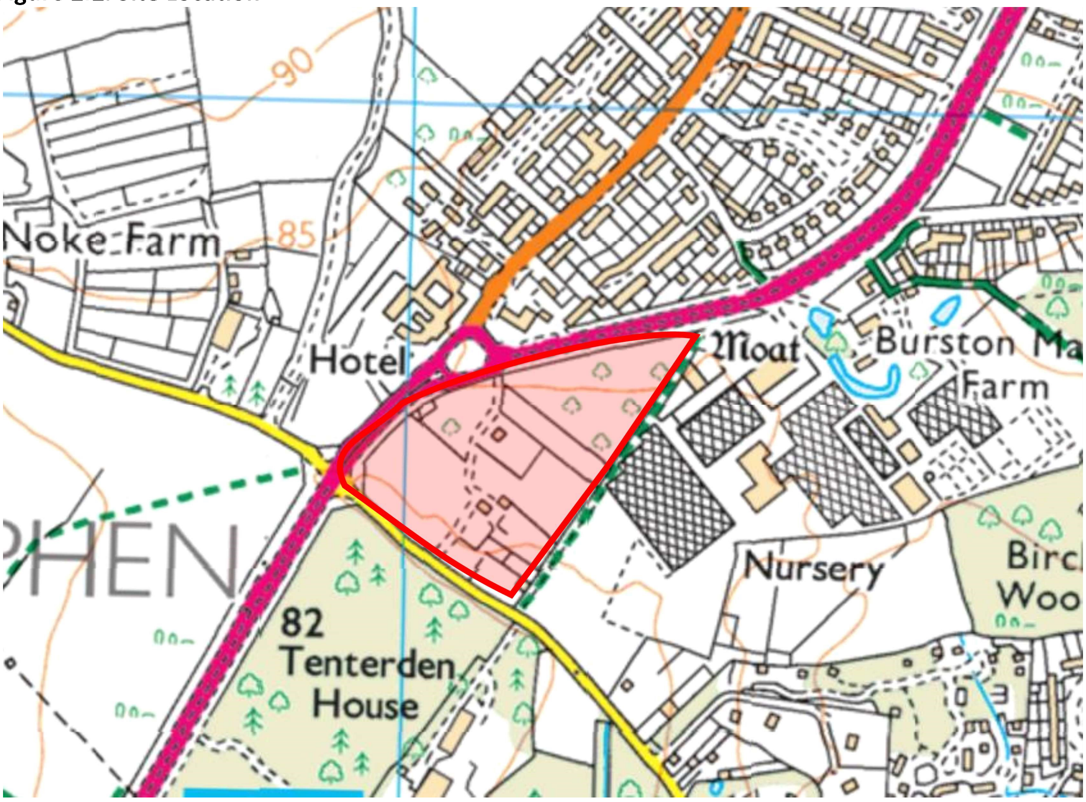
2.1.1 The development site is located Land off Lye Lane, St Albans in Herefordshire, (Figure 2.1, Table 2.1 and Appendix A).

2.1.2 The approximately 4.8 ha wooded and open green field site is bounded by Lye Lane to the south, North Orbital Road (A405) to the north and retail / business land the east. The site also has a residential property and numerous garages across the central and southern part of the site.

Table 2.1: Site Location

OS X	OS Y	Site Area (ha)	Nearest Postcode
513103	203577	6.1 total including buffers 4.5 development area	AL2 3EH

Figure 2.1: Site Location



2.2 Topography

2.2.1 Existing site levels range from 85.5 m AOD on the northern boundary to a level of 79.0 m AOD at the south eastern corner. The average slope is 1:42 to the south.

2.3 Hydrology

2.3.1 The nearest surface water feature is an unnamed pond located circa 100m to the north east of the site. A further surface water feature (a ditch) is located 168m south of the site.

2.3.2 The nearest significant watercourse is the River Ver, located 1.6km to the east of the site. It is classified by the EA as a 'Main River' and has a total catchment area of 14,635 ha close to the site.

2.4 Geology and Hydrogeology

2.4.1 Geological mapping indicates that site is underlain by superficial deposits of the Kesgrave Catchment Subgroup comprising of sands and gravels. This is underlain by the Lewes Nodular Chalk and Seaford Chalk Formations.

2.4.2 The Kesgrave Catchment Subgroup is described by the BGS as "*Mainly gravels characterised by quartz and quartzite from the Triassic, Carboniferous and Devonian rocks of the West Midlands, Welsh Borderland and possibly south-western Pennines, and by felsic volcanic rocks from northern Wales. The members comprise bodies of cross-bedded and massive, moderately sorted sand and gravel. The upper part of the gravels which dominate the subgroup are commonly affected by pedogenesis*".

2.4.3 No description is provided for the Lewes Nodular Chalk and Seaford Chalk Formation.

2.4.4 DEFRA / EA's *MAGiC* classifies the site's superficial deposits as a Secondary A aquifer and its bedrock as a Principal Aquifer.

2.4.5 The EA defines Secondary A Aquifers as "*permeable layers capable of supporting water supplies at a local rather than strategic scale, in some cases forming an important source of base flow to rivers*".

2.4.6 The EA defines Principal Aquifers as "*layers of rock of 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*".

2.4.7 In accordance with DEFRA / EA's *MAGiC*, the site is in a groundwater source protection zone (Zone 2).

2.4.8 Outer zone (Zone 2) is defined as "*the 400-day travel time from any point below the water table to the groundwater source*".

2.4.9 JNP Group has consulted online borehole records held by the BGS. The records of two boreholes exist within 250m of the site. These are TL10SW40 and TL10SW140.

2.4.10 Borehole TL10SW40, located 72m northeast of the site, encountered a topsoil surface covering over a gravel then a sand to 4.2m bgl. Underlying this, a blue clay was encountered to 5.4m bgl. Following this a clay with flints was noted to 12m bgl with chalk being encountered thereafter to the base of the hole at 28.65m bgl. The base of the chalk was unproven. Groundwater was noted to be struck at 17.6m bgl. The borehole was used as an abstraction well.

2.4.11 Borehole TL10S0W140, located 214m south-west, encountered a soft brown silty clay becoming more sandy with depth to 2.4m bgl. Underlying this, a loose to compact reddish brown fine to medium sand with a little gravel was encountered to 3.5m bgl. A loose dry structureless chalk was encountered below this to the base of the hole at 4.5m bgl. No groundwater was encountered at this location.

2.4.12 The ground dissolution risk determined in the JNP Phase I report was low across the southern part of the site and very low across the northern part.

2015 GI

2.4.13 The bespoke ground investigation undertaken on-site by Soils Ltd in October 2015 confirms the expected geology and hydrogeology, identifying superficial deposits of Kesgrave Catchment Subgroup and Lewes Nodular Chalk Formation. Instances of made ground have been identified in the central area of the site.

2.4.14 Groundwater was only encountered within one borehole (BH2) and was struck at a depth of 12.40m bgl.

2.4.15 Tests in accordance with BRE 365 determined infiltration rates between 3.85 x 10^{-5}m/s and 6.878 x 10^{-5}m/s in the south and 4.491 x 10^{-6}m/s in the west, all within the Kesgrave Catchment Subgroup.

2023 GI

2.4.16 Further limited ground investigation was undertaken in March 2023 (reported in S11880-JNP-XX-XX-RP-G-1001 Soakaway Tests). Infiltration testing in accordance with BRE 365 was undertaken in four locations across the site. Results were variable across the locations, ranging from one location where infiltration was not viable, to positive tests with an infiltration rate of 1.4 x 10^{-4} m/s.

2.4.17 Groundwater was located in one area at shallow depth; this is not where infiltration basins are proposed. .

2.4.18 The ground investigations indicate that the Kesgrave Catchment Subgroup is variable across the site resulting in variable infiltration rates across the site and localised perched groundwater. The rates are summarised in a drawing in Appendix A.

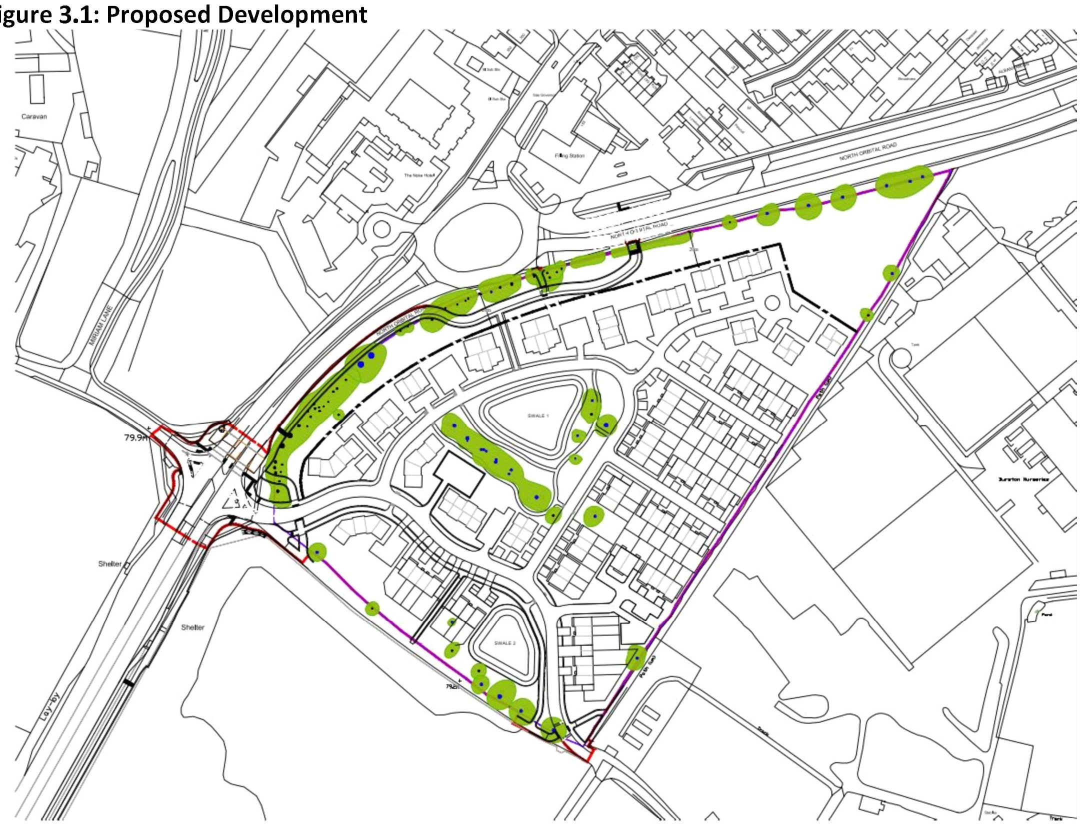
2.4.19 Based on the available geologic and hydrogeologic information, namely the soil / bedrock lithology, water table levels and infiltration rates, infiltration drainage is deemed feasible at the development site but further limited testing may be required.

3 PROPOSED DEVELOPMENT

3.1.1 The proposed development (Figure 3.1 and Appendix B) comprises 4.80 ha of residential development, including 2. 14 ha of hard paved / impermeable surfaces (e.g. roofs, roads, driveways, parking areas, etc.); this includes a 10% allowance for urban creep.

3.1.2 Under *Table 2* of the *Flood Risk and Coastal Change Guidance* (March 2014), 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 in Table 4.1. 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
Coastal	*Low risk*
Fluvial	*Low risk – Flood Zone 1, no areas at higher risk close to the site.*
Surface Water	Very low risk across the majority of the site. Small area of low risk from ponded water impacting a small area in the north east of the site. Overland flow route parallel to Lye Lane in south west has an increased risk of surface water flooding. Refer to section 4.3.
Groundwater	Phase I indicates a moderate risk of groundwater flooding. Refer to Section 4.4.
Sewers	*Low risk. Head of a foul sewer network located in the southern corner of the site Lowest part of the site). No indication of issues in Thames Water pre-app response.*
Infrastructure Failure	*EA mapping indicates no risk.*

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 guidance *Flood Risk Assessment: Climate Change Allowances* (May 2022), the proposed must take account of the following allowances:

- Peak Rainfall Intensity
  - Central 25%
  - Upper End 35%

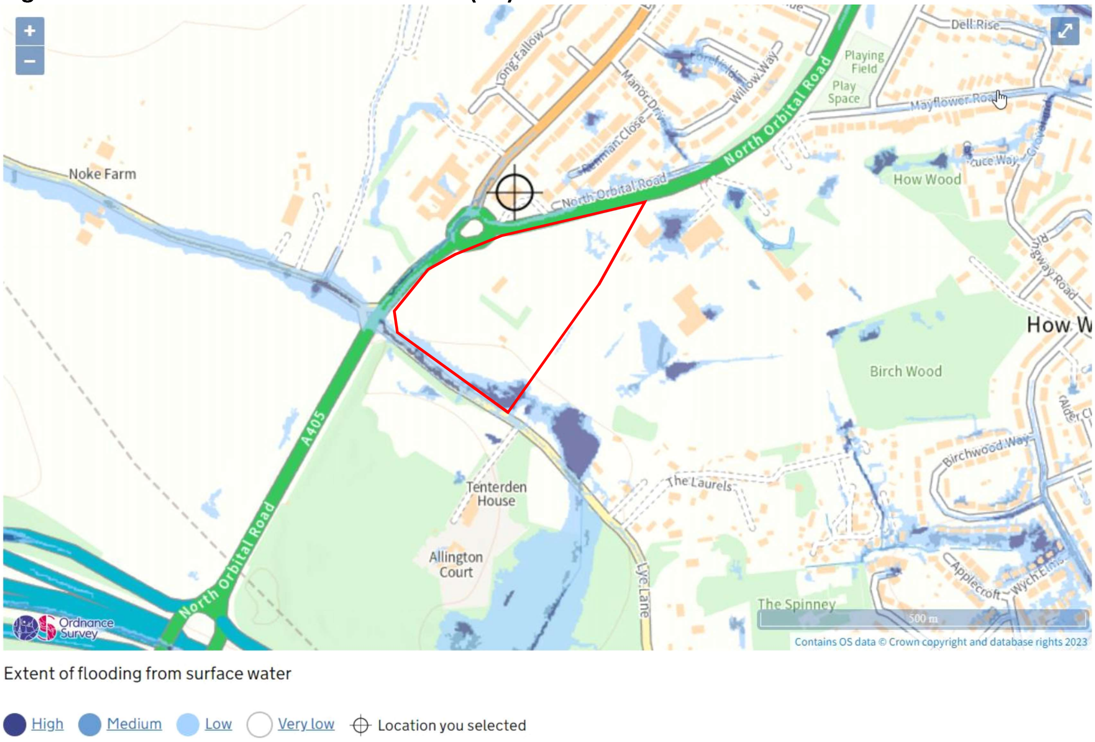
4.3 Surface Water Flood Risk

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 very intense, short lived rainfall events, but can also occur during milder, longer lived rainfall events, when collecting systems are at capacity or the ground is saturated. It often results in the inundation of low points in the terrain.

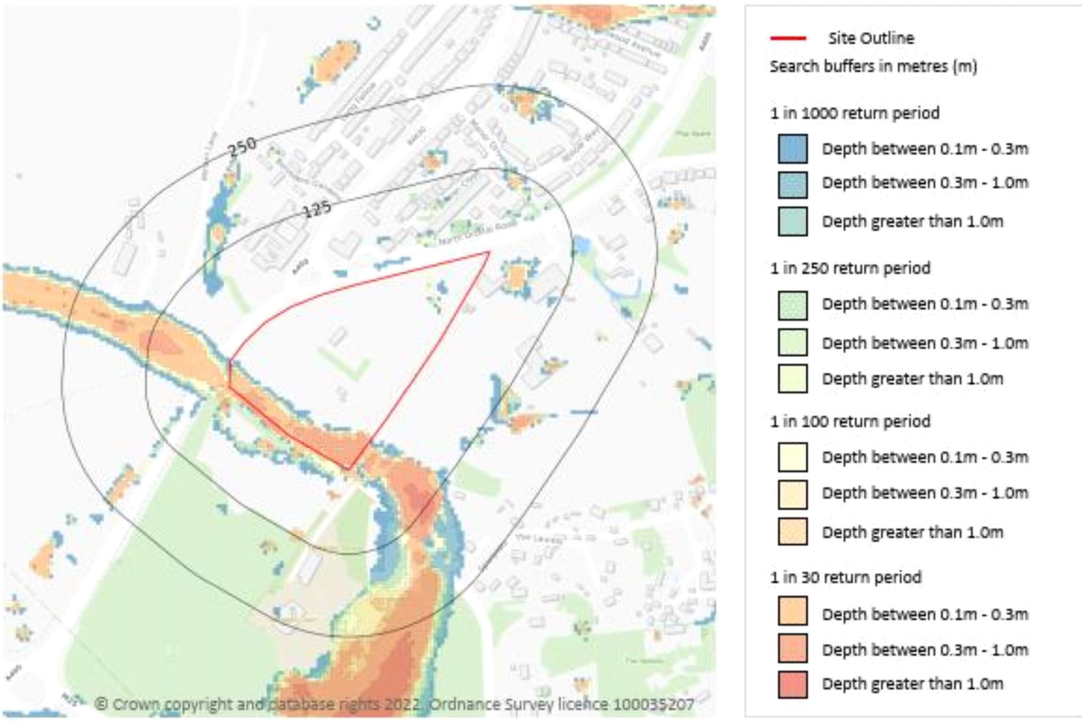
4.3.3 In accordance with the EA's *Long Term Flood Risk Information* (Figure 4.), the development site is mostly at very low (< 0.1% AEP) risk of surface water flooding. However, there is a small area at low risk of flooding in the north of the site and the area near the prominent overland flow path along the south western boundary (Lye Lane) is 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: Flood Risk from Surface Water (EA)



4.3.4 Data from the Groundsure report included in the Phase I report shows a similar picture but more detail is provided about the predicted flooding. the largest flood is predicted to result from a 1 in 30 year storm and result in flood depths up to 1.0m in the southern corner of the site (Figure 4.2).

Figure 4.2: Flood Risk from Surface Water (Groundsure)



4.3.5 The available information suggests off-site overland flows are expected to reach the development site from flows channelled along Lye Lane for some distance to the west.

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 within the development site will be managed by the drainage strategy described in Section 6.

4.4 Groundwater Flood Risk

4.4.1 Groundwater flooding occurs when the level of water filling the pores and / or cracks in the underlying soil and / or rock (i.e. water table) rises and emerges on the surface. The level of the water table varies seasonally and depends upon long term rainfall, thickness and porosity of the underlying strata and groundwater abstraction.

4.4.2 Groundwater flooding is most common in areas where the underlying bedrock and superficial deposits are very porous, but it can also happen at locations where superficial layers of sand or gravel overlay impermeable bedrock.

4.4.3 Groundwater flooding usually occurs after days or weeks of prolonged rainfall and often lasts for days or weeks, as subsiding of the water table can be a very slow process.

4.4.4 Besides posing a direct flood risk to developments (particularly basements), high water table levels can exacerbate other sources of flood risk by preventing infiltration and / or leaking into drainage systems.

4.4.5 The Groundsure report in the Phase I report indicates a moderate risk of groundwater flooding. The areas given this designation are coincident with the outcrop of the Kesgrave Catchment Subgroup. This stratum was investigated as part of the 2015 GI which did not find groundwater within the shallow Kesgrave Catchment Subgroup deposits. The 2023 GI did find a small area with a shallow water table associated with a lens of more cohesive strata. Spring lines were not observed on the site.

4.4.6 The risk of groundwater flooding on-site is therefore considered to be low.

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 The *Flood Risk and Coastal Change Guidance* categorises different types of uses and development according to their vulnerability to flood risk. 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 development in Flood Zone 1.

5.2 Surface Water Flood Risk

5.2.1 The following surface water flood risk management measures have been incorporated in the proposed development's master plan:

- As detailed in Section 6, the proposed surface water drainage strategy 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 + 40% climate change allowance.
- Vulnerable development will be set at least 150 mm above external ground levels, which will be designed to safely route overland flows away from buildings and towards the south east, using less vulnerable parts of the proposed development such as public open spaces, parking areas and roads to convey and attenuate overland flows (Appendix C). Plots may need to be raised more than 150mm along the route of the surface water flooding in the south of the site.
- Off-site runoff reaching the development site from the west will be allowed to continue to flow along the existing flowpath along the south western site boundary / Lye Lane.

6 SURFACE WATER DRAINAGE STRATEGY

6.1 Existing Drainage (Greenfield Runoff)

6.1.1 A single storey house with garage and drive was noted to be present in the central area of the site. A further garage and shed was noted in the central eastern and south eastern areas of the site. It is not known if these are served by existing drainage systems.

6.1.2 Greenfield and existing runoff rates of 1.5 l/s/ha (100.0% AEP), 1.8 l/s/ha (Q_{BAR}), 4.1 l/s/ha (3.3% AEP) and 5.8 l/s/ha (1.0% AEP) have been established for the development site using the *IH124* methodology with *ICP SuDS* correction for small catchments (Appendix D).

6.2 Proposed Drainage Strategy

6.2.1 The proposed drainage strategy has been designed to infiltrate all runoff from the site, with no additional off-site runoff.

6.2.2 The available ground information indicates that the site is underlain by Kesgrave Catchment Subgroup (refer to Section 2.4).

6.2.3 Infiltration testing has shown that infiltration rates in the Kesgrave Catchment Subgroup is variable. However, infiltration testing has been targeted at areas proposed as infiltration basins and positive results have been obtained at these site. Some shallow groundwater has been noted in areas but this is not at the proposed location of infiltration basins and groundwater is not anticipated within 1m of the base of these structures. Further ground investigation will be required to confirm these conclusions. However, the proposed drainage strategy is based on these assumptions. An alternative strategy is also proposed in case further testing indicates that a site wide infiltration strategy is not appropriate.

6.2.4 Rainwater is proposed to be collected from roof areas via rainwater pipes and conveyed by gravity to 2 no. infiltration basins. Small areas of the proposed roads cannot be drained by gravity to these locations, highway soakaways will be used in these areas.

6.2.5 The proposed drainage strategy (Appendix E) has been designed so that flooding does not occur on any part of the site for all events up to 1.0% AEP (1 in 100 years) + 40% climate change allowance.

6.2.6 Infiltration rates determined through testing are summarised on the plan in Appendix A. In the design, the following infiltration rates have been used:

- Basin 1 2.5×10^{-5} m/s
- Basin 2 3.9×10^{-5} m/s

6.2.7 The performance of the proposed surface water drainage strategy has been tested for storm events with 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.

6.2.8 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 Alternative Drainage Strategies

6.3.1 An alternative drainage strategy is also proposed, to be implemented should testing indicate that the ground conditions are not suitable for infiltration (areas of low infiltration near the proposed basins or a high water table).

6.3.2 In this case, a new connection should be made to the existing public sewers. There is a surface water sewer on the site side of the A405 to the north west of the site (Appendix F). Runoff should be restricted to as close to greenfield rates as possible, with the basins used to store excess run-off prior to discharge. Surface water will need to be pumped to the public sewer as this is at a higher elevation than the site.

6.3.3 A greenfield Q_{BAR} runoff rate of 1.8 l/s/ha has been established for the site using the IH124 methodology with ICP SuDS correction for small catchments (Appendix D). The proposed impermeable area is 2. 14 ha (including a 10% allowance for urban creep), so the greenfield runoff rate for the proposed development is 3.9 l/s.

6.3.4 As the existing surface water sewers are public, a pre-development enquiry should be made to Thames Water to confirm the sewer has capacity for the proposed discharge rate.

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 pervious pavements and infiltration basins to manage runoff quantity, Table 6.1 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 6.1: 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 a have a significant impact on downstream attenuation storage requirements. Blue roofs can be designed to provide significant attenuation (and evapotranspiration).
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.

SuDS Component	Description and Opportunities
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.
Bioretention Systems	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.
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. Pervious pavements are proposed for some of the parking courts.
Detention Basins	Detention basins are landscaped depressions that are normally dry expect 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). Infiltration basins are proposed in two locations on-site.
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.

6.5 Exceedance Events

6.5.1 Plot levels are set at least 150 mm above external ground levels and external ground levels have been designed to safely route overland flows away from buildings and towards the south, using the less vulnerable parts of the proposed development such as public open spaces, parking areas and roads to convey and store overland flows.

6.5.2 Overland flows resulting from exceedance events are expected to leave the developed site via the vehicle access in the south, as currently occurs (i.e. pre-development conditions), without posing any increased flood risk on site or elsewhere. The proposed overland flood routing plan is included in Appendix C.

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 Table 6.2.

Table 6.2: Surface Water Quality Management (Simple Index Approach)

Runoff Route / Treatment Train				
Land Use / SuDS	**Hazard Level**	**TSS**	**Metals**	**Hydrocarbons**
Pollution Hazard Indices				
Residential Roofs	Very Low	0.20	0.20	0.05
Driveways, residential car parks and low traffic roads	Low	0.50	0.40	0.40
SuDS Mitigation Indices				
Pervious Pavement	-	0.70	0.60	0.70
Detention Basin	-	0.50	0.50	0.60
Total SuDS Mitigation Index ≥ 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 Table 6.3. Appropriate legal agreements defining maintenance responsibilities and access rights over the lifetime of the proposed development must be established prior to construction.

Table 6.3: Entities Responsible for SuDS Maintenance

SuDS Component	Location	Function	Responsible Entity
Pervious Pavement	Private & public parking areas	Store & treat runoff	Owner or private management company
Detention Basin	Public open spaces	Store & treat runoff	Local authority, water company or private management company

6.7.3 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.

6.7.4 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 Table 6.4.

Table 6.4: Typical Operation and Maintenance Requirements

Operation and Maintenance Activity	SuDS Component	
	Pervious Pavement	Detention Basin
Regular Maintenance		
Inspection	■	■
Litter and debris removal	■	■
Grass cutting	□	■
Weed and invasive plant control	□	□
Shrub management (including pruning)	□	□
Shoreline vegetation management		□
Aquatic vegetation management		□
Occasional Maintenance		
Sediment management	■	■
Vegetation replacement		□
Vacuum sweeping and brushing	■	
Structure rehabilitation/repair	□	□
Infiltration surface reconditioning	□	

Key:
■ Will be required
□ 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. 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 pre-development conditions.
- Construction runoff should be directed to dedicated infiltration 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 undeveloped (greenfield) development site does not benefit from a formal foul water drainage system as foul flows from the existing property on site are collected in a cess pit to the rear (south) of the property.

7.1.3 In accordance with records obtained from TW (Appendix F), the nearest public foul sewer is the 150 mm pipe along Lye Lane.

7.1.4 It is proposed to provide a formal foul drainage system for the site, connected to the public sewer in Lye Lane (Appendix E).

7.1.5 As invert levels of the existing public foul drainage network are deep enough to allow gravity drainage from the site, a gravity system is proposed.

8 CONCLUSIONS AND RECOMMENDATIONS

8.1.1 JNP Group has been commissioned by 51 Pegasus to prepare a Flood Risk Assessment and Drainage Strategy (including Maintenance Plan) for the proposed development at Copsewood, Lye Lane in Chiswell Green, St Albans, Hertfordshire.

8.1.2 The site has a total area of 6.1 ha of which 4.5 ha is the development area. The is currently partially developed.

8.1.3 The site is underlain by the Kesgrave Catchment Subgroup which GI has proven to be mainly sands and gravels but with some more cohesive lenses of material. Groundwater was generally absent from the stratum but a lens of groundwater was associated with the more cohesive strata in the centre / north of the site. Infiltration testing reflected this variation in lithology with positive results in parts of the site and some areas where infiltration was not possible.

8.1.4 Based on the available geological and hydrogeological information, infiltration drainage is deemed feasible at targeted locations across the development site. Some additional testing is recommended to confirm infiltration rates in these areas.

8.1.5 There is a pond and ditch within 200m of the site but otherwise there is not significant surface water features close to the site. Discharge to surface water is deemed unfeasible.

8.1.6 The Flood Risk Assessment section of this report demonstrates that the risk of flooding from all most (fluvial, tidal, groundwater, sewer and reservoir) is low.

8.1.7 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.

8.1.8 The development site is mostly at very low risk of surface water flooding. However, there is a small area at low risk of flooding in the north of the site and the area near the prominent overland flow path along the south western boundary (Lye Lane) is at low, medium and high risk of surface water flooding.

8.1.9 The surface water flood risk will be mitigated by the proposed surface water drainage strategy for the proposed development, vulnerable development will be set at least 150 mm above external ground levels and off-site runoff reaching the development from the west will be allowed to continue to flow along the existing flowpath along the south western site boundary / Lye Lane.

8.1.10 The site is currently completely mostly greenfield and development will increase the impermeable area. There is no formal drainage stem on site at the moment connecting to the public system.

8.1.11 The proposed drainage strategy intends to collect runoff via a series of rainwater pipes and pervious pavements before discharging into infiltration basins. The design of these is based on infiltration rates determined at the basin locations.

8.1.12 Should further testing indicate infiltration is not a viable strategy (areas of low infiltration near the proposed basins or a high water table), then an alternative strategy is proposed to discharge surface water to the public system at a greenfield run-off rate (3.9 l/s). Attenuation storage would be provided in proposed basins.

8.1.13 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 plus 40% climate change allowance.

8.1.14 Overland flows resulting from exceedance events are expected to leave the developed site via the southern vehicular access, as currently occurs.

8.1.15 Water quality management is to be achieved through the treatment potential of the pervious pavement and infiltration (attenuation) basins. The hazard level is very low or low, and the water quality treatment is considered acceptable following the completion of the simple index approach from the SuDS Manual.

8.1.16 The proposed foul water drainage strategy is to drain into the foul sewer network in the surrounding highway network (to the north west). It is expected that the surrounding network will have enough capacity for the proposed development but this should be confirmed with Thames Water.

8.1.17 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, including SuDS features.

8.1.18 In conclusion, the proposed development is not at risk of flooding and does not increase flood risk off-site.

8.1.19 Any connection to the public sewer is subject to a Section 106 application.

8.1.20 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.

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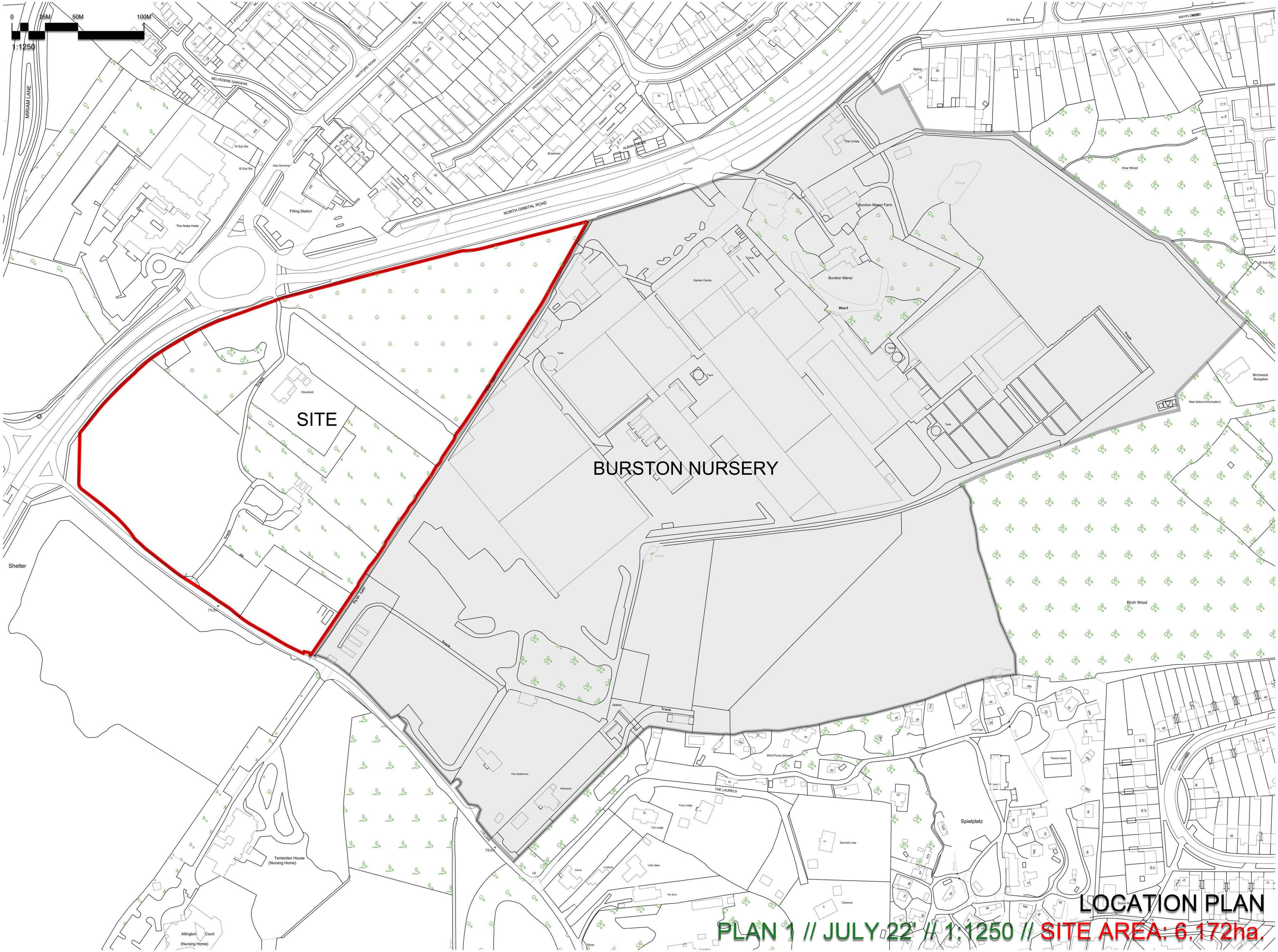
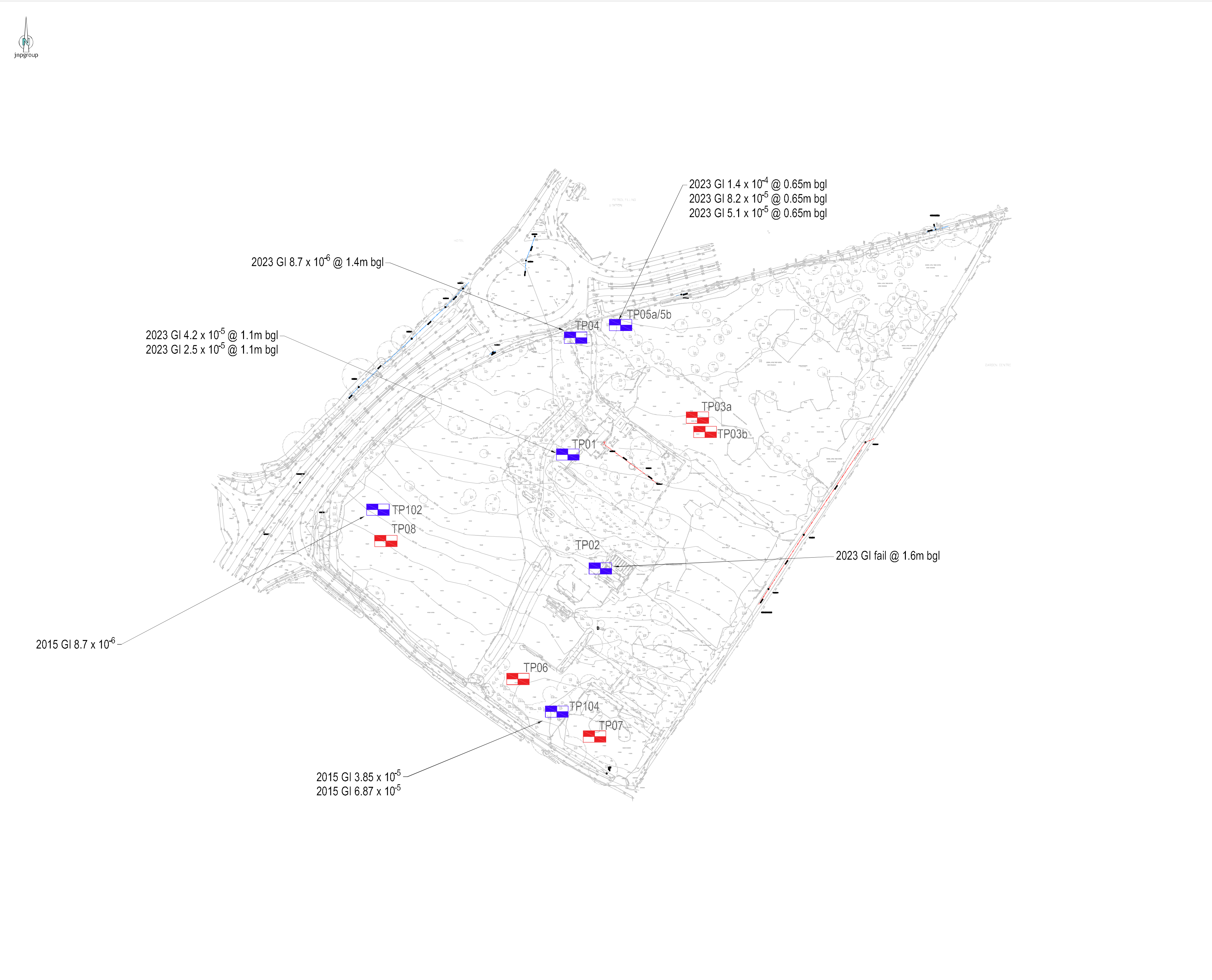
APPENDIX A
SITE INFORMATION

BURSTON NURSERIES ST ALBANS



LOCATION PLAN

PLAN 1 // JULY 22' // 1:1250 // SITE AREA: 6.172ha.



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Key

- Trial Pit
- Trial Pit with Soakaway Test Infiltration rates in m/s

Rev	Date	Description	Chk
P01	29/03/2023	Exploratory Hole Location Plan	CG

Suitability: S2 - Suitable for Information

JNP GROUP
CONSULTING ENGINEERS
Chesham • Brighouse • Bristol • Glasgow • Hartlepool • Leamington Spa • Sheffield
www.jnpgroup.co.uk

Client: 51 Pegasus

Job: Copsewood, Lye Lane

Title: Infiltration Rates Summary

FI_60_20

Scale @ A1: 1:1000

S11880 - JNP-XX-XX- DR-G- 7002 | P01

APPENDIX B

PROPOSED DEVELOPMENT

Notes

Figured dimensions to be used in preference to scaled.
The Contractor is to check all site dimensions and setting-out and obtain the Architect's instructions in respect of any discrepancy revealed before work is put in hand.
Description or illustration of proprietary systems or products is not to be taken as licence in respect of patents or copyright involved or royalties due.
All rights in drawing and design are reserved to the Architect.
Copyright; not to be reproduced without the Architect's permission.
Subject to survey.
Subject to detail design and planning.

SUBJECT TO PLANNING

N — 0 10 20 40 60m

Site Boundary 6.54Ha (66382m²) Including Highways Improvements

Ownership Boundary 6.16Ha (61586m²) Including Existing Landscape Buffer

SITE AREA:

OWNERSHIP SITE AREA - 61586m²
INCLUDES:
BUFFER - **11174m²**

TPO ZONES - **1694m²**
(Central Zone 2014m² + Southern Zone 1273m²)

SURFACE WATER ATTENUATION - **3287m²**
(Central Basin 2014m² + Southern Basin 1273m²)

NET DEVELOPABLE SITE AREA - 45431m² (4.54HA)

DENSITY - 41.9 DWELLINGS/HA

Rev. | Date | Details

Project:
Copsewood,
North Orbital Road,
St Albans,
AL2 3TD

Content:
Post Pre-Application
Proposed Indicative Site Plan

Scale: 1:1000@A1 | North:
Date: MAR23 | Drawn: TH | Rev: -

CW/23/PP03

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