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**FLOOD RISK ASSESSMENT AND
SURFACE WATER DRAINAGE STRATEGY**

AT

**UNIT 1 STADIUM TRADE & BUSINESS PARK
READING**

REF: 220115-MNP-XX-XX-RP-C-0001

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Report prepared by:



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1. INTRODUCTION

1.1. Mason Navarro Pledge Ltd have been commissioned by NRP Ltd to produce a Flood Risk Assessment (FRA) and Drainage Strategy report for a proposed redevelopment of Unit 1/1A at Stadium & Trade Business Park, Reading.

1.2. Based on the guidance in the National Planning Policy Framework (NPPF, February 2019) and associated Planning Practice Guidance (PPG, amended April 2015), developments should include an appropriate Flood Risk Assessment if any or all of the following criteria are met:

- Site is greater than 1 hectare
- Potentially located in Flood Zone 2 or 3
- Considered a major planning application (as defined by local planning authority)

1.3. In this case, the overall site area extends over 0.45 hectares where the existing industrial unit is shown to lie within Flood Zone 2 and the external hardstanding areas with Flood Zone 3, therefore this assessment has been prepared to accompany the planning application.

1.4. This report has been prepared in accordance with the NPPF and the accompanying Technical Guidance.

1.5. The following documents were consulted to inform the flood risk assessment and drainage strategy for the site:

- The Flood Risk and Flood Zone Maps published by the Environment Agency (EA);
- Geological information published on the British Geological Survey (BGS) website;
- DEFRA Magic Map Application;
- Herts and Essex Site Investigation Phase I Desktop Study Report, August 2020;
- Reading Borough Local Plan - *Reading Borough Council, November 2019*;
- Reading Borough Council's Strategic Flood Risk Assessment - Peter Brett Associate Ltd, June 2017;
- Reading Borough Council Local Flood Risk Management Strategy, October 2015;
- Reading Borough Council Sustainable Design and Construction Supplementary Planning Document, December 2019;
- SJB Surveying Ltd existing topographical survey, April 2020
- Drainflow Solutions Ltd Drainage Survey Plan
- SGP architects + Masterplanners Proposed Site Plan

1.6. This report has been prepared by Andrew Quinn BEng (Hons).

SITE LOCATION & USE

- 1.7. The proposed development covers an area of 0.45Ha and is located at National Grid Reference (NGR) 468631mE, 174381mN. The existing site is located at Unit 1/1A, Stadium Way, Reading, RG30 6BX. Refer to Figure 1 below for site Location.
- 1.8. The existing building was an industrial unit housed within Stadium & Trade Business Park - that has since been demolished due to extensive fire damage (refer to Figure 2 below). The site itself is accessed of Scours Lane/Stadium Way to the North. At the front of the building there was an office area with a concrete slab forming a mezzanine floor. Elsewhere the building was a single storey industrial unit. In the north east corner of the site, there is an electrical sub-station, this substation is to be retained as part of the redevelopment.
- 1.9. The previous Unit 1/1A adjoined to other industrial units to the south. These existing adjoining units to the south are to remain as existing as they remain outside the sites demise. The extent of the site boundary to the north does encapsulate part of the Stadium Way access road and the junction with Scours Lane. The east site boundary also includes a portion of the shared service yard area. The southern boundary line runs directly between where Unit 1/1A stood and the retained units to the south. To the west the site boundary includes a service yard that provided rear access to the unit. Refer to Appendix A for the full extent of the site boundary.
- 1.10. Beyond the northern boundary of the site lies the Great Western railway line. Beyond the railway line the River Thames lies approximately 225m north from the site.

FIGURE 1: SITE LOCATION (PINK LINE APPROXIMATE SITE BOUNDARY)

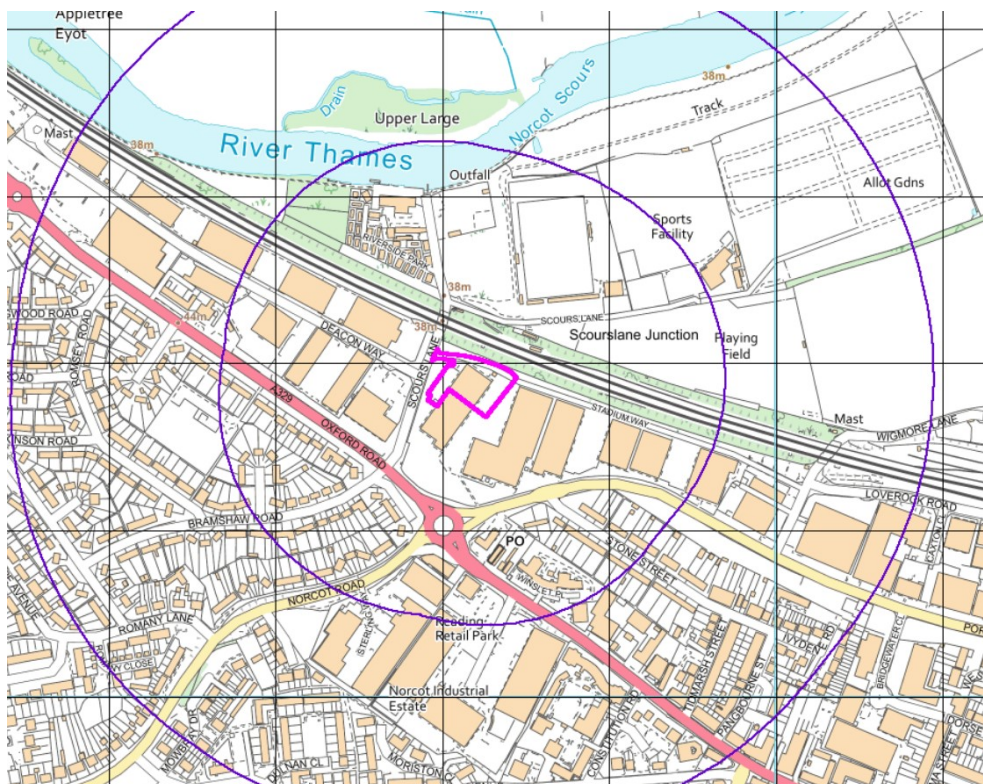


FIGURE 2: EXISTING SITE PHOTO (LOOKING SOUTHWARD)



2. POLICY CONTEXT

NATIONAL PLANNING POLICY FRAMEWORK (NPPF)

- 2.1 The latest NPPF was adopted in February 2019, one of the overarching objectives of the NPPF is the encouragement of growth and acknowledgement that decision-makers should adopt a presumption in favour of sustainable development. Paragraph 11 of the document states:

*“For **decision-taking** this means:*

- approving development proposals that accord with an up-to-date development plan without delay; or*
- where there are no relevant development plan policies, or the policies which are most important for determining the application are out of date, granting permission unless:*
 - the application of policies in this Framework that protect areas or assets of particular importance provides a clear reason for refusing the development or*
 - any adverse impacts of doing so would significantly and demonstrably outweigh the benefits, when assessed against the policies in this Framework taken as a whole.”*

- 2.2 Section 14 of the NPPF seeks to address the issues of climate change, flooding and coastal change. In paragraph 155 it states: “Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere.”

PLANNING PRACTICE GUIDANCE TO THE NATIONAL PLANNING POLICY FRAMEWORK

- 2.3 The Planning Practice Guidance (PPG) was first published in March 2014 and at the same time the Technical Guidance to the NPPF was withdrawn. The key difference with the new PPG is that it is a web-based resource, and each section is updated as needed.
- 2.4 Section 7 covers “Flood Risk and Coastal Change” and was last updated in April 2015.
- 2.5 The assessment of flood risk is based on the definitions in Table 1 of the PPG. This information is replicated below for ease of reference.

TABLE 1: FLOOD ZONE DEFINITIONS

Flood Zone	Annual probability of river or sea flooding
Zone 1 <i>Low Probability</i>	Land having less than 1 in 1000 annual probability of river or sea flooding (<0.1%)
Zone 2 <i>Medium Probability</i>	- Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or - Land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding.
Zone 3a <i>High Probability</i>	- Land having a 1 in 100 or greater annual probability of river flooding; or - Land having a 1 in 200 or greater annual probability of sea flooding.
Zone 3b <i>The Functional Floodplain</i>	- This zone comprises land where water has to flow or be stored in times of flood. - Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency.

- 2.6 The NPPF classifies the Flood Risk Vulnerability of various land uses in Table 2 (reproduced below). The More Vulnerable Classification encompasses usages such as hospitals and buildings used for dwellings. Less Vulnerable applies to buildings used for general industry, storage and distribution.

TABLE 2: LAND USE CLASSIFICATION

Classification	Land Use
Essential Infrastructure	- Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. - Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood. - Wind turbines.
Highly Vulnerable	- Police stations, ambulance stations and fire stations and command centres and telecommunications installations required to be operational during flooding. - Emergency dispersal points. - Basement dwellings. - Caravans, mobile homes and park homes intended for permanent residential use. - Installations requiring hazardous substances consent (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities,

Classification	Land Use
	or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as “essential infrastructure”).
More Vulnerable	■ Hospitals. ■ Residential institutions such as residential care homes, children’s homes, social services homes, prisons and hostels. ■ Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels. ■ Non-residential uses for health services, nurseries and educational establishments. ■ Landfill and sites used for waste management facilities for hazardous waste. ■ Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
Less Vulnerable	■ Buildings used for shops; financial, professional and other services, restaurants and cafes, hot ■ food takeaways, offices, general industry, storage and distribution and assembly and leisure. ■ Land and buildings used for agriculture and forestry. ■ Waste treatment (except landfill and hazardous waste facilities). ■ Minerals working and processing (except for sand and gravel working). ■ Water treatment plants and sewage treatment plants (if adequate pollution control measures are in place).
Water-compatible development	■ Flood control infrastructure. ■ Water transmission infrastructure and pumping stations. ■ Sewage transmission infrastructure and pumping stations. ■ Sand and gravel working. ■ Docks, marinas and wharves.

2.8 The overall aim is to steer new development to Flood Zone 1. Where there are no reasonably available sites within Flood Zone 1, local planning authorities allocating land in local plans or determining planning applications for development at any particular location should take into account the flood risk vulnerability of land uses and consider reasonably available sites in Flood Zone 2, applying the Exception Test if required. The table below, replicated from Table 3 of the PPG, indicates which

Flood Zones are considered to be appropriate for different land uses based upon the Sequential Test.

TABLE 3: FLOOD RISK VULNERABILITY CLASSIFICATION

Flood Zone	Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable (Residential)	Less Vulnerable
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	✓	Exception Test Required	✓	✓
Zone 3a	Exception Test Required	✓	✗	Exception Test Required	✓
Zone 3b Functional Floodplain	Exception Test Required	✓	✗	✗	✗

- ✓ Development is appropriate
- ✗ Development should not be permitted

- 2.9 The sequential approach requires the application of the Sequential Test whereby, in addition to the requirements of Table 3, development should first be directed to Flood Zone 1, then Flood Zone 2 and lastly Flood Zone 3.
- 2.10 Where the Exception Test is required it is necessary to demonstrate, partly through a site-specific flood risk assessment, that:
- The development will provide extensive sustainability benefits to the community
 - And that these benefits outweigh the flood risk
 - When considering the vulnerability of its users, the development will be safe for its lifetime
 - Flood risk is not increased elsewhere, and reduced overall where possible
- 2.11 Further detail on the lifetime of development is also given in the PPG, which advises for residential development that a period of 100 years should be considered whilst for non-residential this is dependent upon the development characteristics.
- 2.12 The use of sustainable drainage systems is considered by the PPG to offer the following benefits:

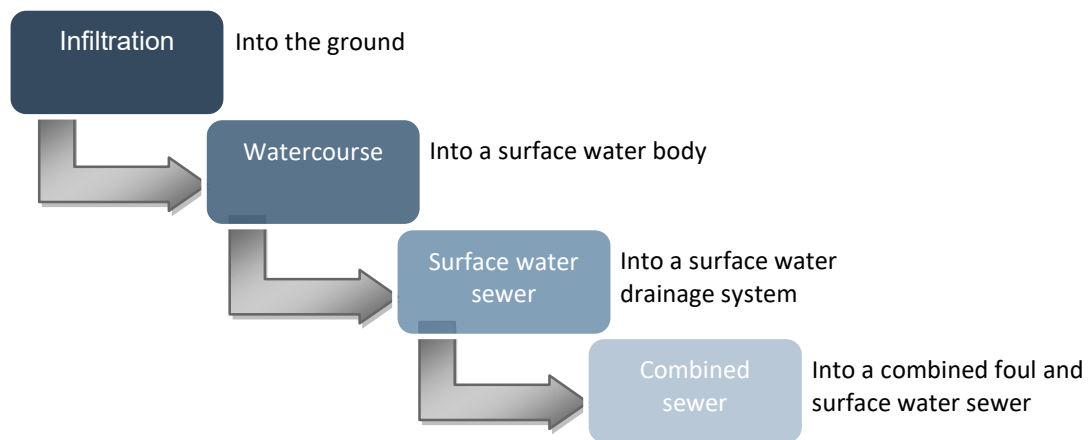
- Reduce the causes and impacts of flooding
- Remove pollutants from urban run-off at source
- Combine water management with green space with benefits for amenity, recreation and wildlife

2.13 In the consideration of major developments, sustainable drainage should be provided unless it can be demonstrated that this would be inappropriate. Major developments are defined in the Town and Country Planning Order 2015; some of these definitions encompass the following:

- Development site area of 1 hectare or more
- Provision of 10 or more residential dwellings
- Development of residential dwellings on a site having an area of 0.5 hectares or more and where the proposed no. of dwellings is not known to fall into the above criterion or not
- Provision of buildings where the floor space to be created by the development is 1,000m² or greater

2.14 The aim of sustainable drainage systems is to dispose of surface water using the following hierarchy were reasonably practicable.

FIGURE 3: SURFACE WATER DISPOSAL HIERARCHY



2.15 The assessment of what is considered to be reasonably practicable in terms of sustainable drainage system provision should consider the costs associated with the design, construction, operation and maintenance of the system, and whether these are economically proportionate in relation to the consumer costs for an effective drainage system that instead connects directly to a public sewer.

READING BOROUGH COUNCIL - STRATEGIC FLOOD RISK ASSESSMENT (SFRA)

- 2.16 The main purpose of the SFRA is to provide sufficient flood risk information to enable an update of any flooding policies within the area. In achieving this, the SFRA will achieve the objectives of:

- Influencing Council policy regarding decisions that are made
- Aiding the Council's response to proposed developments
- Recognising means of reducing flood risk
- Inform the emergency flood plans

- 2.17 Reading Borough Council's Strategic Flood Risk Assessment was prepared by Peter Brett Associates which was published in June 2017.

LOCAL POLICIES & GUIDANCE

- 2.18 In conjunction with the Reading Borough Local Plan 2033. The following policies are applicable to flood risk and drainage.

Local Plan Policy CC3 - Adaptation to Climate Change

"All developments will demonstrate how they have been designed to incorporate measures to adapt to climate change. The following measures shall be incorporated into development:

- *All development shall minimise the impact of surface water runoff from the development in the design of the drainage system, and where possible incorporate mitigation and resilience measures for any increases in river flooding levels as a result of climate change"*

Local Plan Policy EN18 - Flooding and Sustainable Drainage Systems

"Development will be directed to areas at lowest risk of flooding in the first instance, following the Sequential and Exceptions Test set out in the NPPF, and taking into account the effects of climate change. It will consider flooding from all sources, including fluvial, surface water, groundwater and sewer flooding. Where development in areas at risk of flooding is necessary, it will not reduce the capacity of the flood plain to store floodwater, impede the flow of floodwater or in any way increase the risks to life and property arising from flooding. Wherever possible, development should be designed to reduce flood risk, both on- and off-site.

All major developments must incorporate sustainable drainage systems (SuDS) as appropriate and in line with the Government's Technical Standards. Smaller schemes are encouraged to incorporate SuDS, where possible. Runoff rates should aim to reflect greenfield conditions and, in any case, must be no greater than the existing conditions of the site. Schemes should ensure that the movement of water through vertical infiltration as well as horizontal run-off does not worsen contamination effects. Wherever possible, SuDS provision should maximise

ecological benefits, link into the existing Green Network, incorporate tree planting and landscaping and avoid damage to existing significant trees, including through changes to the site hydrology. All new developments in areas of flood risk should give priority to SuDS.”

- 2.19 The Reading Sustainable Design and Construction Supplementary Planning Document provides some further guidance in relation to sustainable surface water drainage for the borough.

“All major developments must incorporate SuDS as appropriate (as outlined in Policy EN18: Flooding and Sustainable Drainage Systems of the Local Plan) and in line with the Government’s Technical Standards.

SuDS must be integrated into designs from the beginning and early discussions with the Local Planning Authority are highly encouraged, as this can prevent issues during the application stage especially on large sites.

Permeable pavement is an alternative to conventional paving in which water filters through the paved structure rather than running off it. Both the surface and the subgrade need to be designed with this function in mind. Water may be allowed to infiltrate directly into the subsoil where conditions are suitable. Alternatively, it can be held in a reservoir structure under the paving for re-use, infiltration or delayed discharge.”

- 2.20 The drainage assessment in this report will ensure that any proposals for additional drainage are assessed and mitigated, against flood risk, and incorporate good SuDS practices where possible.

- 2.21 Consideration of the following is also addressed in this report, where applicable:

- I. The presence of constraints that must be considered prior to planning infiltration SuDS.
- II. The drainage potential of the ground.
- III. Potential for ground instability when water is infiltrated.
- IV. Potential for deterioration in groundwater quality as a result of infiltration.

3. DEVELOPMENT DESCRIPTION

- 3.1 As described in section 1 the previous existing Unit 1/1A has been demolished due to extensive fire damage. The original unit was used as a single industrial unit/warehouse.
- 3.2 The proposed redevelopment is to construct a like for like to the original unit to the same footprint size in the same location on the 0.45Ha site which will be used a trade/warehouse unit. The internal configuration is to slightly differ from that of the previous unit, as it is to be divided in to four separate units.
- 3.3 There is to be no change to the existing footprint of the building or impermeable area of the site based on the proposed development.
- 3.4 Refer to Appendix A for a copy of the proposed site plan.

4 GEOLOGY, HYDROLOGY & TOPOGRAPHY

SITE GEOLOGY

- 4.1 Geological conditions at the site are detailed below in Table 4 and are based on the British Geological Survey (BGS) Viewer. The focus of an FRA study on geology is to examine the potential movement of water through the local geology.

TABLE 4: GEOLOGICAL GROUND CONDITIONS

Formation	Description
Superficial Deposits (Drift Deposits)	Alluvium - Clay, silt, sand and gravel. Alluvium is a general term for clay, silt, sand and gravel. Normally soft to firm consolidated, compressible silty clay, but can contain layers of silt, sand, peat and basal gravel. Taplow Gravel Member - Sand and gravel, locally with lenses of silt, clay or peat.
Bedrock	Seaford Chalk Formation and Newhaven Chalk Formation - Chalk. Sedimentary bedrock formed between 89.8 and 72.1 million years ago during the Cretaceous period

SITE HYDROGEOLOGY

- 4.2 The hydrogeological features of the site are provided in summary in Table 5. Hydrogeological features of the site have been identified from the DEFRA Magic Map application.

TABLE 5: HYDROGEOLOGICAL GROUND CONDITIONS

Map Dataset	Designation	Comment
Groundwater Vulnerability Zone	Medium - High (Soluble Rock Risk)	This describes the vulnerability of the underlying groundwater body from activities carried out on the surface. High - Areas able to easily transmit pollution to groundwater. They are characterised by high leaching soils and the absence of low permeability superficial deposits.
Aquifer Maps: Bedrock Deposits Designation	Principal	These are layers of rock or drift deposits that have high intergranular and/or fracture permeability. 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.
Aquifer Maps: Superficial Deposits Designation	Secondary A	permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

Groundwater Source Protection Zone	Zone 0	This zone has no groundwater source protection zone.
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SITE TOPOGRAPHY

- 4.3 A site-specific topographical survey has been carried out by SJB Surveying Ltd (April 2020). The topographical survey was carried out prior to the demolition of Unit 1/1A. Refer to survey enclosed in Appendix B.
- 4.4 Unit 1/1A had a surveyed finished floor level of 38.800mAoD. the external levels to the east of the unit fall away from the unit to approximately 38.500mAoD. From the survey it is believed that the hardstanding area is served by a number of gullies located in low points.
- 4.5 The area to the west of the previous unit similar to the east falls away from the unit to an approximate level of 38.500mAoD. The topographical survey has not surveyed any surface water gullies or channels. Given the existing area to the west is primarily cover in impermeable surfaces it is assumed that the area is drained by gullies, but given the on-site demolition, a new drainage infrastructure to this area is likely to be required.
- 4.6 The external area to the north falls away from the existing unit towards Stadium Way to approximate levels of 38.450mAoD. The Stadium Way covered by the topographical survey shows the levels along Stadium Way to primarily level between 38.400m and 38.500mAoD with localised low points to collect surface water runoff.

5 FLOOD RISK

5.1 The NPPF and the SFRA identifies several potential sources of flooding that must be considered when assessing flood risk, these are considered below in the following order:-

- Flooding from rivers (fluvial flooding)
- Flooding from the sea (tidal flooding)
- Flooding from land
- Flooding from sewers
- Flooding from groundwater
- Flooding from reservoirs, canals, and other artificial sources

FLOODING FROM RIVERS (FLUVIAL FLOODING) & SEA (TIDAL FLOODING)

5.2 The indicative flood maps published by the Environment Agency (EA) identifies that the previously existing unit on site was located entirely within Flood Zone 2. With a portion of the external hardstanding areas shown to be within Flood Zone 3.

FIGURE 4: EA FLOOD MAP FOR PLANNING

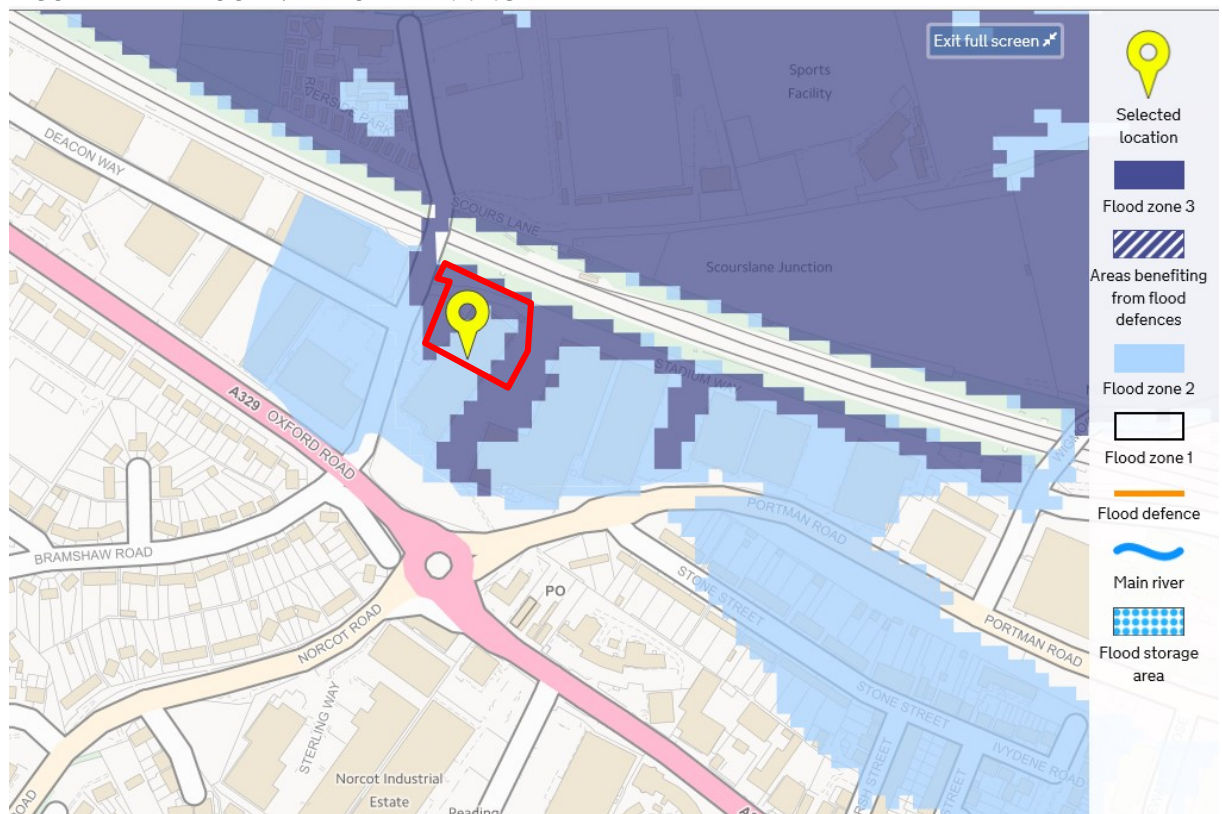
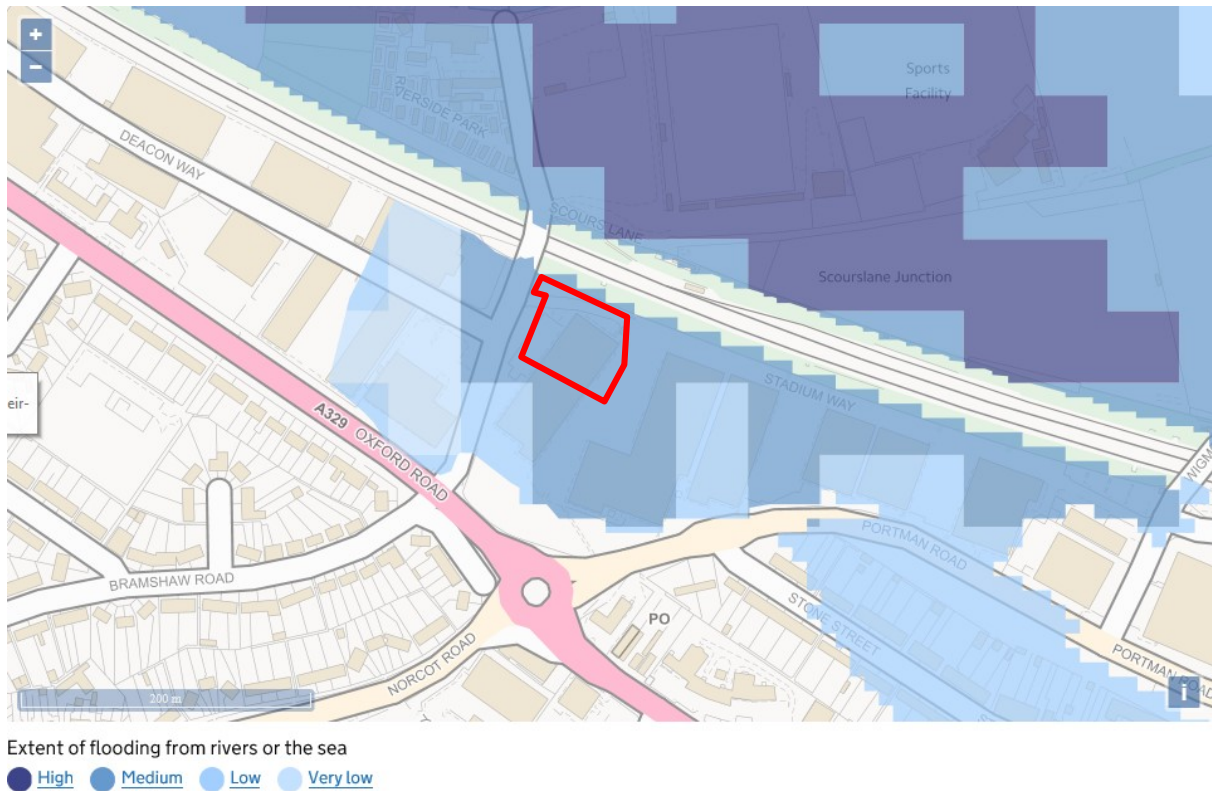


FIGURE 5: EA FLOOD RISK MAP FROM RIVERS AND SEAS



- 5.3 In summary the existing building falls within Flood Zone 2 which is classed as land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding and is considered at low to medium risk. The large majority of the external yard areas and the access road of Stadium Way to the north falls within Flood Zone 3a which is classed as land having between a 1 in 20 and 1 in 100 annual probability of river flooding and identified at medium risk flooding from rivers and seas.

FLOODING FROM SURFACE WATER

- 5.4 The EA Risk of Flooding from Surface Water map is published on their website to identify areas potentially at risk of flooding from surface water. This mapping identifies overland flow and surface water flooding which typically arises following periods of intense rainfall, often of short duration, that is unable to soak into the ground or enter drainage systems, it can run quickly off land and result in localised flooding.

FIGURE 6: EA SURFACE WATER FLOOD MAP



- 5.5 With reference to Figure 6 above, the site is predominantly shown to be in an area at low risk of flooding from surface water. The extent of the immediate existing yard area on all sides of the building is shown to be at low risk. As you move to the south/southwest side of the building the risk to surface water flooding decrease and moves to very low risk, suggesting the land rises here. Along Stadium Way to the north and at the intersection with Scours Lane the risk of surface water flooding moves to medium and high risk.
- 5.6 In summary, whilst the building and the immediate external areas are at low risk of surface water flooding. The carriageway of Stadium Way to the north is at medium to high risk.

FLOODING FROM GROUNDWATER

- 5.7 Flooding from groundwater generally occurs when water stored beneath the ground reaches the surface. This type of flooding is generally associated with porous rocks such as sands, gravels, limestone and chalk. It can result in flooding for a prolonged period of time. A groundwater flood event results from a rise in groundwater level sufficient for the water table to intersect the ground surface and inundate low lying land. Groundwater floods tend to be long in duration developing over weeks or months and prevailing for days or weeks.
- 5.8 Section 6.5 of the Reading Borough Council SFRA provides details on groundwater flooding in the borough of Reading. The SFRA notes that the risk of groundwater flooding across the borough is typically considered to be low. Figure F3 of the SFRA maps out within the borough recorded historic groundwater flooding incidents. With reference to the map there is no recorded groundwater flood event to have occurred at the site.
- 5.9 With reference to Map F8 of the Reading Borough Council SFRA which depicts an area's susceptibility to groundwater flooding, the site is shown within an area with 50-75% susceptibility to groundwater flooding.
- 5.10 In summary, although the site is depicted within an area with slightly elevated susceptibility. Given there has been no recorded groundwater flood incidents to have occurred at or within the vicinity of the site, the site is deemed to not be at significant risk of flooding from groundwater.

FLOODING FROM SEWERS

- 5.11 During heavy rainfall, flooding from the sewer system may occur where the rainfall event exceeds the capacity of the drainage system. The system becomes blocked by debris or sediment. The system surcharges due to high water levels in receiving watercourses.
- 5.12 Section 6.6 of the Reading Borough Council SFRA provides details on sewer flooding for the borough. Map F9 of the SFRA illustrates areas of recorded sewer flooding incidents across the borough as per their postcode (site - RG30 6). The DG5 data used to produce Map F9 is only up until incidents as of February 2016. The development site is located in an area that has recorded greater than 101 sewer incidents as per Thames Water records.
- 5.13 If reference is made to Figure F3 of the SFRA the map indicates that there is no recorded sewer flooding incident on the site.
- 5.14 In summary, whilst the site's postcode of RG30 6 is defined as having had greater than 101 sewer flooding incidents, there is no sewer flooding incident to have occurred on the site and therefore the site is deemed at low risk to sewer flooding.

HISTORICAL FLOODING

- 5.15 With reference to both the Environment Agencies requested data and section 8.1 of the Reading Brough Council SFRA. Mapping illustrates that the site was subjected to flooding in 1947. Refer to Appendix C for mapping of flood extent.
- 5.16 Section 8.1.5 of the SFRA outlines the route cause of the 1947 flood *“The 1947 flood was the greatest flood of the last century (and the greatest flood since 1894) and was largely due to rare meteorological circumstances whereby an extensive period of heavy snowfall was rapidly followed by a rapid thaw combined with heavy rainfall, which could not percolate into the still frozen ground”*

FLOODING FROM RESERVOIRS, CANALS & OTHER ARTIFICIAL SOURCES

- 5.17 The EA Risk of Flooding from Reservoirs Map is published on their website to identify areas potentially at risk of flooding from large reservoirs (>25,000 m³ of water), if they were to fail and release the water they hold. It does not display data for smaller reservoirs

FIGURE 7: EA FLOOD MAP FOR RESERVOIR BREACH EVENT



Extent of flooding from reservoirs

● Maximum extent of flooding

- 5.18 The EA Risk of Flooding from Reservoirs Map notes no large reservoirs that may affect the site in a breach event.

ENVIRONMENT AGENCY FLOOD DATA

- 5.19 Product 4 Flood Data has been sourced specific for the site from the Environment Agency. The Product 4 data provides further information on areas benefiting from defences, statutory main river designations, historic flood event and more detailed information from computer river models (including model extent, information on one or more specific points, flood levels, flood flows). Please refer to Appendix D for the Product 4 data.
- 5.20 The EA has conducted some 2D river modelling and provide the specific flood data for the site. With reference to the Product 4 modelled data extracted below in Table 6. The nearest modelled node to the site is 'Flood Point 3' the 1 in 1000 year fluvial flood level is modelled at 39.517mAoD and the 1 in 100 year fluvial flood level is modelled at 38.860mAoD.

TABLE 6: FLOOD POINT 3 PRODUCT 4 FLOOD LEVELS

Return Period	Flood Level (mAoD)
20% AEP	No data
5% AEP	38.410
1% AEP	38.860
1% AEP+25%CC	39.210
1% AEP+35%CC	39.300
1% AEP+70%CC	39.630
0.1% AEP	39.517

- 5.21 With reference to a survey conducted by SJB Building Surveys (Refer to Appendix B). A survey of the existing site notes that the existing building threshold/finished floor level of 38.800mAoD. The existing building floor level is approximately at the 1 in 100 year flood level. The surrounding external levels are lower than the building threshold level with levels varying between 38.450 - 38.600mAoD, which puts this below the 1 in 100 year modelled fluvial flood level of 38.860mAoD but above the 1 in 20 year flood level of 38.410m, which puts these areas within Flood Zone 3a as per EA flood maps for planning shown in figure 3.
- 5.22 With reference to section 3 and the proposed scheme produced by SGP. Given the development proposal is to replace part of an existing industrial unit covering the same footprint area and is classified as 'less vulnerable'. It is proposed that the proposed building be put in at the same finished floor level as per the existing site, 38.800mAoD. This will provide resilience for flood events almost up to the 1 in 100 year fluvial flood level.
- 5.23 Given part of the existing units to the south are to be retained, any raising of the proposed floor level to the development will require a step or level difference

internally between the units. Raising of the finished floor level would also remove the availability for level access entrances which would affect the ability of entering the building for the disabled.

- 5.24 It is important to note with reference to Table 2 & 3 of this report that the development is considered as a less vulnerable development and the development is permitted through the sequential test.
- 5.25 With reference to the Environment Agencies standing advice “If you cannot raise floor levels above the estimated flood level, you need to consider extra flood resistance and resilience measures.” Given the standing advice for the development from the Environment Agency, below is a list of typical flood resilient measures that should be incorporated in to the building where possible to ensure flood mitigation:
- Flood Barriers - An effective way of controlling flood water and helping prevent it from entering your property. The barriers are a popular flood defence method and are much more effective than traditional sandbags. Flood barriers are reusable and therefore provide ongoing protection from flooding. They often consist of a shield that can be fitted onto a doorway, or into a gate when necessary. They can help to reduce the amount of water that enters a residential or commercial property during a flood.
 - Resilient Wall Finishes - There are paints and plasters (e.g. lime plaster) which are more resilient to water. They dry out without cracking and disintegration, so can be repainted once this drying process is complete
 - Resilient Floor Finishes - Resilient floor finishes can be 100% waterproof which makes drying and cleaning the property easy and quick.
 - Raised Electrical Sockets - Another resilience measure you may wish to consider would be the raising of electrical sockets, wires and other services up the walls of the property (rather than at skirting board height). This will reduce the risk of having to rewire a building following a flood. It may also be possible to keep some electrical power running in the property once it is flooded.
- 5.26 With reference to the standing advice above and the suggested flood resilient measures recommended as part of the incorporation in to the project. Given the proposed developments similarity to the existing site arrangements it is considered that there is no greater risk of flooding to the building than already exists and with the incorporation of some of the mentioned measures above the building should be more protected in the unlikely fluvial flood event.

6 FLOOD RISK MANAGEMENT STRATEGY

SAFE ACCESS/EGRESS

- 6.1 According to the EA flood maps, when flooding occurs it will come from the River Thames to the north of the site and propagate southward. In the immediate event of a flood, people should seek higher ground. It is hence proposed that the safe access/egress to and from the site in a flood event will be provided by routes for vehicles and pedestrians southward to Oxford Road. Vehicles and pedestrians should leave the site west towards Scour Lane and head south to the intersection with Oxford Road, and sort immediate refugee at the roundabout with Norcot Road. Oxford Road is located within Flood Zone 1 and at very low to low risk from flooding rivers, seas and surface water

FLOOD RISK ELSEWHERE

- 6.2 In accordance with the Local Planning policy EN18 *“Where development in areas at risk of flooding is necessary, it will not reduce the capacity of the flood plain to store floodwater, impede the flow of floodwater or in any way increase the risks to life and property arising from flooding. Wherever possible, development should be designed to reduce flood risk, both on- and off-site.”* As the developments proposal consist of replacing the existing unit with a new unit of the same area with some internal reconfigurations compared to the existing it is considered that the proposal will have no adverse effect on the current flood risk to the site and the wider surrounding areas and no increase in the impermeable area.

FLOOD WARNINGS

- 6.3 The EA provides a free flood warning service that is available by registration. The EA service provides flood warnings for the site and surrounding area.

7 PROPOSED DRAINAGE STRATEGY

EXISTING DRAINAGE INFRASTRUCTURE

- 7.1 A site-specific sewer survey has been carried out by Drainflow Solutions Ltd - refer to existing sewer plan in Appendix E. The survey has identified the site is served by a live and operational existing separate surface and foul water drainage system that serve the existing unit.
- 7.2 With reference to the drainage survey plan, surface water that is collected by the units existing roof is conveyed by gravity through a number of rainwater downpipes. These downpipes drain eastward in to a separate surface water system.
- 7.3 The upstream end of the surface water network receives run off from one of the rainwater pipes named as SW3. This manhole has a depth to invert of 1010mm. the 225mm sewer heads north-eastward from SW3 towards Stadium Way. At SW1 which has a depth to invert as 1334mm the second rainwater pipe discharges in to the network.
- 7.4 Surface water flows continue northward towards Stadium Way from SW1. The 225mm sewer passes under Stadium Way and discharges in to manhole SW4 located in the northern verge of Stadium Way with a depth to invert of 1650mm.
- 7.5 It is not none if or when the surface water runoff enters to a public sewer network. Confirmation can only be made from obtaining a public sewer asset plan. Without the asset plan it is currently assumed that SW4 is a public surface water that serves the industrial estate and runs from east to west parallel to Stadium Way or alternatively, SW4 conveys surface water flows in a sewer from east to west where flows continue westward to Scours Lane and discharge to a public surface water sewer under Scours Lane. Subject to confirmation via a public sewer asset plan.
- 7.6 The external hardstanding areas to the east, west and Stadium Way to the north appear to be drained by a series of road gullies that have been identified on the topographical survey and also identified on Google Maps. Whilst it is not confirmed on the survey that these gullies discharge in to the surface water network described above.
- 7.7 The drainage survey conducted by Drainflow Surveys Ltd identified no on site SuDS features or restrictive discharge features and it is therefore reasonable to assume that the 0.45Ha site discharges surface water runoff at an unrestricted rate.
- 7.8 The site-specific sewer survey by Drainflow Solutions Ltd - refer to existing sewer plan in Appendix E. Identifies an existing foul water drainage system that serves the existing unit.
- 7.9 The served foul network lies on the east side of the unit and runs in a southward direction, opposite to that of the surface water drainage.
- 7.10 The upstream end of the foul networks lies directly to the east of the unit in the external yard area noted as FW1 which has a depth of 800mm. A 100mm sewer

discharges from FW1 in a south westerly direction to FW3 which lies adjacent to the adjoining industrial unit. FW3 has a depth to invert of 1900mm.

- 7.11 It is assumed that all existing foul flows generated by the existing unit enter the foul gravity system at FW1. An internal manhole is picked up on the survey within the existing unit as FW2. It is also assumed that foul flows from the adjoining unit enter the system at FW3.
- 7.12 Similarly to the surface water system, It is not none if or when the foul water network described above enters a public sewer network. Given the direction that the foul system discharges in, it is assumed that the foul network enters a public sewer under Oxford Road to the north of the industrial park. Subject to confirmation via a public sewer asset plan.

EXISTING RUNOFF RATES

- 7.13 As the site is already developed (brownfield), it is assumed that the total site area of 0.45Ha discharges surface water to a public sewer network.
- 7.14 On the basis that the site freely discharges, the modified rational method can be adopted in line with Section 24.6.2 of the CIRIA "The SuDS Manual", in order to determine an estimate for the existing surface water runoff rate from the site. Table 7 below outlines the existing run off rates for a number of events. The average intensities are based on FSR rainfall data and a winter rainfall profile for a duration of 15 minutes, please refer to Appendix F for Micro Drainage rainfall intensities.

TABLE 7: EXISTING BROWNFIELD RUN OFF RATES

Event	Average intensity (i) 15min Winter Event	Calculation	Brownfield Discharge Rate
1 in 1 year	29.1mm/hr	$Q = 3.61 \times 1.00 \times 29.1 \times 0.45$	47.30l/s
1 in 30 year	71.2mm/hr	$Q = 3.61 \times 1.00 \times 71.2 \times 0.45$	115.70l/s
1 in 100 year	92.2mm/hr	$Q = 3.61 \times 1.00 \times 92.2 \times 0.45$	149.80l/s

CLIMATE CHANGE ALLOWANCES

- 7.15 DEFRA recommends an allowance of 20%-40% to be made to account for the increase in rainfall intensity. A total potential increase of 40% will be adopted.

TABLE 8: PEAK RAINFALL INTENSITY CLIMATE CHANGE ALLOWANCE

Applies across all of England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper End	10%	20%	40%
Central	5%	10%	20%

PROPOSED SURFACE WATER STRATEGY

- 7.16 As per Section 3 the proposed redevelopment is to construct a like for like to the original unit to the same footprint size in the same location on the 0.45Ha site which will be used a trade/warehouse unit. The internal configuration is to slightly differ from that of the previous unit, as it is to be divided in to four separate units. There is to be no change/increase to the existing footprint of the building or impermeable area of the site based on the proposed development.
- 7.17 In accordance with the surface water discharge hierarchy shown in section 2.14, disposal by infiltration is a non-viable option. The site is already served by a fully operational and live surface water network. Therefore, it is proposed to utilise the existing surface water drainage infrastructure that already serves the existing building.
- 7.18 The drainage survey conducted by Drainflow Surveys Ltd identified no on-site SuDS features or restrictive discharge features and it is therefore reasonable to assume that the 0.45Ha site discharges surface water runoff at an unrestricted rate.
- 7.19 Given the development comprises of constructing a like for like to the original unit that stood on the site, there is no increase in impermeable area and that the existing site freely discharges surface water runoff. As part of the development it is proposed to match in large the existing surface water strategy and utilise the existing infrastructure. To provide betterment in line with the local guidance, it is proposed to install a significant area of permeable paving to the west of the unit in the service yard/car parking area.
- 7.20 Permeable pavements are commonly used in car parks as they provide a suitable road surface, a storage system below while providing a treatment train for pollutants. The sub-base consists of a no fines granular bed providing approximately 30% voids. All permeably paved areas are to be constructed as tanked systems where the surface water is collected by a perforated pipe into the sub-base for returning back in to the piped network. Not only do permeable pavements provide surface water attenuation but they also provide a level of treatment by removing hydrocarbons from the runoff as the surface water passes through the sub base.
- 7.21 The entire west area is proposed to be underlain with a type 3 permeable sub base with the parking bays overlaid with a permeable asphalt. The aisles and loading routes will also have the type 3 permeable sub base but will be overlaid with a more traditional asphalt as it will be subject to higher loading, with the surface water runoff directed to the bays. With a typical 250mm type 3 sub base proposed across approximately 830m² of hardstanding, this should generate approximately 60m³ of surface water attenuation. Given the routing of the surface water through the permeable pavement, this will subsequently slow up the rate of runoff. It is envisaged that this will in turn reduce the surface water runoff rate entering the existing system and therefore providing a betterment as part of the development.

- 7.22 It is envisaged that by utilising the existing drainage strategy and providing the extensive amount of permeable paving, this will have no additional impact on loads to the receiving drainage network or the subsequent flood risk.
- 7.23 The new industrial unit is to be drained more traditionally, through a series of vertical rainwater pipe that will drain by gravity. In order to facilitate the west permeable pavement a new drainage run is to run along the north elevation. Subsequently a number of roof down pipes will connect in to this. The remaining roof downpipes will drain eastward and connect in to the existing network.
- 7.24 A Thames Water pre-development enquiry is to be submitted in due course which will confirm that there is capacity within the public sewer network to accommodate the post development flows from the site.
- 7.25 Refer to Appendix G for a proposed Drainage General Arrangement drawing.

PROPOSED FOUL WATER STRATEGY

- 7.26 As per section 7.1, there is evidence that the site is served by a live fully operational foul water network that is assumed to connect in to a nearby public foul sewers. As part of the redevelopment of the site, it is proposed to utilise the existing foul drainage and associated connections to the public sewer in order to serve the building post development.
- 7.27 The proposed unit will primarily have the amenities and WC's located centrally within the building, with each of the four units housing their own facilities. As per the above the redevelopment is to utilise as much of the existing foul drainage as possible.
- 7.28 Foul flows from the units are to drain to a small internal network that will then discharge via gravity to the surveyed existing foul manhole close to the east elevation of the existing unit named FW2. With all foul flows discharging in to existing internal manhole FW2, all flows are to utilise the existing network downstream from this point as described above.
- 7.29 A Thame Water pre-development enquiry is to be submitted in due course which will confirm that there is capacity within the public sewer network to accommodate the post development flows from the site.
- 7.30 Refer to Appendix G for a proposed Drainage General Arrangement drawing.

8 RECOMMENDATIONS AND CONCLUSIONS

- 8.1 The proposed redevelopment is to construct a like for like to the original unit to the same footprint size in the same location on the 0.45Ha site which will be used a trade/warehouse unit. The internal configuration is to slightly differ from that of the previous unit, as it is to be divided in to four separate units. There is to be no change to the existing footprint of the building or impermeable area of the site based on the proposed development.
- 8.2 Geological conditions at the site are based on the British Geological Survey Viewer, superficial deposits of Alluvium - Clay, silt, sand and gravel are present on site, which are underlain by bedrock deposits of Seaford Chalk Formation and Newhaven Chalk Formation.
- 8.3 A site-specific topographical survey has been carried out by SJB Surveying Ltd (April 2020). The topographical survey notes Unit 1/1A had a surveyed finished floor level of 38.800mAoD. the external levels to the east of the unit fall away from the unit to approximately 38.500mAoD
- 8.4 The proposed site is not located in a groundwater source protection zone. Bedrock deposits are a 'Principal' aquifer and superficial deposits are a 'Secondary A' designation. The site is also located over a 'Medium-High' groundwater vulnerability zone.
- 8.5 The existing industrial unit is shown to lie within Flood Zone 2 and the external hardstanding areas with Flood Zone 3a. From Table 2 the site is classified as 'Less Vulnerable' (Flood Risk Vulnerability Classification) and therefore, from Table 3 the development is classified as 'appropriate'.
- 8.6 The EA published flood risk from surface water map shows that the building and the immediate external areas are at low risk of surface water flooding. The carriageway of Stadium Way to the north is at medium to high risk. The reservoir flood risk map shows the site is outside the maximum flood extents area from reservoirs and any other artificial sources. The Reading Borough Council SFRA indicates that although the site is depicted within an area with slightly elevated susceptibility. Given there has been no recorded groundwater flood incidents to have occurred at or within the vicinity of the site, the site is deemed to not be at significant risk of flooding from groundwater.
- 8.7 The EA has conducted some 2D river modelling and provide the specific flood data for the site. The nearest modelled node to the site is 'Flood Point 3' the 1 in 1000 year fluvial flood level is modelled at 39.517mAoD and the 1 in 100 year fluvial flood level is modelled at 38.860mAoD.
- 8.8 Given the development proposal is to replace part of an existing industrial unit covering the same footprint area and is classified as 'less vulnerable'. It is proposed

that the proposed building be put in at the same finished floor level as per the existing site, 38.800mAoD. This will provide resilience for flood events almost up to the 1 in 100 year fluvial flood level.

- 8.9 With reference to the Environment Agencies standing advice “If you cannot raise floor levels above the estimated flood level, you need to consider extra flood resistance and resilience measures.” Given the standing advice for the development from the Environment Agency, flood resilient measures should be incorporated in to the building where possible.
- 8.10 With reference to the standing advice and the suggested flood resilient measures recommended as part of the incorporation in to the project. Given the proposed developments similarity to the existing site arrangements it is considered that there is no greater risk of flooding to the building than already exists and with the incorporation of some of the mentioned measures above the building should be more protected in the unlikely fluvial flood event.
- 8.11 In accordance with the Local Planning policy EN18 “*Where development in areas at risk of flooding is necessary, it will not reduce the capacity of the flood plain to store floodwater, impede the flow of floodwater or in any way increase the risks to life and property arising from flooding. Wherever possible, development should be designed to reduce flood risk, both on- and off-site.*” As the developments proposal consist of replacing the existing unit with a new unit of the same area with some internal reconfigurations compared to the existing it is considered that the proposal will have no adverse effect on the current flood risk to the site and the wider surrounding areas and no increase in the impermeable area.
- 8.12 A site-specific sewer survey has been carried out by Drainflow Solutions Ltd. The survey has identified the site is served by a live and operational existing sperate surface and foul water drainage system that serve the existing unit.
- 8.13 With reference to the drainage survey plan, surface water that is collected by the units existing roof is conveyed by gravity through a number of rainwater downpipes. These downpipes drain eastward in to a separate surface water system.
- 8.14 The external hardstanding areas to the east, west and Stadium Way to the north appear to be drained by a series of road gullies that have been identified on the topographical survey and also identified on Google Maps.
- 8.15 The drainage survey conducted by Drainflow Surveys Ltd identified no on-site SuDS features or restrictive discharge features and it is therefore reasonable to assume that the 0.45Ha site discharges surface water runoff at an unrestricted rate.
- 8.16 It is assumed that all existing foul flows generated by the existing unit enter the foul gravity system at FW1. An internal manhole is picked up on the survey within the existing unit as FW2. It is also assumed that foul flows from the adjoining unit enter the system at FW3 and all discharge south of the site in to a public sewer.

-
- 8.17 the proposed redevelopment is to construct a like for like to the original unit to the same footprint size in the same location on the 0.45Ha site which will be used a trade/warehouse unit. There is to be no change/increase to the existing footprint of the building or impermeable area of the site based on the proposed development.
- 8.18 Given the development comprises of constructing a like for like to the original unit that stood on the site, there is no increase in impermeable area and that the existing site freely discharges surface water runoff. As part of the development it is proposed to match in large the existing surface water strategy and utilise the existing infrastructure. To provide betterment in line with the local guidance, it is proposed to install a significant area of permeable paving to the west of the unit in the service yard/car parking area.
- 8.19 The entire west area is proposed to be underlain with a type 3 permeable sub base with the parking bays overlaid with a permeable asphalt. The aisles and loading routes will also have the type 3 permeable sub base but will be overlaid with a more traditional asphalt as it will be subject to higher loading, with the surface water runoff directed to the bays. With a typical 250mm type 3 sub base proposed across approximately 830m² of hardstanding, this should generate approximately 60m³ of surface water attenuation. Given the routing of the surface water through the permeable pavement, this will subsequently slow up the rate of runoff. It is envisaged that this will in turn reduce the surface water runoff rate entering the existing system and therefore providing a betterment as part of the development.
- 8.20 There is evidence that the site is served by a live fully operational foul water network that is assumed to connect in to a nearby public foul sewers. As part of the redevelopment of the site, it is proposed to utilise the existing foul drainage and associated connections to the public sewer in order to serve the building post development.
- 8.21 The responsibility for the enacting of this SuDS Maintenance and Management Plan will be the responsibility of the property/land owner.

APPENDICES

APPENDIX A

ARCHITECTURAL SITE PLAN

APPENDIX B

TOPOGRAPHICAL SURVEY

PROJECT:
Unit 1
Stadium Way
Reading
CLIENT:
SGP Architects and Masterplanners

DRAWING:
Survey Drawing
Site Plan

DRAWING NUMBER:
180/01

SCALE: 1:100 @ A/DL DATE: April 2020

DAVAN
CD

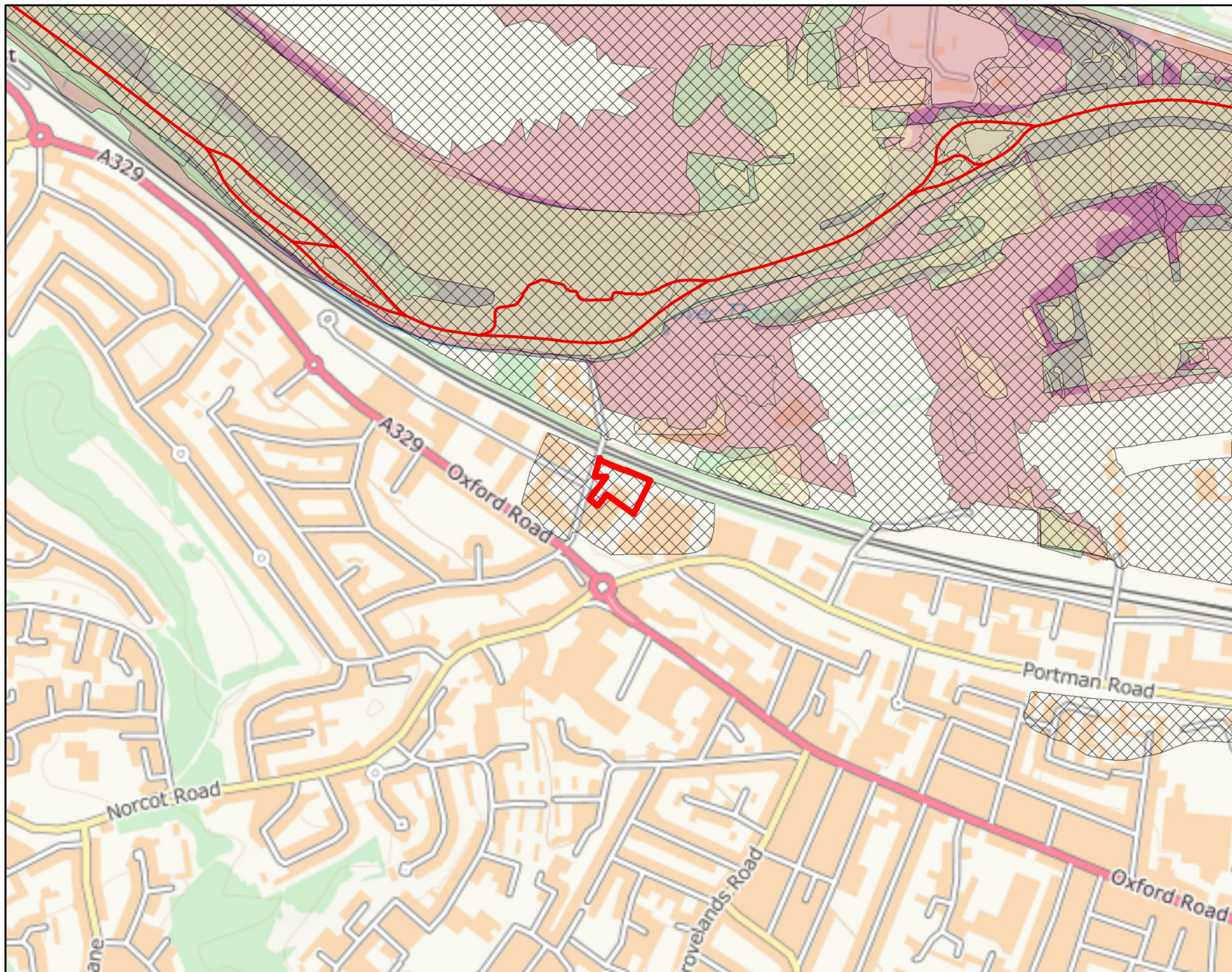
SJB Surveying Ltd
07967605089

APPENDIX C

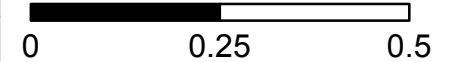
HISTORICAL FLOOD MAP

Historic Flood Map centred on Stadium Way, Reading, RG30 6BX

Created on 07/09/2020 REF: THM183389



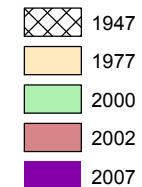
Kilometres



Legend

— Main River

year



Flooding from rivers or sea without defences (Flood Zone 3) shows the area that could be affected by flooding:

- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

The Extent of an extreme flood (Flood Zone 2) shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.

APPENDIX D

EA PRODUCT 4 DATA

Product 4 (Detailed Flood Risk) for Stadium Way, Reading, RG30 6BX

Our Ref: THM183389

Product 4 is designed for developers where Flood Risk Standing Advice FRA (Flood Risk Assessment) Guidance Note 3 Applies. This is:

- i) "all applications in Flood Zone 3, other than non-domestic extensions less than 250 sq metres; and all domestic extensions", and
- ii) "all applications with a site area greater than 1 ha" in Flood Zone 2.

Product 4 includes the following information:

Ordnance Survey 1:25k colour raster base mapping;
Flood Zone 2 and Flood Zone 3;
Relevant model node locations and unique identifiers (for cross referencing to the water levels, depths and flows table);
Model extents showing *defended* scenarios;
FRA site boundary (where a suitable GIS layer is supplied);
Flood defence locations (where available/relevant) and unique identifiers; (supplied separately)
Flood Map areas benefiting from defences (where available/relevant);
Flood Map flood storage areas (where available/relevant);
Historic flood events outlines (where available/relevant, not the Historic Flood Map) and unique identifiers;
Statutory (Sealed) Main River (where available within map extents);

A table showing:

- i) Model node X/Y coordinate locations, unique identifiers, and levels and flows for *defended* scenarios.
- ii) Flood defence locations unique identifiers and attributes; (supplied separately)
- iii) Historic flood events outlines unique identifiers and attributes; and
- iv) Local flood history data (where available/relevant).

Please note:

If you will be carrying out computer modelling as part of your Flood Risk Assessment, please request our guidance which sets out the requirements and best practice for computer river modelling.

This information is based on that currently available as of the date of this letter. You may feel it is appropriate to contact our office at regular intervals, to check whether any amendments/ improvements have been made. Should you re-contact us after a period of time, please quote the above reference in order to help us deal with your query.

This information is provided subject to the enclosed notice which you should read.

This letter is not a Flood Risk Assessment. The information supplied can be used to form part of your Flood Risk Assessment. Further advice and guidance regarding Flood Risk Assessments can be found on our website at:

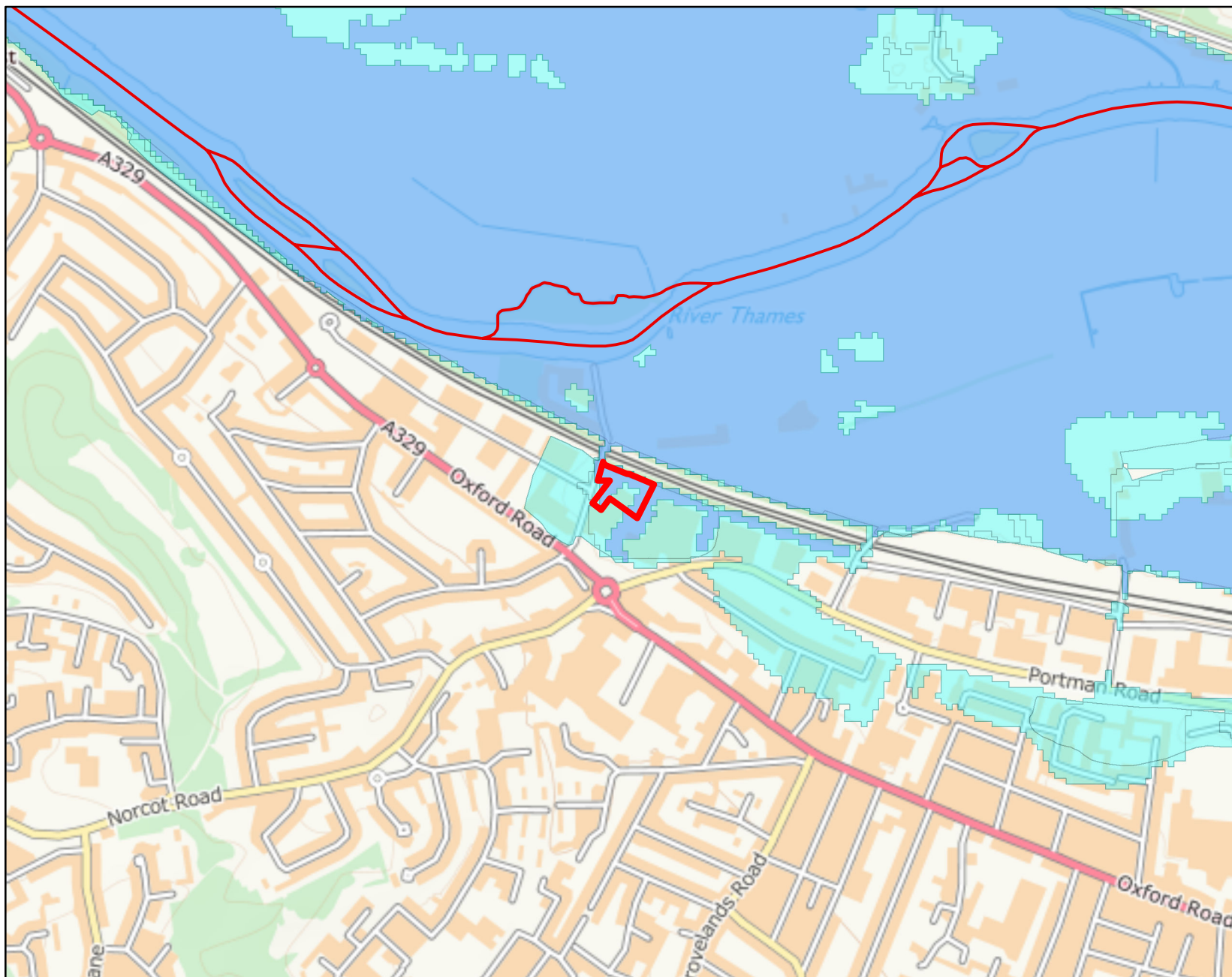
<https://www.gov.uk/guidance/flood-risk-assessment-local-planning-authorities>

If you would like advice from us regarding your development proposals you can complete our pre application enquiry form which can be found at:

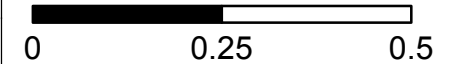
<https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion>

Flood Map for Planning centred on Stadium Way, Reading, RG30 6BX

Created on 07/09/2020 REF: THM183389



Kilometres



Legend

- Main River
- Flood defences
- Areas benefiting from flood defences
- Flooding from rivers or sea (FZ3)
- Extent of extreme flood (FZ2)
- Flood Map - flood storage areas

Flooding from rivers or sea without defences (Flood Zone 3) shows the area that could be affected by flooding:

- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

The Extent of an extreme flood (Flood Zone 2) shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.

Defence information

Defence Location: No defences on Main River

Description: This location is not currently protected by any formal defences and we do not currently have any flood alleviation works planned for the area. However we continue to maintain certain watercourses and the schedule of these can be found on our internet pages.

Model information

THM183389

Model: Thames (Sandford to Mapledurham) 2018

Description: The information provided is from the Abingdon Flood Schemes mapping completed in June 2017. The previous model 1D model was updated to a 1D-2D model (Flood modeller-Tuflow). The updated model will also be used to assess downstream effects due to flood alleviation options in Oxford and Abingdon.

Model design runs:

1 in 2/ 50% AEP; 1 in 5 / 20% AEP; 1 in 10/ 10% AEP; 1 in 20 / 5% AEP; 1 in 50/ 2% AEP; 1 in 75 / 1.3% AEP; 1 in 100 / 1% AEP, 1 in 100+25% / 1% + 25% AEP with climate change; 1 in 100+35% / 1% + 35% AEP with climate change; 1 in 100+70% / 1% + 70% AEP with climate change; 1 in 200/ 0.5% AEP and 1 in 1000 / 0.1% AEP.

Mapped outputs:

1 in 2/ 50% AEP; 1 in 5 / 20% AEP; 1 in 10/ 10% AEP; 1 in 20 / 5% AEP; 1 in 50/ 2% AEP; 1 in 75 / 1.3% AEP; 1 in 100 / 1% AEP, 1 in 100+25% / 1% + 25% AEP with climate change; 1 in 100+35% / 1% + 35% AEP with climate change; 1 in 100+70% / 1% + 70% AEP with climate change; 1 in 200/ 0.5% AEP and 1 in 1000 / 0.1% AEP.

Modelled in-channel flood flows and levels

THM183389

The modelled flood levels and flows for the closest most appropriate model node points for your site that are within the river channel are provided below:

Node label	Model	Easting	Northing	Flood Levels (mAOD)						
				20% AEP	5% AEP	1% AEP	1% AEP (+25% increase in flows)	1% AEP (+35% increase in flows)	1% AEP (+70% increase in flows)	0.1% AEP
061_00_2018_002_36.105	Thames (Sandford to Mapledurham) 2018	467842	175027	38.31	38.64	39.02	39.32	39.40	39.71	39.60
061_00_2018_002_36.091	Thames (Sandford to Mapledurham) 2018	468455	174640	38.16	38.52	38.93	39.27	39.35	39.67	39.56
061_00_2018_002_36.071A	Thames (Sandford to Mapledurham) 2018	469093	174852	37.77	38.17	38.71	39.10	39.19	39.53	39.42

Node label	Model	Easting	Northing	Flood Flows (m3/s)						
				20% AEP	5% AEP	1% AEP	1% AEP (+25% increase in flows)	1% AEP (+35% increase in flows)	1% AEP (+70% increase in flows)	0.1% AEP
061_00_2018_002_36.105	Thames (Sandford to Mapledurham) 2018	467842	175027	191.90	233.30	273.96	298.34	308.47	342.31	326.64
061_00_2018_002_36.091	Thames (Sandford to Mapledurham) 2018	468455	174640	168.61	188.66	208.61	214.02	213.79	228.90	219.25
061_00_2018_002_36.071A	Thames (Sandford to Mapledurham) 2018	469093	174852	203.35	225.01	227.14	229.44	230.43	232.92	231.94

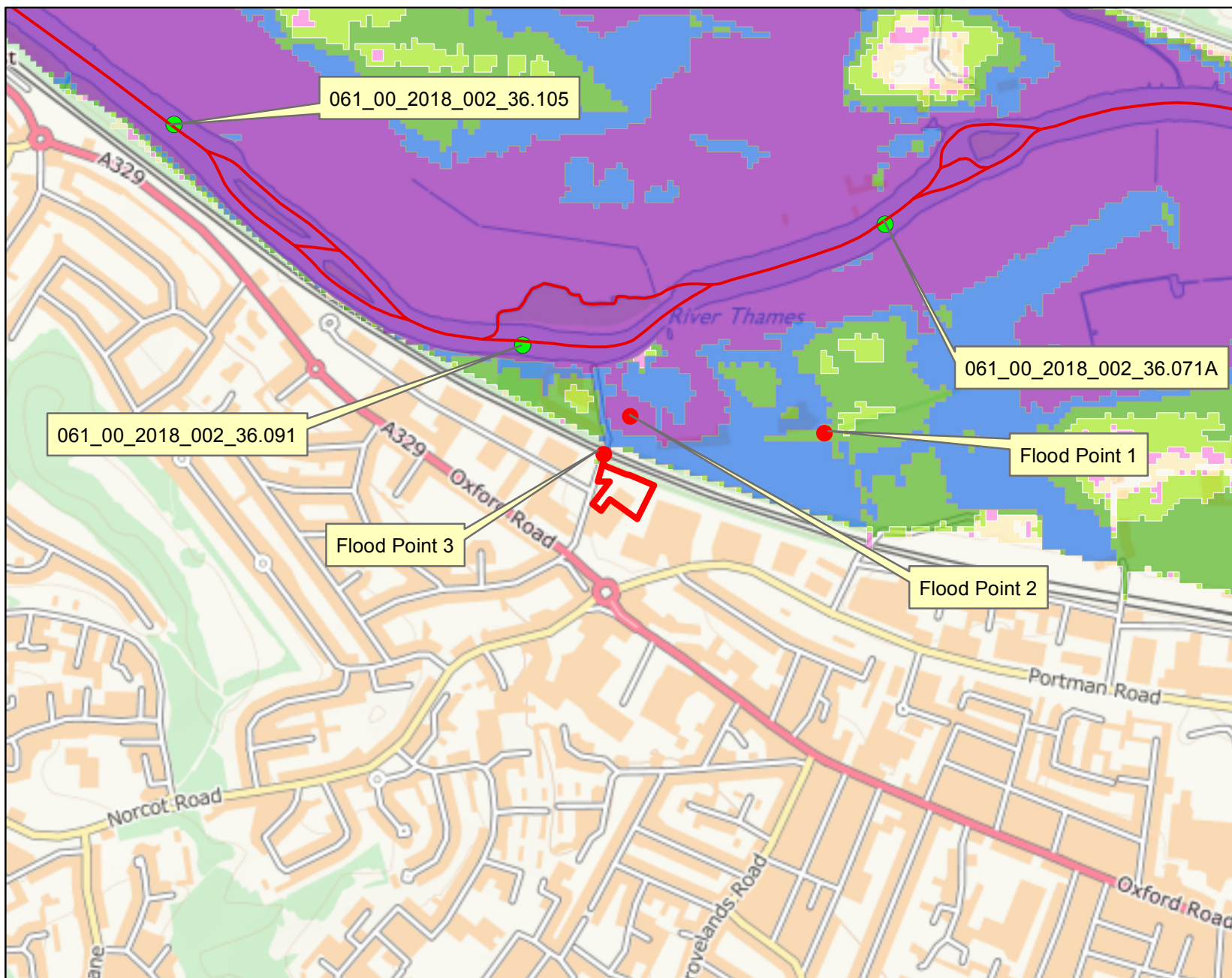
Note:

Due to changes in guidance on the allowances for climate change, the 20% increase in river flows should no longer to be used for development design purposes. The data included in this Product can be used for interpolation of levels as part of an intermediate level assessment.

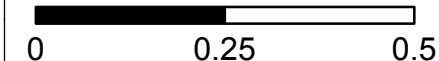
For further advice on the new allowances please visit <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

Detailed FRA Map centred on Stadium Way, Reading, RG30 6BX

Created on 07/09/2020 REF: THM183389



Kilometres



Legend

- Main River
- Model Nodes
- 20% AEP Flood Outline
- 5% AEP Flood Outline
- 1% AEP Flood Outline
- 1%+25% CC AEP Flood Outline
- 1%+35% CC AEP Flood Outline
- 1%+70% AEP Flood Outline
- 0.1% AEP Flood Outline

AEP = Annual Exceedance Probability
The probability of a flood of a particular magnitude, or greater, occurring in any given year

Where available climate change extents have been calculated with an additional flow added to an AEP event. An example of how this is written is 1%+20% AEP.

Modelled floodplain flood levels

THM183389

The modelled flood levels for the closest most appropriate model grid cells for your site are provided below:

2D grid cell reference	Model	Easting	Northing	flood levels (mAOD)						
				20% AEP	5% AEP	1% AEP	1% AEP (+25% increase in flows)	1% AEP (+35% increase in flows)	1% AEP (+70% increase in flows)	0.1% AEP
Flood Point 1	Thames (Sandford to Mapledurham) 2018	468,988	174,481	No data	No data	38.82	39.16	39.25	39.57	39.458
Flood Point 2	Thames (Sandford to Mapledurham) 2018	468,645	468,645	37.99	38.41	38.85	39.20	39.29	39.62	39.509
Flood Point 3	Thames (Sandford to Mapledurham) 2018	468,595	174,446	No data	38.41	38.86	39.21	39.30	39.63	39.517

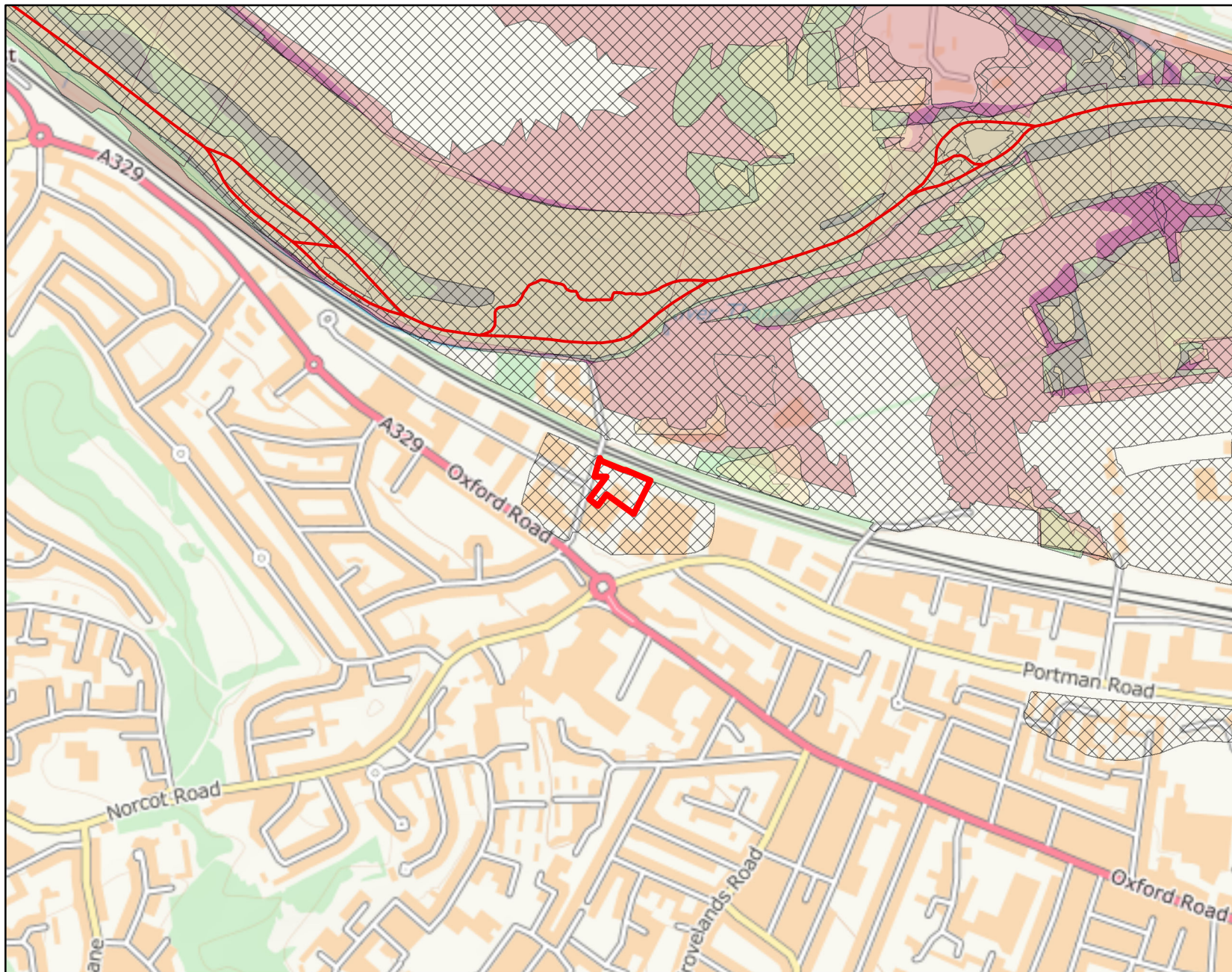
This flood model has represented the floodplain as a grid.
The flood water levels have been calculated for each grid cell.

Note:
Due to changes in guidance on the allowances for climate change, the 20% increase in river flows should no longer to be used for development design purposes. The data included in this Product can be used for interpolation of levels as part of an intermediate level assessment.

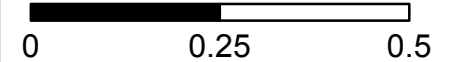
For further advice on the new allowances please visit
<https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

Historic Flood Map centred on Stadium Way, Reading, RG30 6BX

Created on 07/09/2020 REF: THM183389



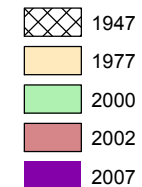
Kilometres



Legend

— Main River

year



Flooding from rivers or sea without defences (Flood Zone 3) shows the area that could be affected by flooding:

- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

The Extent of an extreme flood (Flood Zone 2) shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.

Historic flood data

THM183389

Our records show that the area of your site has been affected by flooding.
Information on the floods that have affected your site is provided in the table below:

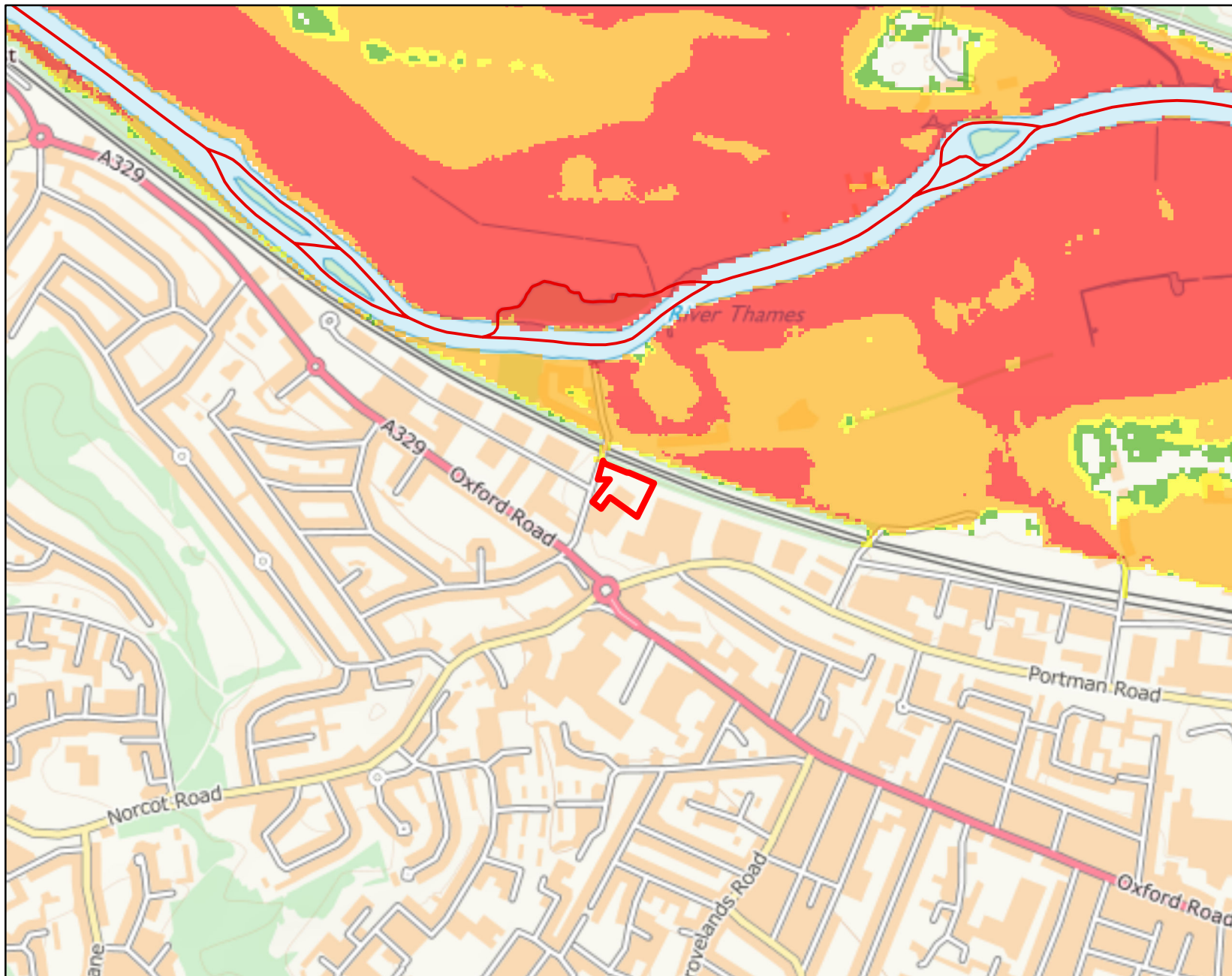
Flood Event Code	Flood Event Name	Start Date	End Date	Source of Flooding	Cause of Flooding
EA0619470300108	06MarchSpring1947	01/01/1947	12/12/1947	main river	channel capacity exceeded (no raised defences)
EA0619770800865	06AugustSummer1977	01/01/1977	12/12/1977	main river	channel capacity exceeded (no raised defences)
EA0620001200973	06DecemberWinter2000	01/01/2000	12/12/2000	main river	channel capacity exceeded (no raised defences)
EA0620030101899	06JanuaryNewYear2003	23/12/2002	12/01/2003	main river	channel capacity exceeded (no raised defences)
ea061231504	Reading_Fluvial Water	19/07/2007	29/07/2007	main river	channel capacity exceeded (no raised defences)

Please note the Environment Agency maps flooding to land not individual properties. Floodplain extents are an indication of the geographical extent of a historic flood. They do not provide information regarding levels of individual properties, nor do they imply that a property has flooded internally.

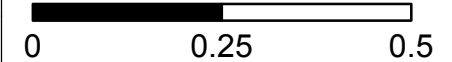
Start and End Dates shown above may represent a wider range where the exact dates are not available.

Hazard Map centred on Stadium Way, Reading, RG30 6BX

Created on 07/09/2020 REF: THM183389



Kilometres



Legend

- Main River
- Low hazard
- Hazard to some
- Hazard for most
- Hazard to all

For hazard and debris factor we used HR Wallingford and Environment Agency (May 2008) supplementary note on flood hazard ratings and thresholds for development planning and control purpose. The following calculation is used:

$$HR = d \times (v+0.5) + DF$$

HR = flood hazard rating
d = depth of flooding (m)
v = velocity of floodwaters (m/sec)
DF = debris factor calculated (0, 0.5, 1 depending on probability that debris will lead to a hazard)

Hazard Mapping (for the 1%+35% climate change scenario)

Hazard Mapping methodology:

To calculate flood hazard with the debris factor we have used the supplementary note to Flood Risk to People Methodology (see below).

The following calculation is used:

$$HR = d \times (v+0.5) + DF$$

Where HR = flood hazard rating

d = depth of flooding (m)

v = velocity of floodwaters (m/sec)

DF = debris factor calculated (0, 0.5, 1 depending on probability that debris will lead to a hazard)

The resultant hazard rating is then classified according to:

Flood Hazard	Colour	Hazard to People Classification
Less than 0.75	Green	Very low hazard - Caution
0.75 to 1.25	Yellow	Danger for some - includes children, the elderly and the infirm
1.25 to 2.0	Orange	Danger for most - includes the general public
More than 2.0	Red	Danger for all - includes the emergency services

REF: HR Wallingford and Environment Agency (May 2008) Supplementary note of flood hazard ratings and thresholds for development planning and control purpose – Clarification of the Table 113.1 of FD2320/TR2 and Figure 3.2 of FD2321/TR1

APPENDIX E

EXISTING DRAINAGE SURVEY

STADIUM WAY

7

LAT 1 (rwp)

1500 VC

SW4
IL 1650mm

2250 VC

SW1
IL 1334mm

2250 VC

SW2
IL 1200mm

FW2
IL ...mm

FW1
IL 800mm

LAT 2 (rwp)

1500 VC

1000 VC

2250 VC

FW3
IL 1900mm

Stopcock



--- SURFACE WATER
--- FOUL WATER

UNIT 1
STADIUM WAY
READING

APPENDIX F

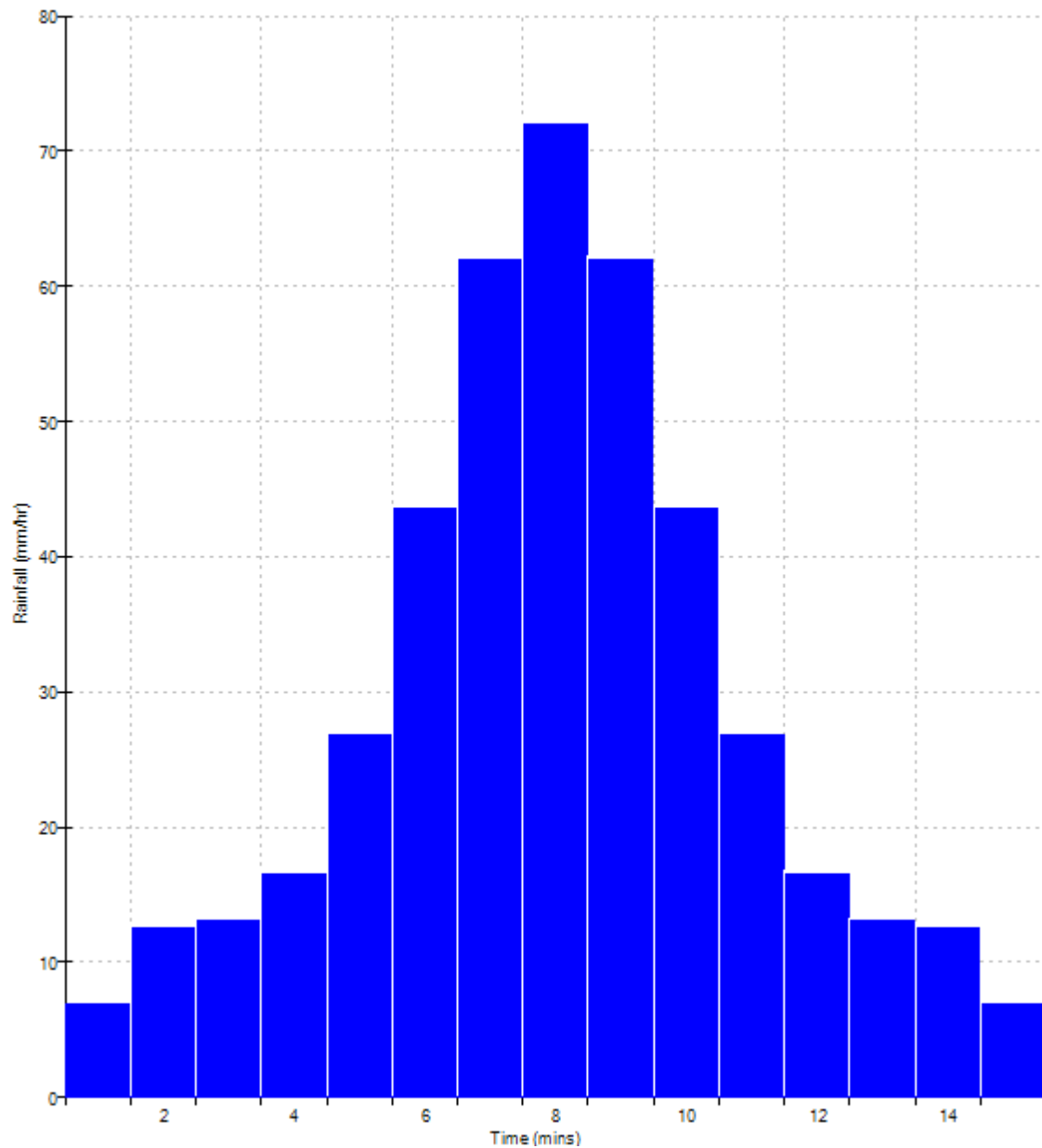
EXISTING BROWNFIELD INTENSITY VALUES

Mason Navarro Pledge		Page 1
Bancroft Court Hertfordshire SG5 1LH, United Kingdom	Unit 1 Stadium Way 1 year i value	
Date 09/09/2020 10:31	Designed by Andrew Quinn	
File	Checked by Richard James	
Innovyze	Network 2020.1	

Rainfall profile

Storm duration (mins) 15

FSR Data
Region England and Wales
M5-60 (mm) 18.800
Ratio R 0.400
Peak Intensity (mm/hr) 72.067
Ave. Intensity (mm/hr) 29.060
Return Period (years) 1.0

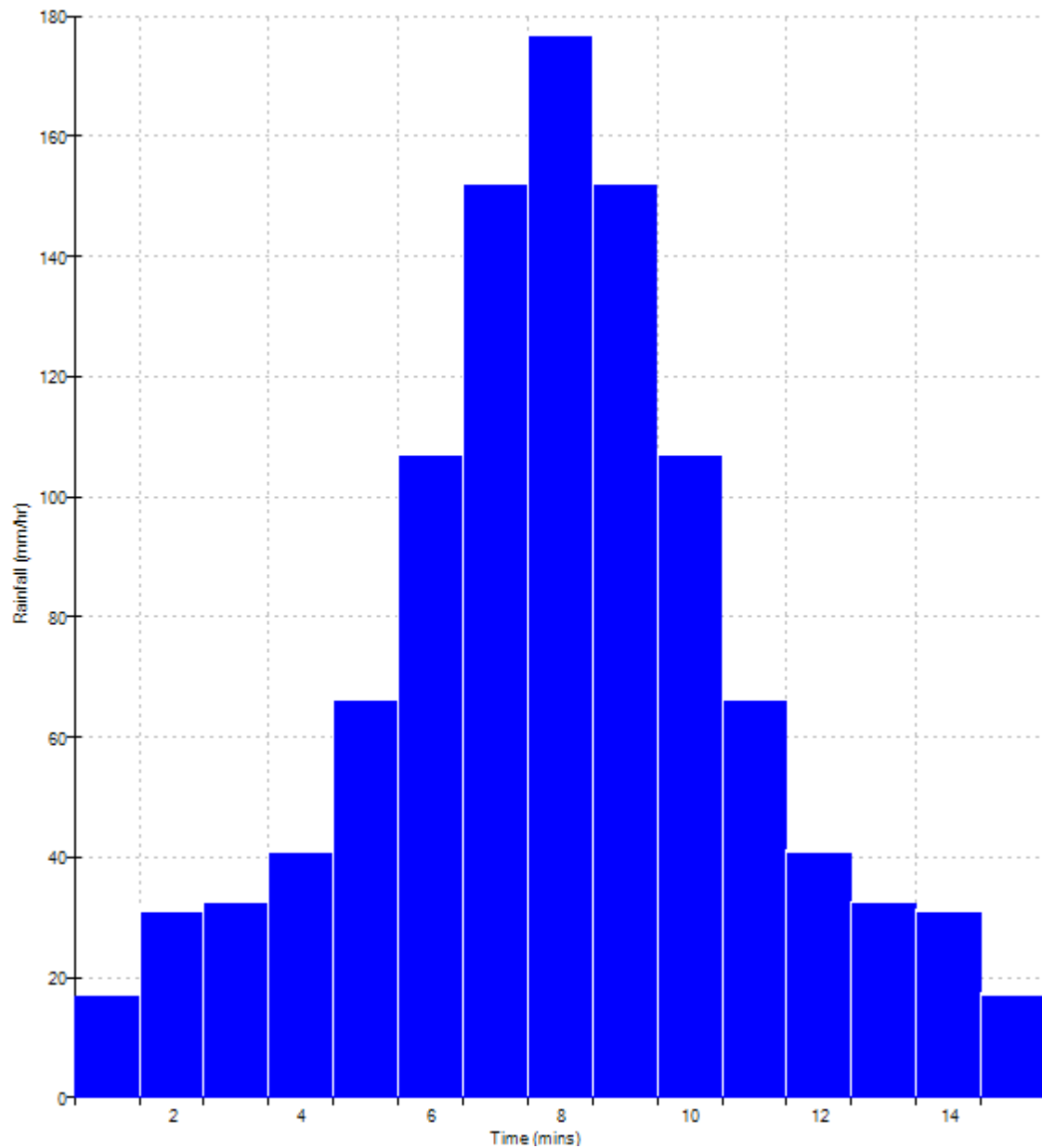


Mason Navarro Pledge		Page 1
Bancroft Court Hertfordshire SG5 1LH, United Kingdom	Unit 1 Stadium Way 30 year i value	
Date 09/09/2020 10:33	Designed by Andrew Quinn	
File	Checked by Richard James	
Innovyze	Network 2020.1	

Rainfall profile

Storm duration (mins) 15

FSR Data
Region England and Wales
M5-60 (mm) 18.800
Ratio R 0.400
Peak Intensity (mm/hr) 176.602
Ave. Intensity (mm/hr) 71.211
Return Period (years) 30.0

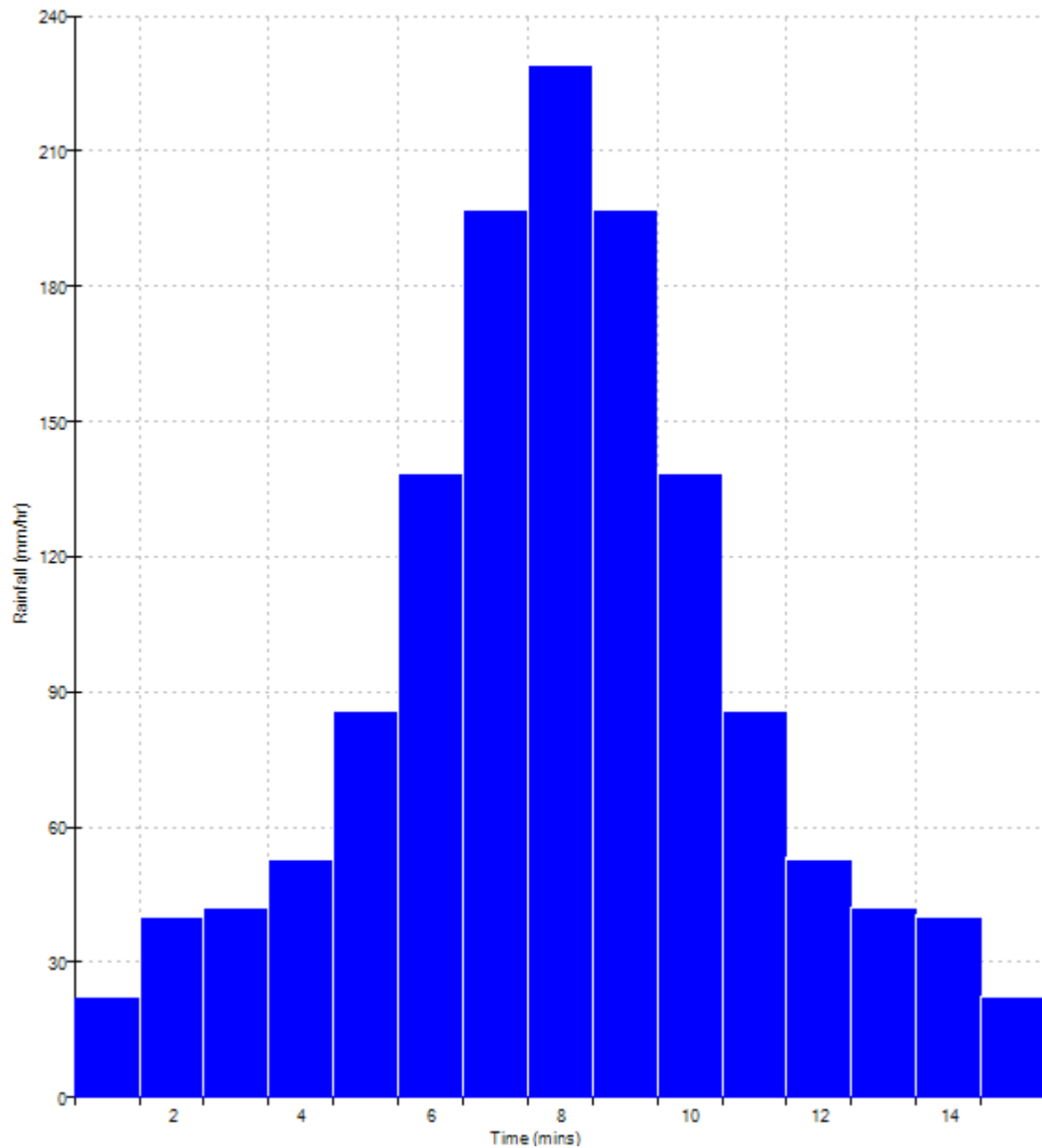


Mason Navarro Pledge		Page 1
Bancroft Court Hertfordshire SG5 1LH, United Kingdom	Unit 1 Stadium Way 100 year i value	
Date 09/09/2020 10:34	Designed by Andrew Quinn	
File	Checked by Richard James	
Innovyze	Network 2020.1	

Rainfall profile

Storm duration (mins) 15

FSR Data
Region England and Wales
M5-60 (mm) 18.800
Ratio R 0.400
Peak Intensity (mm/hr) 228.671
Ave. Intensity (mm/hr) 92.207
Return Period (years) 100.0



APPENDIX G

DRAINAGE STRATEGY GA PLAN

General

1.1 This drawing is to be read in conjunction with all Architect's, Engineer's and Services Engineer's drawings and specifications.

1.2 Do not scale from any of the structural drawings. All dimensions to be verified on site and any discrepancies should be highlighted.

1.3 The contractor is responsible for the stability of the building and adjoining structures during construction and shall design, install, adapt and maintain all necessary propping and temporary works. A method statement for the temporary works must be submitted to the contractor administrator for comment before work begins.

1.4 All materials to comply with the relevant British Standard.

Legend	
Surface Water	Description
	Permeable Asphalt with a Lined 250mm Type 3 Sub-base
	Heavy Duty Asphalt with a Lined 250mm Type 3 Sub-base
	Hardstanding Concrete Service Yard
	New surface water drain
	New surface water manhole
	New rain water down pipe
	Linear drainage channel incorporating in-built falls
	Existing surface water sewer
	Existing surface water manhole
Foul	Description
	New foul water drain
	New shallow foul inspection chamber (typ. 450mmØ)
	New soil and vent pipe
	Existing foul water sewer
	Existing foul water manhole

P2	Preliminary Issue	16.09.20	RJ
P1	Preliminary Issue	11.09.20	RJ
REV	COMMENTS	DATE	CHK

STATUS

PRELIMINARY

mason navarro pledge
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CLIENT

PSK BUILDING SURVEYORS LTD.

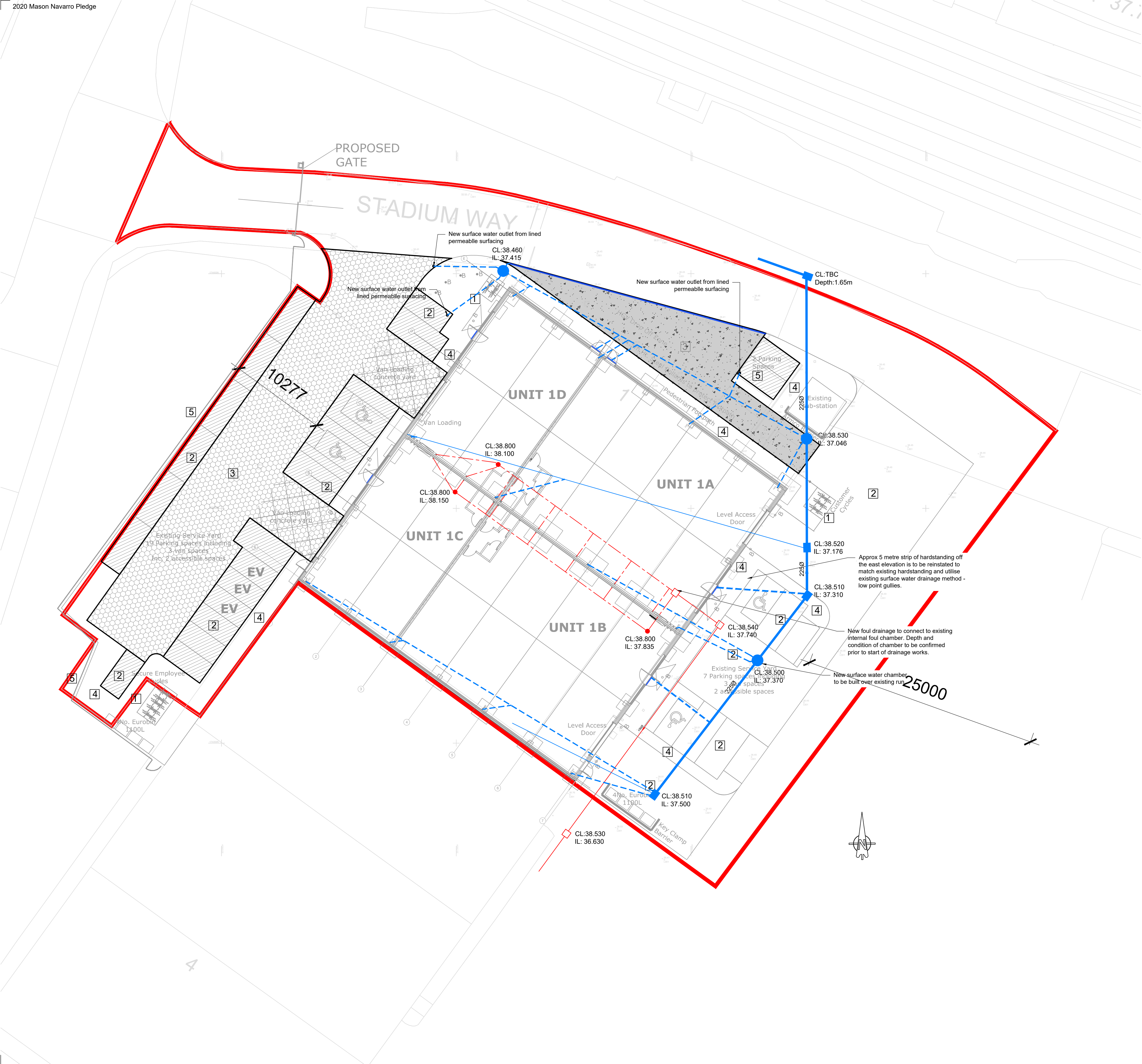
PROJECT

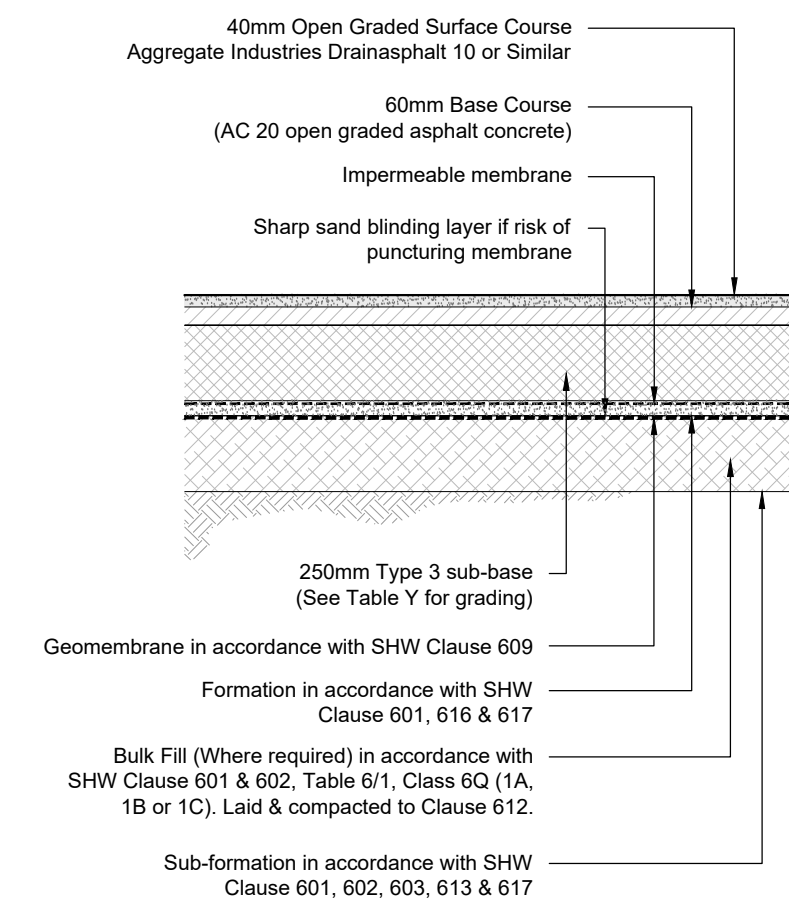
UNIT 1 READING

DRAWING TITLE

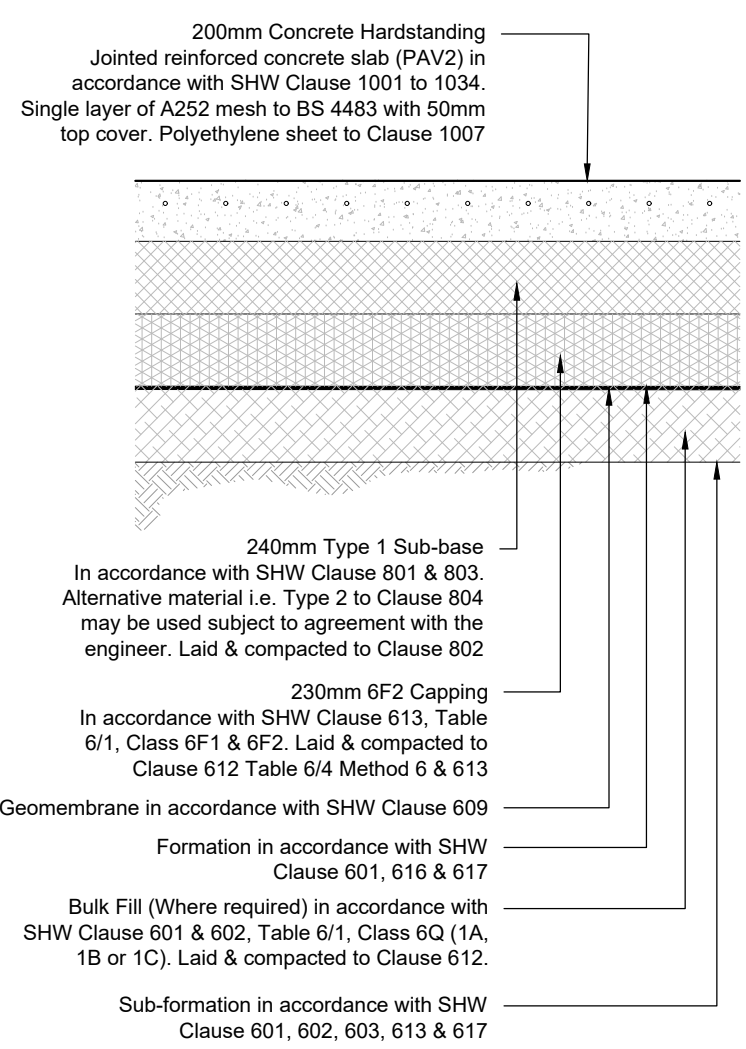
DRAINAGE LAYOUT

SCALE @ A1	DRAWN BY	DATE
1:200 @ A1	TRM	11/09/2020
MNP No.	STATUS CODE	REV
220115	S0	P2
Ref No: 220115-MNP-XX-XX-DR-C-1800		

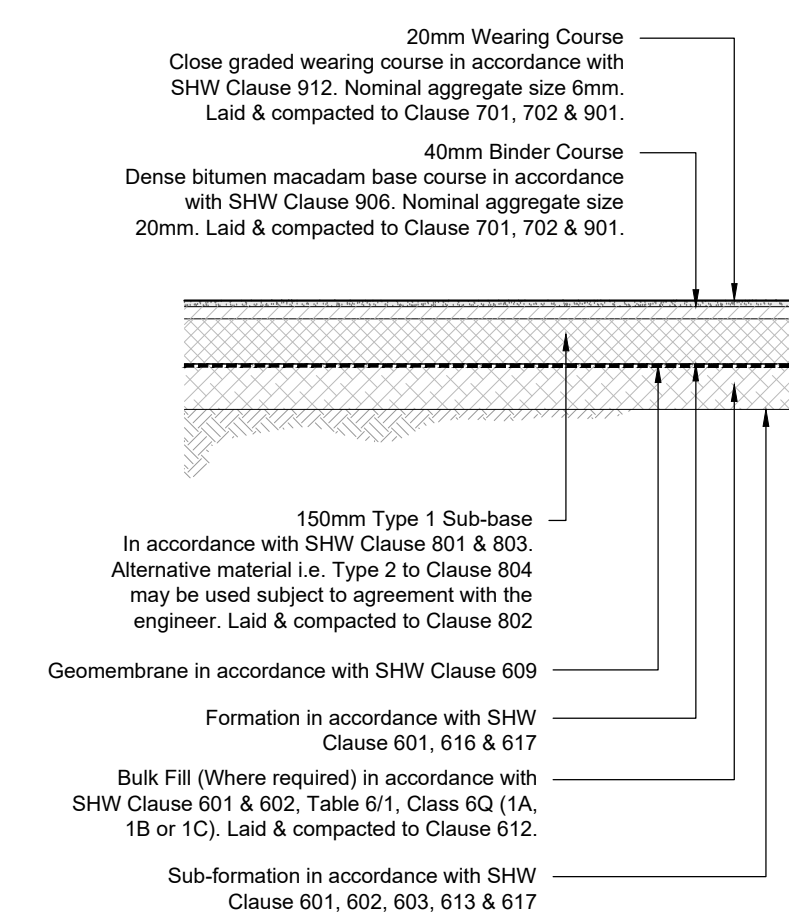




Permeable Tarmac Construction Detail
(Scale 1:25)



Concrete Hardstanding
For 5% CBR
(Scale 1:25)



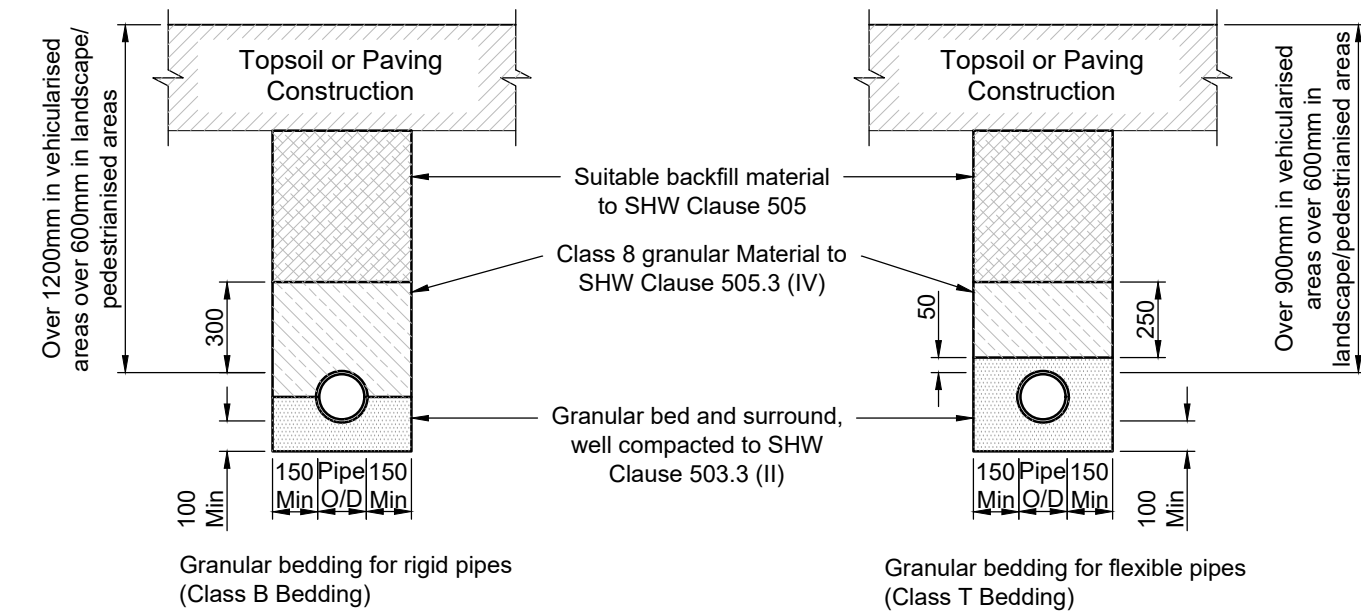
Pedestrian Footpath
(Scale 1:25)

TABLE Z	
Grading for Laying & Jointing Material	
Sieve size (mm)	Percentage passing (%)
14	100
10	98-100
6.3	80-99
2.0	0-20
1.0	0-5

NOTE
These gradings are typical, advice should be sought from the block manufacturer on specific gradings suitable for their manufacturing process.

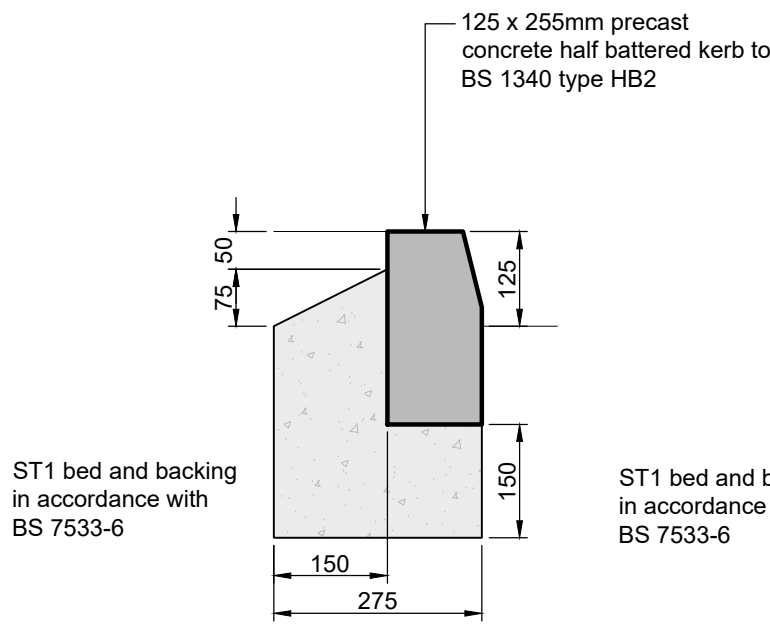
TABLE Y	
Grading for Type 3 Material	
Sieve size (mm)	Percentage passing (%)
80	100
40	80-99
20	50-78
10	31-60
4	18-46
2	10-35
1	6-26
0.5	0-20
0.063	0-5

NOTE
These gradings are typical, advice should be sought from the block manufacturer on specific gradings suitable for their manufacturing process.

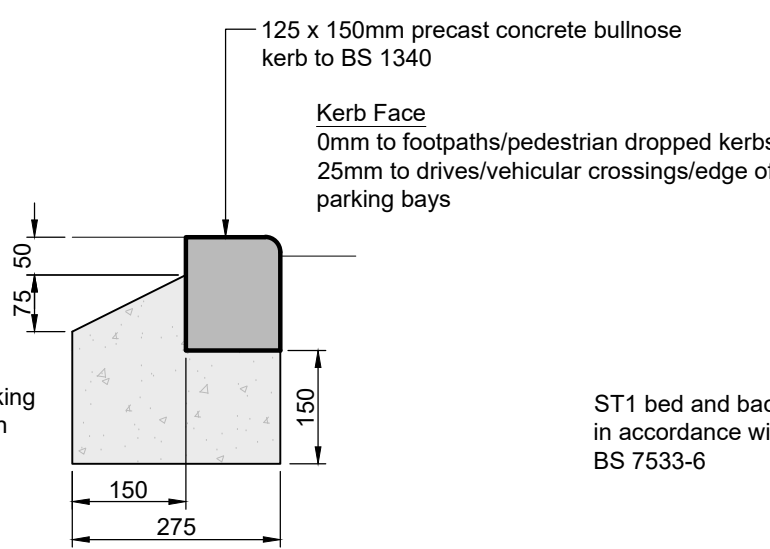


Bedding beneath and at the sides of the pipe to be well compacted the first 300mm of fill above the crown of the pipe is to be lightly tamped by hand. Mechanical compaction may be used only above this level. geotextiles may be used where directed or approved by the engineer to contain bedding material in certain soils e.g. running sand in very wet conditions, where directed or approved by the engineer a temporary land drain may be laid within the granular bed.

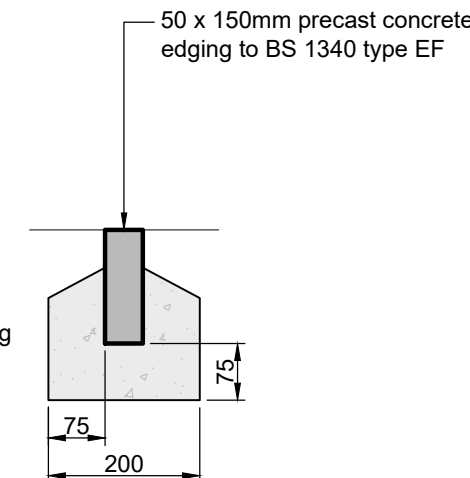
Pipe Bedding Details
(Scale 1:25)



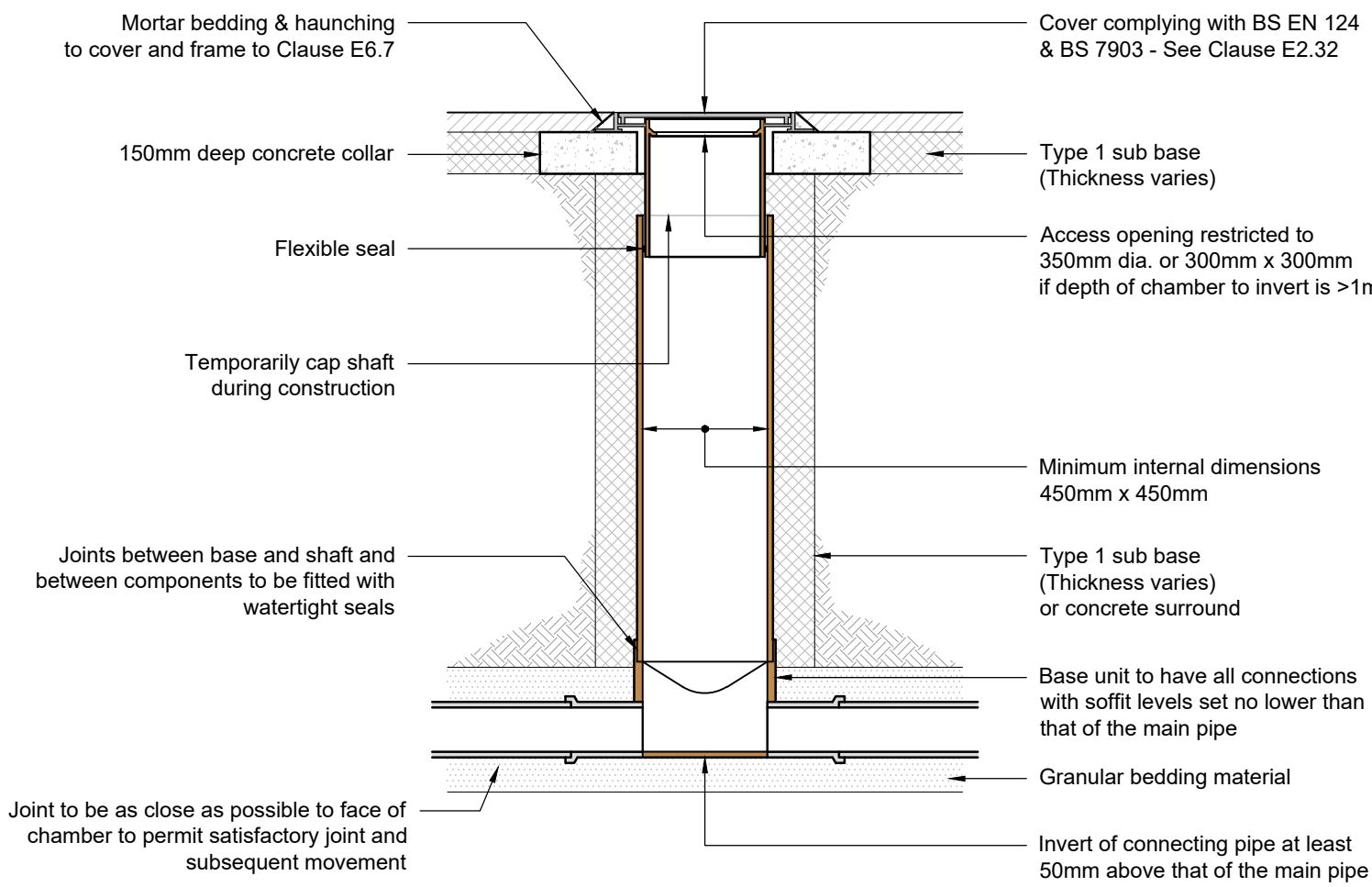
Kerb Detail - HB2
(Scale 1:10)



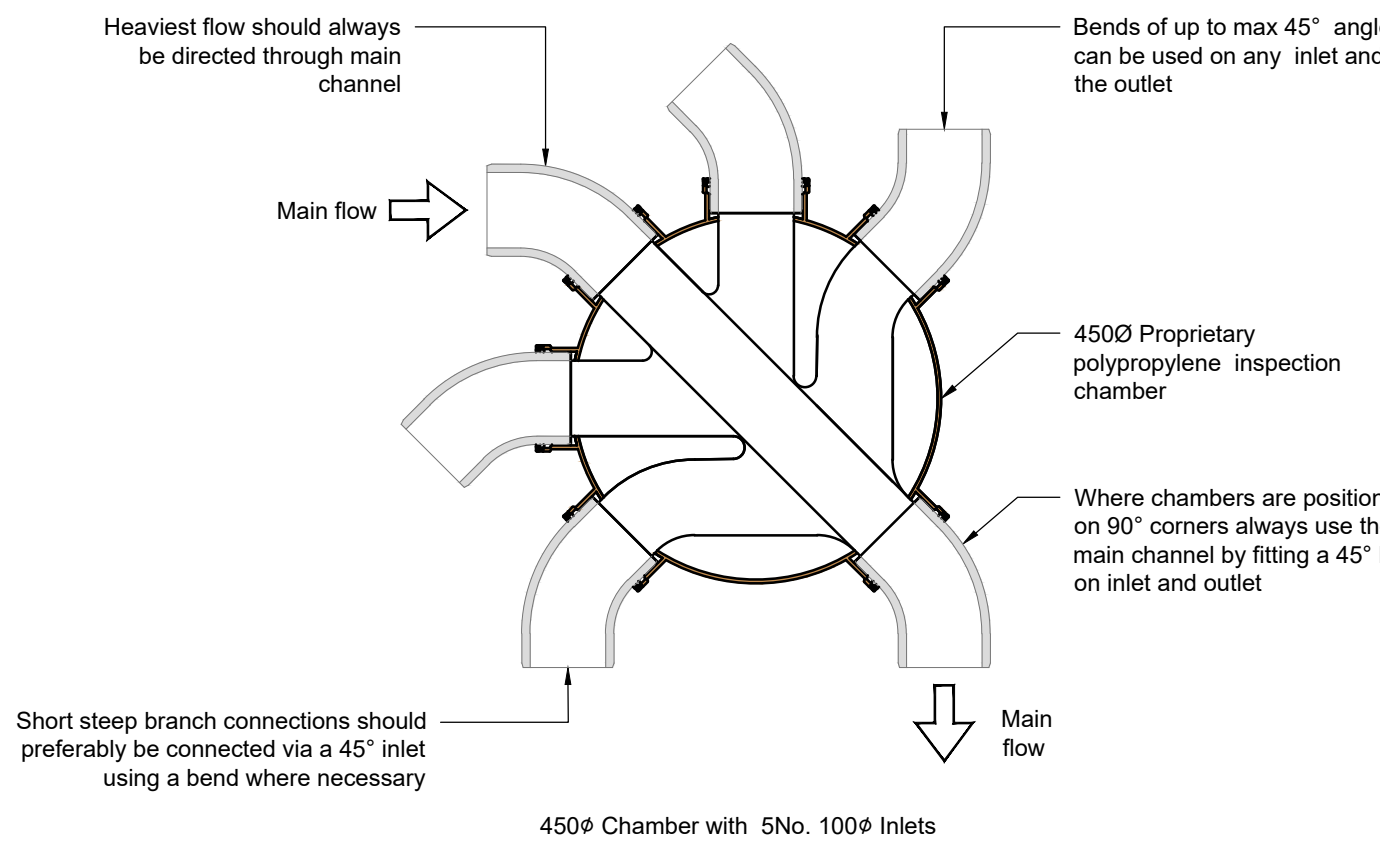
Kerb Detail - BN
(Scale 1:10)



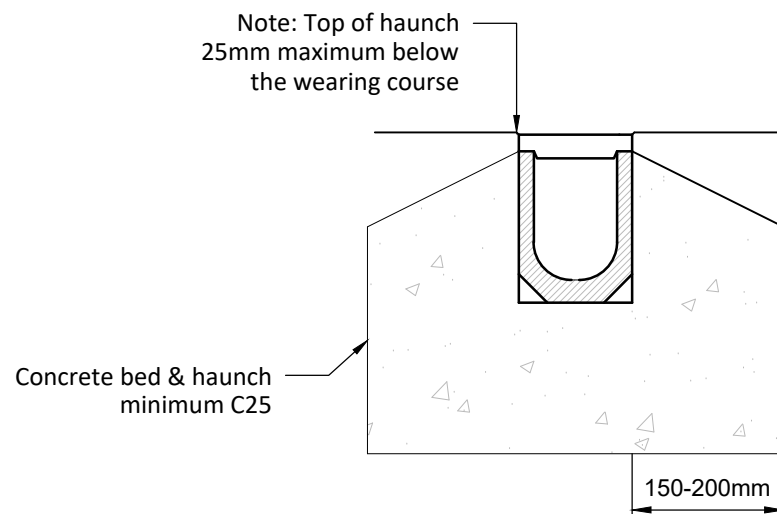
Kerb Detail - EF
(Scale 1:10)



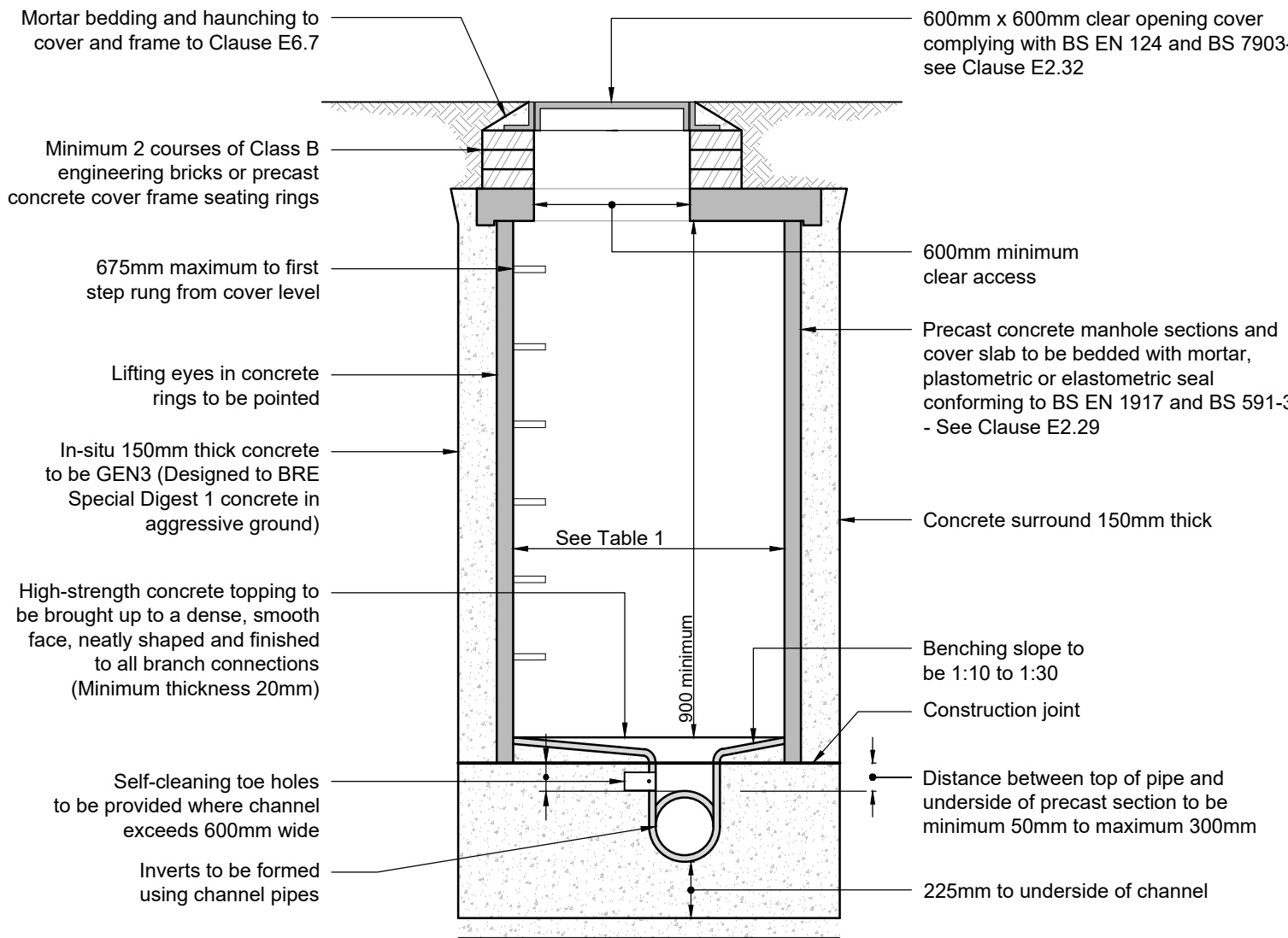
Typical Inspection Chamber Detail - Type 3
Max depth from cover level to soffit of pipe 3.0m, Non-entry
(Scale 1:25)



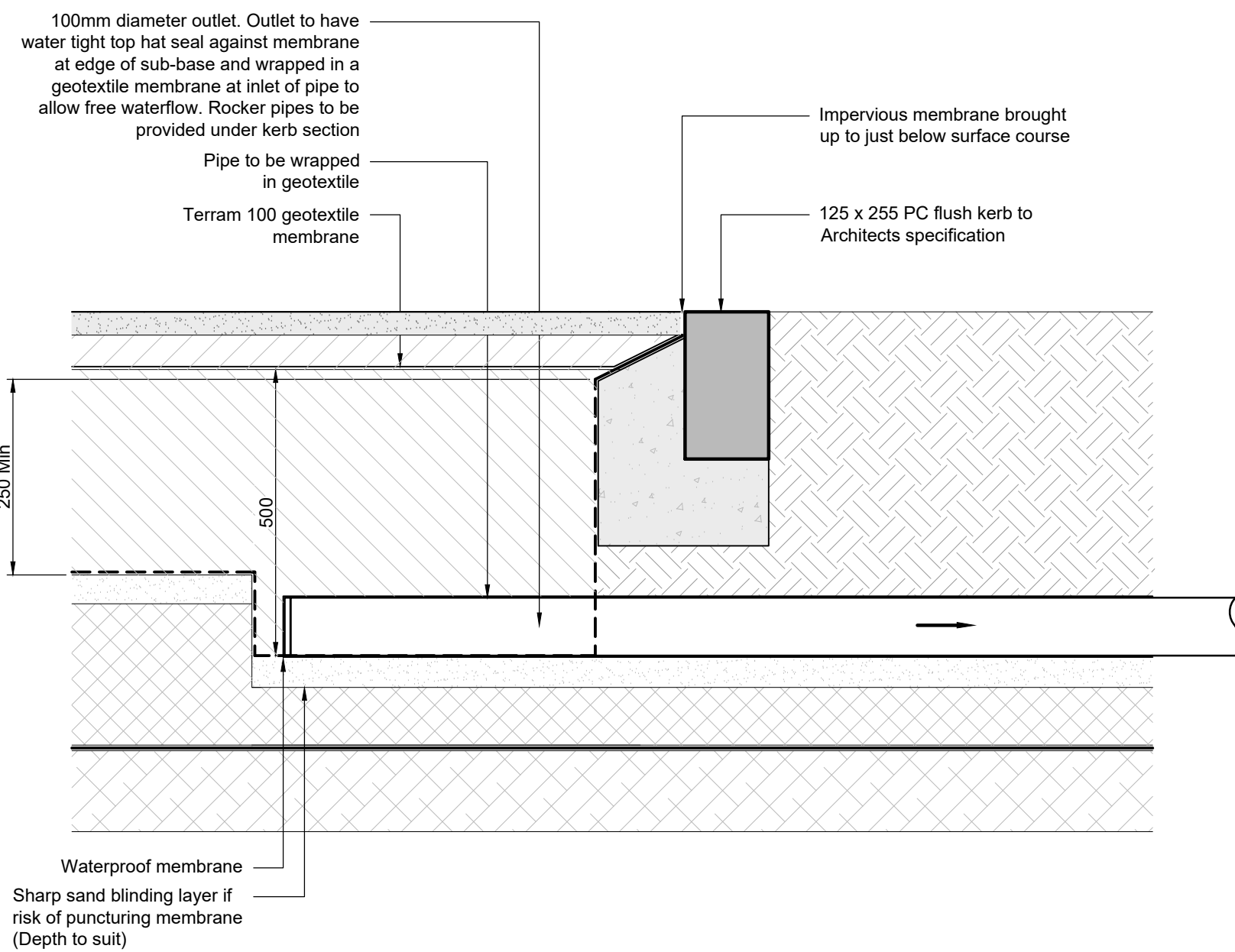
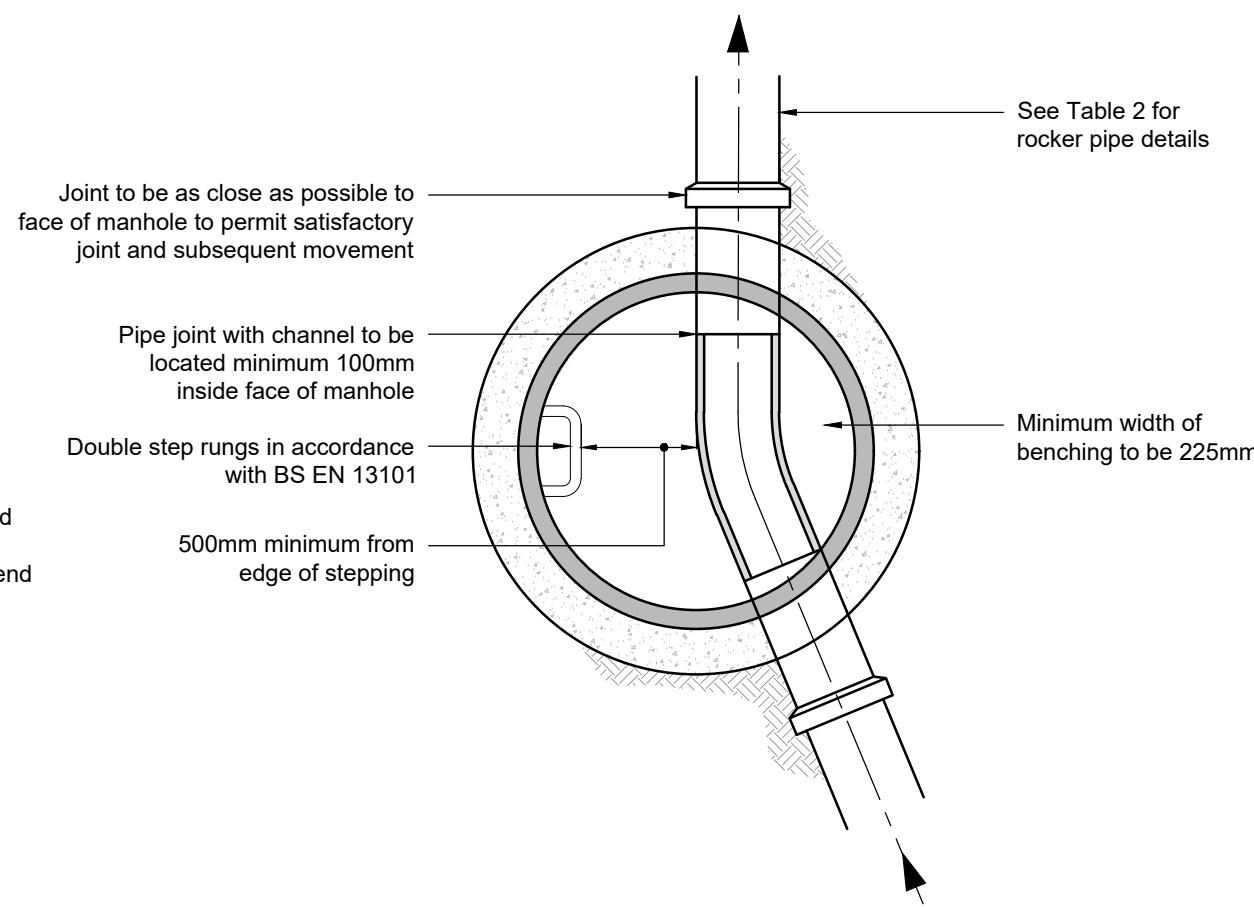
Polypropylene Inspection Chamber
Typical Pipework Arrangements
(Scale 1:10)



ACO Drain Detail
(Scale 1:10)



Typical Manhole Detail - Type 2
Max depth from cover level to soffit of pipe 3.0m
(Scale 1:25)



Typical Section Showing Outfall
of Surface Water Pipe
(Scale 1:10)

General

- 1.1 This drawing is to be read in conjunction with all Architect's, Engineer's and Services Engineer's drawings and specifications.
- 1.2 Do not scale from any of the structural drawings. All dimensions to be verified on site and any discrepancies should be highlighted.
- 1.3 The contractor is responsible for the stability of the building and adjoining structures during construction and shall design, install, adapt and maintain all necessary propping and temporary works. A method statement for the temporary works must be submitted to the contractor administrator for comment before work begins.
- 1.4 All materials to comply with the relevant British Standard.

Rocker Pipe Length

Nominal diameter of pipe (mm)	Maximum effective length (m)
150 TO 600	0.6
675 TO 750	1.0
OVER 750	1.25

Manhole Cover Type

Location of manhole	Cover class
Landscape areas	A15
Footpaths and driveways	B125
Car parks	C250
Highway (Inc areas with HGV access)	D400

Compressible Filler and Packing for Pipelines

Nominal diameter of pipe (mm)	Thickness of compressible filler (mm)
Less than 450	18
450 TO 1200	36
Exceeding 1200	54

P1	Preliminary Issue	11.09.20	RJ
REV	COMMENTS	DATE	CHK
STATUS			

PRELIMINARY

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CLIENT
PSK BUILDING SURVEYORS LTD.

PROJECT
UNIT 1 READING

CONSTRUCTION DETAILS

SCALE @ A1	DRAWN BY	DATE
1:200 @ A1	TRM	11/09/2020
MNP No.	STATUS CODE	REV
220115	S0	P1
Ref No: 220115-MNP-XX-XX-DR-C-1801		