cgs civils Consulting Civil Engineers

Surface Water Flood Risk Assessment

Enterprise-Rent-a-Car, Business Park, Strode Road, Plympton, Strode PL7 4AY

For

Enterprise-Rent-a-Car

Rev -

Reference: C2914

Date **16.11.2023**

REVISION

Revision	**Status**	**Description**	**Date**	**Issued**	**Checked**
-	Final v1	Issued for Approval	17.11.23	RH	CS

1 SITE DESCRIPTION AND LOCATION

1.1 The following report is a brief Flood Risk Assessment (FRA) for the site located at Enterprise-Rent-a-Car, Business Park, Strode Road, Plympton, Strode PL7 4AY (see site location map, Figure 1).

1.2 The property is located in Strode and is currently accessed off of Huxley Close. The development proposals are to add a secondary access off of Lister Close.

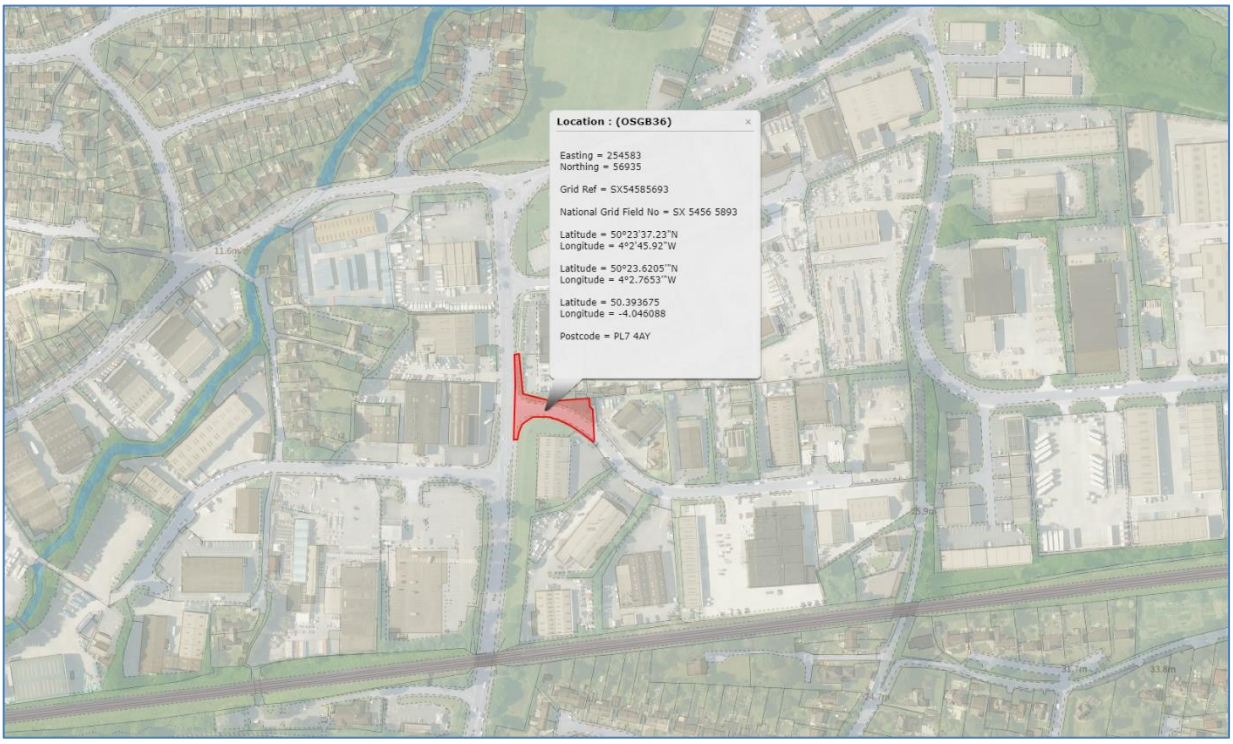


Figure 1 - Site Location Plan (site bordered red) Source: Location Map

RIVERS AND WATERCOURSES

1.3 Based on the EA data, it is understood that there are no major nearby water bodies or watercourses within the immediate vicinity to the site. The nearest watercourse appears to be the Tory Brook, located approximately 200m to the north west.

DEVELOPMENT PROPOSALS

1.4 It is understood that the development proposals are for works to create a second entry point to the site from Lister Close to better facilitate the existing business use. Drawings of the proposed works are provided in Appendix 1. This shows a new site entrance (VXO) off of Lister Close. This VXO will involve removing a section of the kerb (introducing a dropped kerb) and new tactile paving to maintain pedestrian linkage.

FLOOD RISK VULNERABILTY

1.5 This report has used the principles and guidance for assessing flood risk based on the National Planning Policy Framework (NPPF) and its Technical Guidance (the PPG).

1.6 The purpose of this report is to advise on associated surface water flood risk and any impacts to surface water flood risk may result from the development proposals (noting that flood risk from sea or river is considered very low – refer to Section 3 below).

1.7 Based on Annex 3 of the NPPF *'Flood Risk Vulnerability Classification'*, the development proposals are considered to be 'Less Vulnerable' being for commercial/industrial use.

2 DESIGNING FOR FLOOD RISK

2.1 Flood risk as defined by the NPPF, is a combination of the probability and the potential consequences of flooding. Areas at risk of flooding are those at risk of flooding from any source, now or in the future. Sources include rivers and the sea, direct rainfall on the ground surface, rising groundwater, overwhelmed sewers and drainage systems, reservoirs, canals and lakes and other artificial sources. Flood risk also accounts for the interactions between these different sources. This term is key to the application of the presumption in favour of sustainable development in paragraph 11 of the National Planning Policy Framework (NPPF).

2.2 The NPPF designates that the **'Design Flood Event'** (DFE) is used to assess the suitability of a development proposal against the criteria of the NPPF. The design flood, is a flood event of a given annual flood probability, but is generally taken as:

- River flooding likely to occur with a 1% annual probability (a 1 in 100 chance each year), typically shown as Flood Zone 3a as designated on the EA's Flood Map for Planning; or
- Tidal flooding with a 0.5% annual probability (1 in 200 chance each year), typically shown as Flood Zone 3a as designated on the EA's Flood Map for Planning; or
- Surface water flooding likely to occur with a 1% annual probability (a 1 in 100 chance each year), typically shown as the Medium Risk of Surface Water flooding as designated on the EA's Long Term Flood Risk mapping,

2.3 In addition to assessing present day risk, the Design Flood Event also must be assessed to include and appropriate allowance for climate change (refer to Section 3 for climate change allowances) based on the site's geographical location, vulnerability, and design life.

2.4 Table 1 of the NPPF provides definitions of the Flood Zones, from low to high probability of river and sea flooding and also in regard to surface water flood risk. These Flood Zone Classification for the purpose of this FRA are:

- Flood Zone 1 - land assessed as having a less than a 1 in 1,000 annual probability (<0.1%);
- Flood Zone 2 - land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river (1% – 0.1%), 1:100 year or greater of surface water flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year;
- Flood Zone 3 - land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year. Flood Zone 3b is land have greater than 1 in 20 to 1 in 30 year annual probability of flooding.

FLOOD RISK ASSESSMENT SCOPE

2.5 For the purpose of this brief FRA, the worst case DFE (whether this be from tidal, river or surface water sources only), has been used to steer the recommendations of this report. Consideration of extreme events above that of the DFE or from minor and lower risk of severe flooding (such as groundwater, sewer, or reservoir flooding) have not been considered further in the brief FRA.

2.6 Following an assessment from the various sources of flood risk for the DFE, this site-specific FRA has applied the key principles for decision making when flood risk is a consideration and includes in order of importance:

1. **Avoid –** This is to physically locating the development proposals to areas of lowest flood risk within the site and/or determined how to vertically place the proposals to such that more vulnerable uses are positioned above the design flood level (such as raising floor levels or placing more vulnerable uses on upper levels). Developers should refer to the BS 85500:2012-Flood resistant and resilient construction. Guide to improving the flood performance of buildings for applicable strategies);
2. **Control -** Planning authorities and developers can investigate measures to control the risk of flooding affecting the site (this may be through flood defences, flood gates, flood storage or other engineered

solutions such as SUDS). This is rarely applied at the site level and is mostly address through strategic and county level flood defence strategies. At this site level, typically this will be through applying a Water Exclusion or Water Entry strategy when design a building or space.

3. **Mitigate –** Is the use of flood resistance and resilience measures to address any residual risks remaining after the use of the avoidance and control measures described above. Passive measures should be prioritised overactive measures as they are likely to be more effective and more reliable. Flood Resilience is an approach to building design which aims to reduce flood damage and speed recovery and reoccupation following a flood. It uses a combination of flood resistance and recovery measures (referred to here as resilience measures), and is described in the industry-developed CIRIA Property Flood Resilience Code of Practice, which provides advice for both new-build and retrofit.

4. **Managing Residual Risk –** this will usually involve ensuring either safe access and egress is available from the safe in a DFE, Flood Warning Systems/Evacuation Plans are in place, safe refuge is on site during a DFE, the building is designed to account for flood loadings etc.

5. **Flood Risk is not increased elsewhere –** assuming all the above items can be address, it is critical that the development does not increase flood risk elsewhere as a result. Typically this is addressed by ensuring flood waters are not displaced (in surface water or river flood affected areas, the loss of floodplain storage is less likely to be a concern in areas benefitting from appropriate flood risk management infrastructure or where the source of flood risk is **solely** tidal.) or appropriate hydraulic modelling is provided in support of an application to demonstrate that flood risk is not increased outside of a site (such as through on site flood compensation or detailed site specific hydraulic modelling).

2.7 It should be noted, where up to date flood risk or climate change models are not available, best efforts have been made to assess these risks and extrapolate the available data where necessary. However, this approach may require further detailed modelling if deemed necessary by the reviewing authorities. Detailed hydraulic modelling is deemed outside the scope of this report.

3 SOURCES OF FLOOD RISK

3.1 In order to assist the implementation of the Governments NPPF, the EA has undertaken national scale flood risk mapping. This mapping takes into account a range of sources including flooding from rivers, sea, surface water and reservoir breach. Furthermore, each Council produces a Strategic (county scale) Flood Risk Assessments (SFRA) that aim to specifically identify local flood risk issues (such as critical drainage areas and local groundwater flooding).

3.2 The following section reviews the EA data relevant to surface water and river or sea flood risk only.

FLUVIAL (RIVER) AND TIDAL (SEA)

3.3 The EA have undertaken fluvial and tidal modelling of the nation's main rivers in flood to support and ensure developments are steered away from flood prone areas or are designed to ensure risk to people is not increased as a result. It should be noted that the EA's Flood Maps for Planning do not allow for the presence of defences and so illustrate a conservative representation of flood risk from rivers or seas.

3.4 The EA's Flood Maps for Planning shows that the site is located wholly within Flood Zone 1, which is land at very low risk of flooding from river or seas, or land assessed as having a less than a 1 in 1,000 annual probability of river or sea flooding (<0.1%).

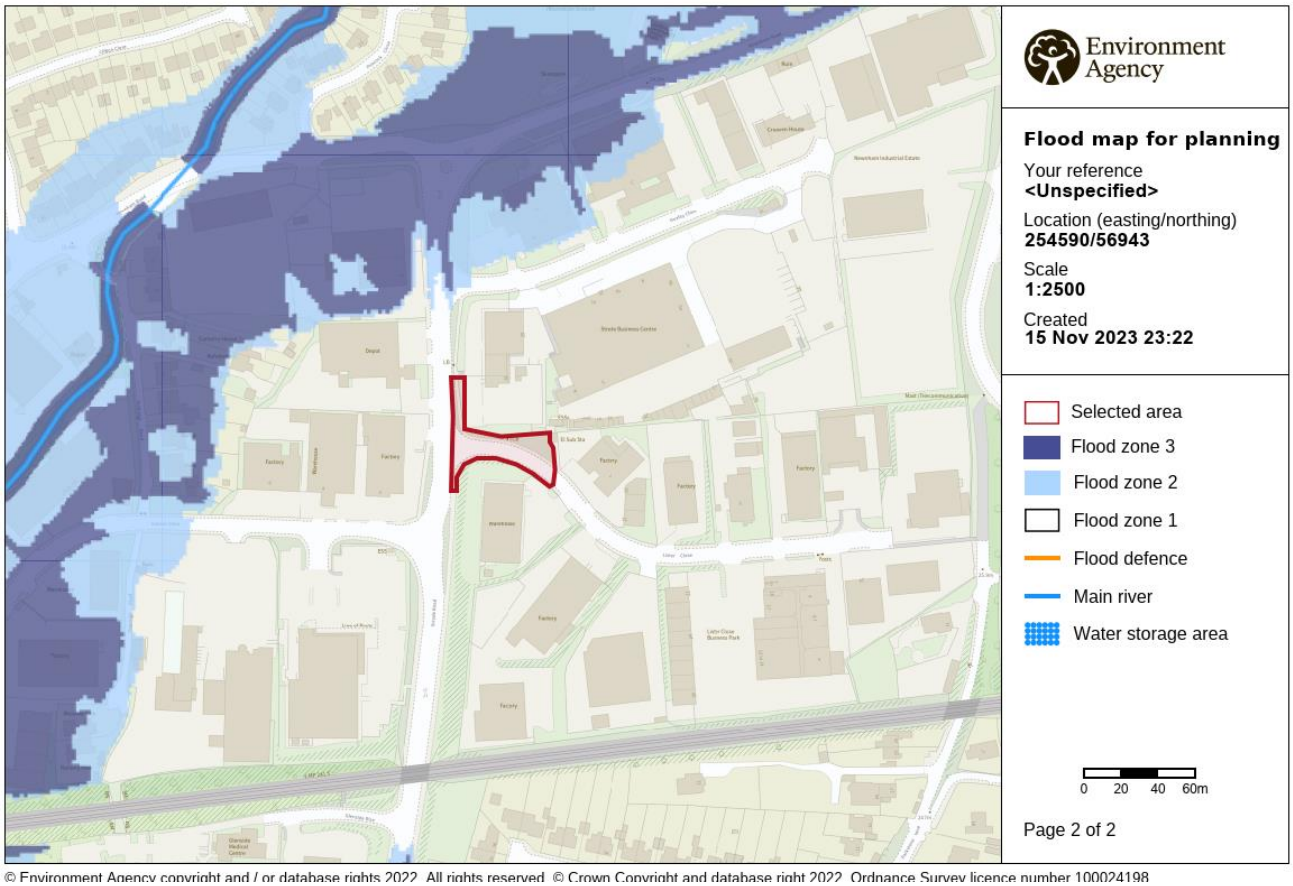


Figure 2 EA Flood Map for Planning overlain in GIS with Site (Lidar) Topography (source Environment Agency Flood Maps)

Impacts of Climate Change

3.5 Given the location of the site and the distance and elevation to the closest area of Flood Zone 2 or 3, it is highly unlikely that the site would be impacted by associated climate change impacts from river or sea flooding in the future.

PLUVIAL (SURFACE WATER)

3.6 Surface water flooding is the term applied to flooding when intense rainfall overwhelms the ability of the land to infiltrate water, or in urban areas for the sewers and road drains to drain the water away, resulting in surface water runoff and consequent flooding. It is a particular problem in urban areas where the excess water will often travel along streets and paths, between and through buildings and across open space. It can result in indiscriminate flooding to properties when not controlled. The high-profile flooding across the UK in the summer of 2007 was largely attributed to excess runoff where the capacity of the drains was exceeded by intense summer rainstorms and led to the Government commissioning the independent Pitt Review in 2008.

3.7 The EA's RoFSW is recommended by the LPA for all but the most complex of sites or where extreme events are required to be assessed. The EA maps use remotely sensed LiDAR data to determine large areas of topography. In all urban areas this LiDAR has been edited to remove the buildings. This editing process results in a slightly un-even surface profile, which can result in the production of small depressions that fill with water but in reality, is not at risk of surface water flooding. This should be taken into account where very localised areas of flooding are evident and are independent of wider surface water flood flows and routes.

3.8 The EA mapping presents 3 event scenarios for the 1 in 30 (3.3% chance of occurring in any one year) return period (high risk), the DFE-1 in 100 (1% chance of occurring in any one year) return period (medium risk) and 1 in 1000 (0.1% chance of occurring in any one year) return period (low risk – Figure 3).

3.9 Figure 3 shows that the site is wholly unaffected by surface water flooding for all modelled event scenarios. However, there may be shallow flooding in Lister Close (up to 150mm) and within Strode Road, up to 300mm. It appears from the mapping, that flood flows along Lister Closer would be directed (by topography) on to Strode Road, where they continue to flow north.

3.10 Importantly to note however is that the site is currently unaffected. Flood Flows appear almost completely restrained to Lister Close Road reserve. As such, the primary consideration will be to ensure that the VXO will not 'open' a pathway for surface water flows to bypass through the site and increase flood hazard within the site.

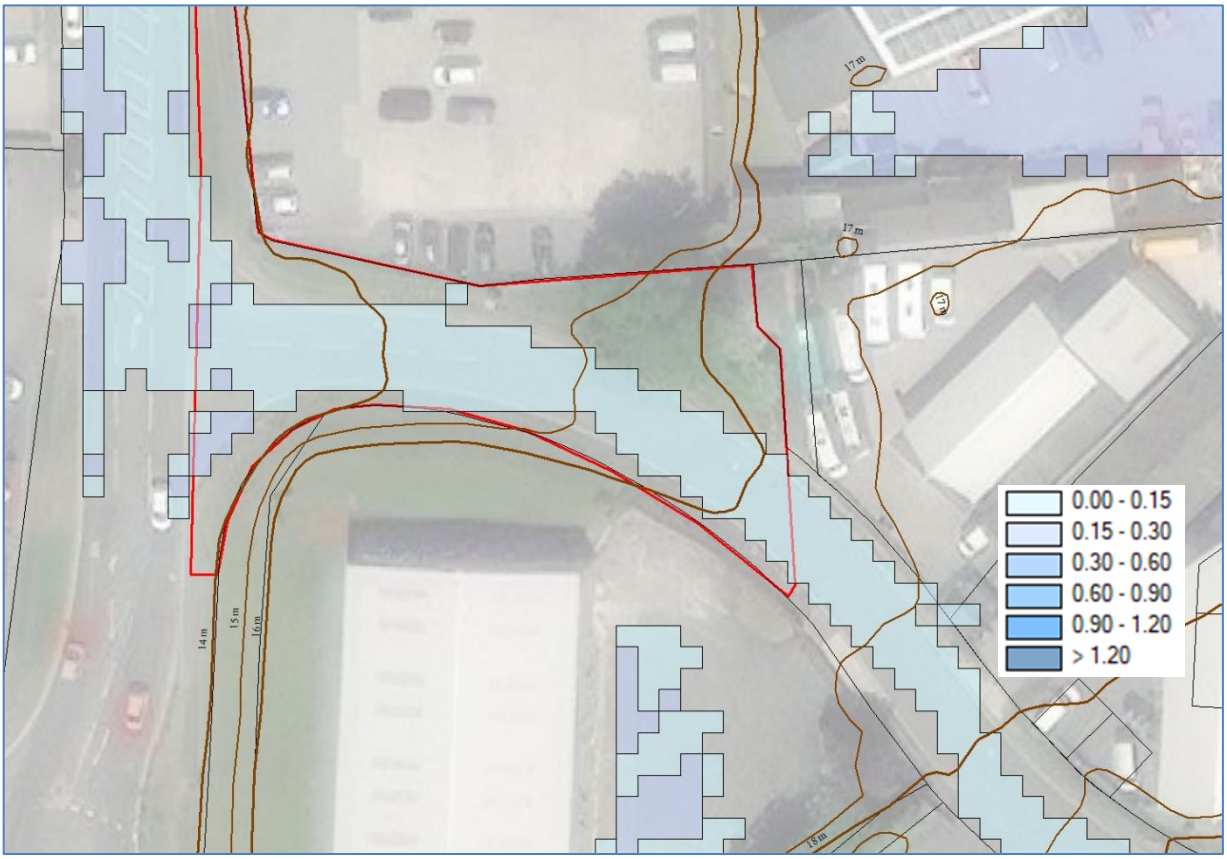


Figure 3 EA extract from the EA's Long-Term Risk of Flooding from Surface Water (RoFSW) maps showing the 1 in 1000 year event

Impacts of Climate Change

3.11 When considering climate change impacts to surface water (pluvial) flooding, The DEFRA peak climate change rainfall allowances detail predicted rainfall increase due to climate change in different regions around England. For all developments with a design epoch up to (and presently beyond) 2070, the NPPF states developments should adopt the Upper End and Central allowances. The site-specific climate change allowances based on the DEFRA data is summarised in **Error! Reference source not found.** below, and should also be adopted for the purposes of surface water drainage design.

Table 1 - Summary of Table 2: peak rainfall intensity allowance in small catchments (less than 5km2) or urban drainage

Tamar ManagementCatchment peak rainfall allowances 2070's	3.3% Annual Exceedance Probability Event	1% Annual Exceedance Probability Event
Central	30%	30%
Upper End	45%	50%

3.12 The guidance acknowledges that in relation to certain factors there is considerable uncertainty with respect to the absolute level of change that is likely to occur. As such, in these instances, the guidance provides estimates of possible changes that reflect a range of different emission scenarios (**Error! Reference source not found.**).

Table 2 - Extract from NPPF designating Flood Risk Climate Change Allowances by Flood Zone and Use. Sites required climate change probability scenario highlighted blue

FLOOD ZONE	ESSIENTIAL INFRASTRUCTURE	HIGHLY VULNERABLE	MORE VULNERABLE	LESS VULNERABLE	WATER COMPTABILE
1/2	Higher Central and Upper End	Higher Central and Upper End	Central and Higher Central	Central	None of these allowances
3a	Upper End	Development should not be permitted	Higher Central and Upper End	Central and Higher Central	Central
3b	Upper End	Development should not be permitted	Development should not be permitted	Development should not be permitted	Central

3.13 As such it is the Central Climate Change Allowance that should be considered in determining the DFE.

3.14 The NPPF requires that the 1% AEP or Medium Risk event is assessed to steer recommendations for planning and improving a properties flood resilience. However, in the absence of the 1% AEP plus climate change data, the 0.1% AEP event has been used to provide a conservative estimate of likely flood extents and depths in this case.

4 RECCOMENDATIONS AND CONCLUSIONS

3.16 Levels along Lister Close fall from the east to the west, and then south to north along Strode Road. At the proposed VXO, the kerb invert at the eastern edge is approximately 15.0mAOD, falling to approximately 14.5mAOD at the western edge. The VXO would extend up into the site, where boundary levels are approximately 14.8mAOD.

3.17 To continue to maintain the existing flows routes down through Lister Close and to prevent the new VXO forming a bypass that could direct surface flows into the site, the VXO should:

1) Tie into the kerb invert;
2) Grade up from the kerb invert first, so there is a minimum 175mm difference between the kerb invert, before grading back and tying into site levels.
3) Grade site levels back away from where the new VXO ties into the site boundary or install a new channel drain at the boundary to prevent site runoff discharging onto the new VXO.

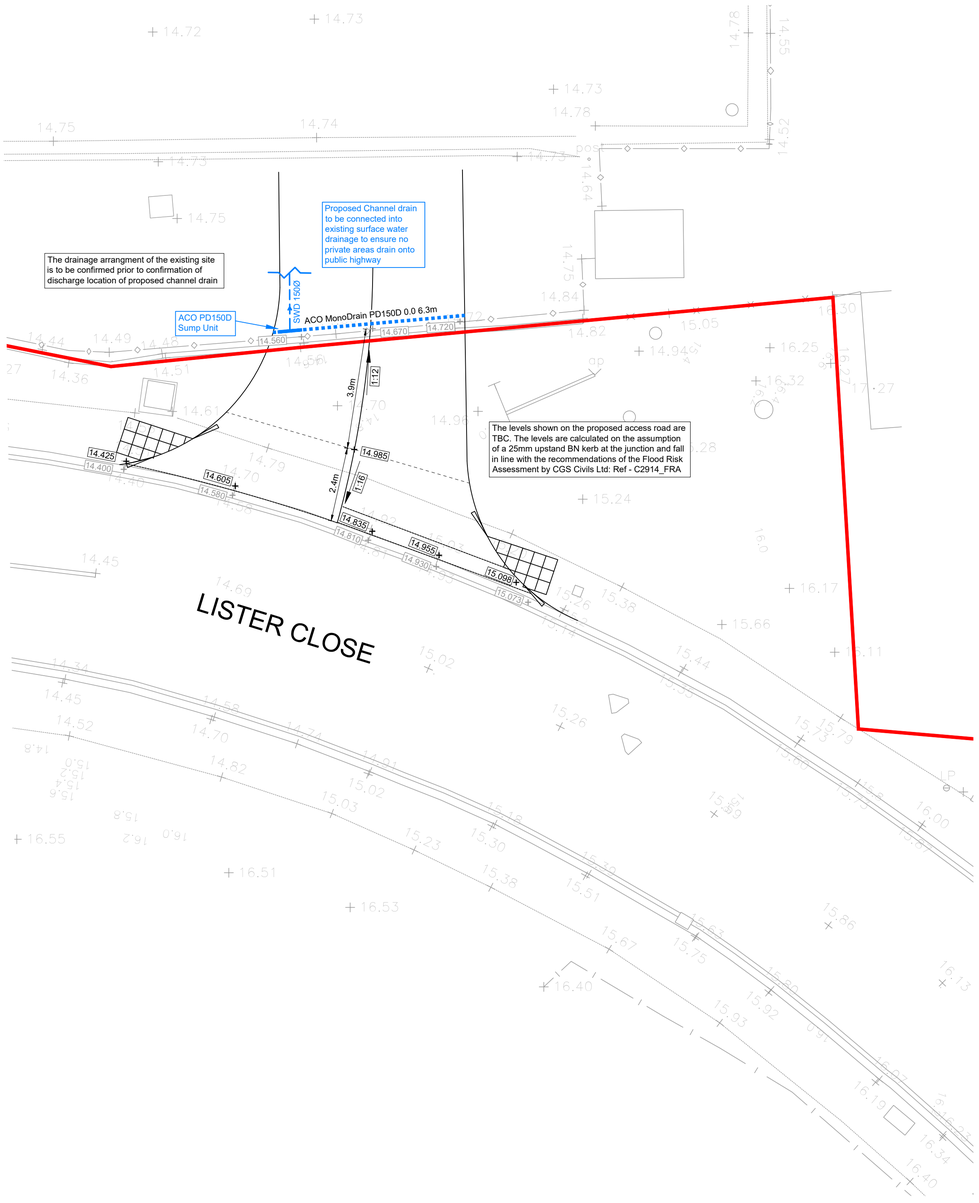
3.18 In addition, the site drainage should ensure no surface water flows are directed onto the new VXO but should be intercepted at the site boundary and managed by the existing sites drainage to prevent overloading the existing highways drainage.

3.19 A drainage layout has been prepared to demonstrate that above which can be found in appendix A.

3.20 This should allow surface flows coming down Lister Close towards Strode Road to largely remain unchanged and prevent surface flows bypassing into the site.

3.21 As demonstrated above, it is considered that by ensuring the VXO ramps up by 175mm from the kerb invert, before tying into site levels, the site can remain protected from surface water flood risk. Care will need to be taken in the design of the drainage and coordinated appropriately with the existing road and site.

Appendix A – Drainage Layout



LEGEND

PROPOSED FEATURES

SWD — Surface Water Drainage

CD — Channel drain

18.250 — Proposed surface level

18.250 — Existing surface level

1:62 — Fall in surface and gradient

Site boundary between Enterprise and Plymouth Council

Site Specific Notes

1. The proposed scheme consists of the construction of a new vehicular crossover that is to serve the existing Enterprise Rent-A-Car located within Plympton, Plymouth.
2. A Flood Risk Assessment was undertaken by CGS Civils Ltd on behalf of the client which had the following recommendations:
   - The new crossover is to tie into the existing kerb invert level.
   - The access is to be graded up from the kerb invert so there is a minimum of 175mm difference between the kerb invert before grading back down and tying into existing site levels.
   - A channel drain is to be installed along the boundary of the site and the new crossover to ensure that no surface water runoff from private areas will drain into the public highway.
3. The proposed crossover levels are based upon the assumption that there is to be a 25mm upstand BN kerb along the junction. The crossover is to be graded at a 1:16 gradient for 2.4m to achieve the 175mm rise in levels are recommended within the FRA. Following this, the access is to then be graded down at a 1:12 gradient for the remaining 3.9m in order to tie into the existing levels on site.
4. A channel drain is to be installed along the boundary of the Enterprise site and the vehicular access in order to capture the surface water runoff from the private site before it drains onto the public highway. This is to be discharged into the existing surface water drainage on site, however, this is subject to confirmation of the existing arranagment at a later stage.

STANDARD DRAINAGE NOTES

1. DO NOT SCALE FROM THIS DRAWING, REFER TO FIGURED DIMENSIONS ONLY. THE CONTRACTOR SHOULD CHECK ALL DIMENSIONS ON SITE.
2. ALL DIMENSIONS IN MILLIMETRES AND ALL LEVELS ARE IN METERS UNLESS NOTED OTHERWISE.
3. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ARCHITECT AND ENGINEERING DETAILS, DRAWINGS AND SPECIFICATIONS.
4. ANY DISCREPANCIES SHOULD BE REPORTED TO THE ARCHITECT AND/OR ENGINEER IMMEDIATELY, SO THAT CLARIFICATION CAN BE SOUGHT PRIOR TO THE COMMENCEMENT OF WORK.
5. BEFORE COMMENCING CONSTRUCTION THE CONTRACTOR MUST CHECK THE INVERT LEVELS OF EXISTING SEWERS TO WHICH CONNECTIONS ARE MADE. IN ADDITION THE CONTRACTOR MUST LOCATE AND DETERMINE INVERT LEVELS OF THE EXISTING SPURS TO WHICH CONNECTIONS ARE PROPOSED. ANY DISCREPANCIES ARE TO BE NOTIFIED TO THE ENGINEER IMMEDIATELY, PRIOR TO CONSTRUCTION.
6. ALL DRAINAGE WORKS SHOULD COMMENCE AT THE PROPOSED DOWNSTREAM CONNECTION POINT, THE WORKS CONTINUING UPSTREAM FOLLOWING CONFIRMATION OF THE TIE-IN INVERT LEVELS TO THE ENGINEER. CONNECTIONS TO MANHOLES OR LARGER SIZED PIPES ETC. SHOULD BE SOFFIT TO SOFFIT UNLESS OTHERWISE INSTRUCTED BY THE ENGINEER, IF THIS IS NOT POSSIBLE INFORM THE ENGINEER IMMEDIATELY.
7. COVER LEVELS SHOWN ARE APPROXIMATE. COVERS AND FRAMES SHALL BE SET TO FINISHED GROUND LEVELS AND FALLS.
8. ALL UN-REFERENCED PIPES ARE TO BE 100mm DIA
9. ALL PIPES TO BE ADOPTED, OR CONNECTING TO ADOPTED SEWERS, TO BE VITRIFIED CLAY TO BS EN 295 AND BS65 (SWS ONLY), OR CONCRETE PIPES TO BE EN 1916 AND BS5911:PART 1.
10. ROAD GULLY OUTLET PIPES ARE TO BE 150mm DIA. WITH CONCRETE SURROUND AND FLEXIBLE JOINTS. ALL GULLIES SHALL BE FITTED WITH GRADE D400 GRATINGS AND FRAMES TO BS EN124, UNLESS OTHERWISE STATED.
11. ALL ADOPTABLE SEWERS SHALL BE CONSTRUCTED TO THE STANDARDS AND SPECIFICATION LAID DOWN DOWN IN 'SEWERS FOR ADOPTION' 6th EDITION, WITH A VIEW TO ADOPTION UPON COMPLETION OF WORKS.
12. ALL PRIVATE DRAINAGE TO BE IN ACCORDANCE WITH THE BUILDING REGULATIONS APPROVED DOCUMENT PART-H, AND TO THE SATISFACTION OF THE BUILDING CONTROL INSPECTOR.
13. THE CONTRACTOR IS TO KEEP A RECORD OF ANY VARIATIONS MADE ON SITE, INCLUDING THE RELOCATION OF SEWERS OR DRAINS, SO THAT AN AS CONSTRUCTED DRAWING CAN BE PREPARED UPON COMPLETION OF THE PROJECT.
14. STUB CONNECTIONS TO ADOPTABLE MANHOLES SHALL BE MADE FROM VITRIFIED CLAY AND CONSIST OF TWO ROCKER PIPES LAID AT THE SAME GRADIENT AS THE UP OR DOWNSTREAM PIPE.
15. IF ANY SUB SOIL DRAINAGE SYSTEMS ARE UNCOVERED DURING THE WORKS CONTACT THE ENGINEER FOR INSTRUCTIONS. SUB SOIL DRAINS ARE TO BE DIVERTED AROUND NEW WORKS AND CONNECTED INTO THE SURFACE WATER.
16. NO PRIVATE AREAS ARE TO DRAIN ONTO ADOPTABLE AREAS AND VICE VERSA.
17. ALL EXISTING MANHOLE COVER'S, GULLIES, ETC, ARE TO BE RAISED/LOWERED TO SUIT NEW LEVELS.
18. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO CONFIRM THE LOCATION AND DEPTH OF ALL EXISTING SERVICES AND UTILITIES THAT MAY BE PRESENT
19. UPON COMPLETION BUT PRIOR TO HANDOVER, CONTRACTOR TO CARRY OUT FULL CCTV SURVEY OF DRAINAGE SYSTEM WHICH IS TO BE REVIEWED BY ENGINEER TO ENSURE SATISFACTORY INSTALLATION

DESIGN SUBJECT TO THE CONFIRMATION OF:
EXTERNAL LEVELS DESIGN
ROOT PROTECTION AREAS

DESIGN SUBJECT TO THE APPROVAL OF:
PLANNING AUTHORITY
BUILDING CONTROL

Prefixed to drawing numbers shall signify the following:-

PL = PLANNING	Shall not be used for contract or construction purposes
P = PRELIMINARY	Shall not be used for contract or construction purposes
T = TENDER	Shall not be used for construction purposes
C = CONSTRUCTION	These are the only drawings that shall be used for construction purposes
R = RECORD	Record of actual completed work

REV	DATE	DESCRIPTION	BY	CHK	APP
P-	17.11.23	PRELIMINARY ISSUE	LH	CS	CS

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Consulting Civil Engineers

CLIENT: ENTERPRISE RENT-A-CAR

ARCHITECT: PAUL BASHAM ASSOCIATES

JOB TITLE: ENTERPRISE RENT-A-CAR PLYMPTON

DRAWING TITLE: SURFACE WATER DRAINAGE STRATEGY

DRAWN	ENGINEER	CHECKED	APPROVED
LH	C SLADE	CS	CS

DATE	SCALE @ A1
NOVEMBER 2023	1:100

JOB No.	STATUS	DRAWING No.	REV.
C2914	PL	101	PL-

FOR PLANNING ONLY