

Technical Note

Introduction

- 1.1 The National Planning Policy Framework (last updated in July 2021) states “*The aim of the sequential test is to steer new development to areas with the lowest risk of flooding from any source*”. This means sources of flooding such as surface water must be considered. If the site is at risk of surface water flooding, then it must pass the sequential test before any development can take place.
- 1.2 The proposed new Lidl store at Purbrook Way is shown to contain an area of “medium risk” surface water flooding located within the application boundary. Refer to Appendix A that shows the currently available Risk of Surface Water Flooding Map. This flooding is located in an isolated area at an existing underpass at the south-west corner of the site. Refer to photos in Appendix B.
- 1.3 The purpose of this Technical Note is to detail the findings from a review of the EA Risk of Flooding from Surface Water mapping and the most recent National Lidar Programme and site specific Topographic Survey elevation data at the application site at Purbrook Road, Havant.

EA Risk of Flooding from Surface Water Mapping

- 1.4 The Environment Agency produced the national Risk of Flooding from Surface Water (RoFSW) map in 2013 which Lead Local Flood Authorities (LLFAs) use as the foundation for determining surface water flood risk in their local area.
- 1.5 The RoFSW model assesses different rainfall events (1in30year, 1in100year and 1in1000year) and provides information on depth, extent, velocity, and hazard which can be used to determine and appropriately plan for surface water flooding at the site.
- 1.6 Figure 1.1 shows the RoFSW extent map for all three rainfall events at the site location.

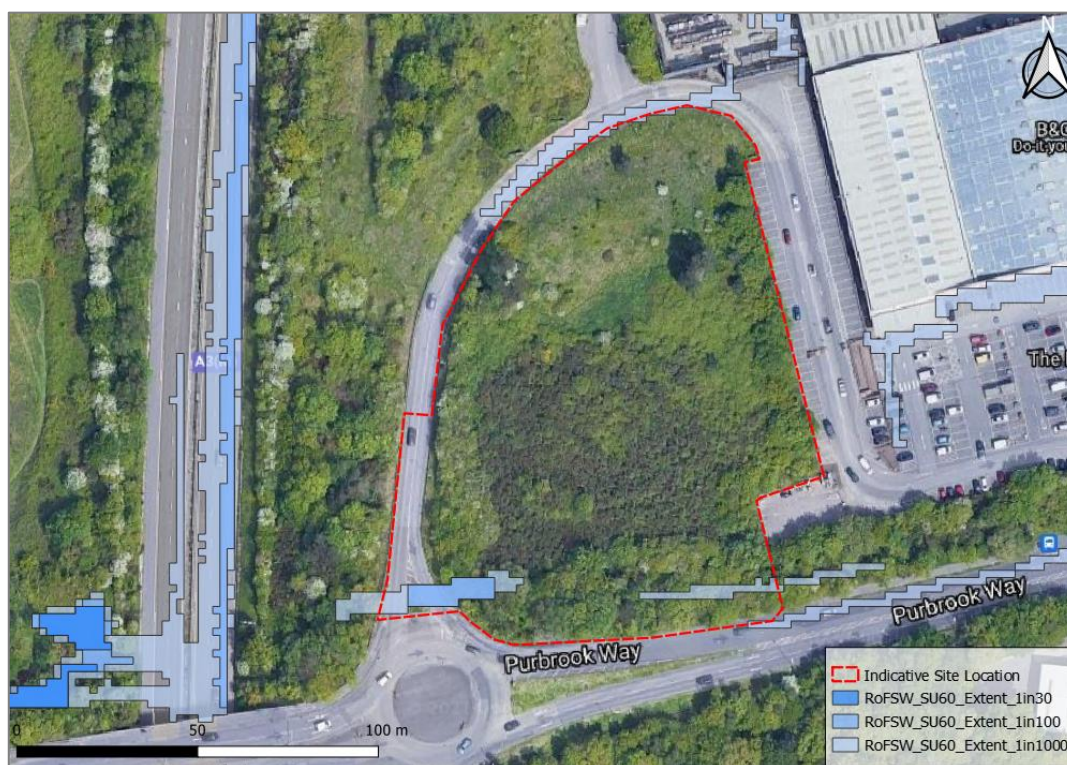


Figure 1.1: RoFSW Extent Map.

- 1.7 Figure 1.1 shows a minor extent of surface water flood extent for the 1in1000 and 1in100 year event concentrated at the southwest corner of the site. This extent corresponds with the location of an underpass under the access road. It is understood that as part of the RoFSW, processing has occurred to ensure surface water isn't shown to back up/pond upstream of the access road (which is elevated). This has been done by manually modifying the elevation data to "burn" a channel through the access road and thus represents the underpass by allowing surface water to flow through to the downstream side.
- 1.8 Importantly, the RoFSW also provides information about the source, quality, and suitability of the data which can be used to determine if it is appropriate to use the RoFSW outputs as an accurate source of information to inform flood risk at the site. These outputs are particularly important to review when the RoFSW flood extent, depth and velocity outputs appear to be erroneous or inaccurate. The key model details at the site location are presented in Table 1.1 below.

Model Type	Publish Date	DTM Resolution	Suitability	Confidence
JFLOW National	2013	2m	County to Town	3 (default confidence level)

Table 1.1: RoFSW model details at site location.

- 1.9 Table 1.1 shows that at the site location, the surface water flood risk information is informed by the national flood model (hasn't been improved with local modelling) from 2013. The model was built with a Digital Terrain Model at a spatial resolution of 2m and is deemed to be suitable for informing "County to Town" level flood risk planning. The model has been assigned the default confidence level.
- 1.10 Figure 1.2 shows the descriptions of the suitability outputs from the RoFSW data. The key factor to note is that "County to Town" suitability is appropriate to identify approximate extents and shallower and deeper areas but is unlikely to be reliable for a local area.

Suitability: 'it's good enough for...'		Reliability: 'how good is it for...'		Examples of this kind of flood risk information
Indicative suitable scale	Indicative suitable use	How reliable is this for a local area?	How reliable is this for an individual property?	
National to county - suitable for identifying which parts of countries or counties are at risk, or which countries or counties have the most risk.	Suitable for identifying areas with a natural vulnerability to flood first, deepest or most frequently.	Very unlikely to be reliable for a local area.	Extremely unlikely to be reliable for identifying individual properties at risk.	The first "National Flood Risk Assessment" (NaFRA, 2004, 2005, and 2006). The first national surface water map "Areas Susceptible to Surface Water Flooding" (ASISWF, 2009).
County to town - suitable for identifying which parts of counties or towns are at risk, or which counties or towns have the most risk.	Suitable for identifying approximate extents, shallower and deeper areas.	Unlikely to be reliable for a local area.	Very unlikely to be reliable for identifying individual properties at risk.	The majority of the current NaFRA which dates from 2008. The second national surface water map "Flood Map for Surface Water" (FMSWF, 2010).
Town to street - suitable for identifying which parts of towns or streets are at risk, or which towns or streets have the most risk.	Suitable for identifying flood extents, approximate depth of flooding, and identifying streets at risk of flooding.	Likely to be reliable for a local area (and so the information is suitable for areas of land, not individual properties).	Unlikely to be reliable for identifying individual properties at risk (and so the information is suitable for areas of land, not individual properties).	Some parts of the current NaFRA which benefit from good local data and have been validated (checked). The Flood Map for Planning (Rivers and Sea) (previously known as the Flood Map, containing Flood Zones).
Street to parcels of land - suitable for identifying which parts of streets or parcels* of land are at risk, or which streets or parcels of land have the most risk.	Suitable for identifying flood extents, depths and approximate velocities.	Very likely to be reliable for a local area (and so the information is suitable for areas of land, not individual properties).	Likely to be reliable for identifying individual properties at risk (though not whether they flood internally, so the information is suitable for areas of land, not individual properties).	Flood models and maps from detailed local studies, which have been successfully calibrated (tuned) and validated (checked) against observed local flood data.
Property (including internal) - suitable for identifying which parts of a property are at risk (including internal / external distinction), or which properties have the most risk.	Suitable for identifying flood extents, depths, velocities, and distinguishing between street and property flooding.	Extremely likely to be reliable for a local area.	Likely to be very reliable at identifying individual properties at risk, including depths of flooding internally (this provides a genuine property level assessment).	Flood models and maps of the whole water system. These are exceptionally detailed local studies which benefit from excellent input data such as long records. This kind of information is only available in a limited number of areas.

Figure 1.2: Suitability of RoFSW (extracted from "EA - What is the Risk of Flooding from Surface Water map – April 2019, report version 2.0).

- 1.11 Considering the age of the model, the relatively low spatial resolution, the suitability rating given, and the post processing that has occurred, there is sufficient reason to question the flood extent, depth and velocity at the site. Therefore, it is important to understand the local topography with the most up to date and accurate information to determine the likely flow paths and ponding locations.
- [National Lidar Programme and Topographic Survey elevation data](#)
- 1.12 In 2017 the Environment Agency announced the National LiDAR Programme (EA NLP), with the aim of producing a full national lidar height dataset by mid-2020 (though this goal was changed to 2021).
- 1.13 The National Lidar Programme aims to replace older, lower resolution LiDAR data with new 1m spatial resolution or higher elevation data nationally.

- 1.14 At the site location, 1m spatial resolution EA NLP data is available, collected in 2020. This data is much more recent, and a higher resolution than the elevation data from 2013 used to produce the RoFSW map. Figure 1.3 presents an overview of the EA NLP elevations near to the site and presents the location of the spot levels presented in Table 1.3.

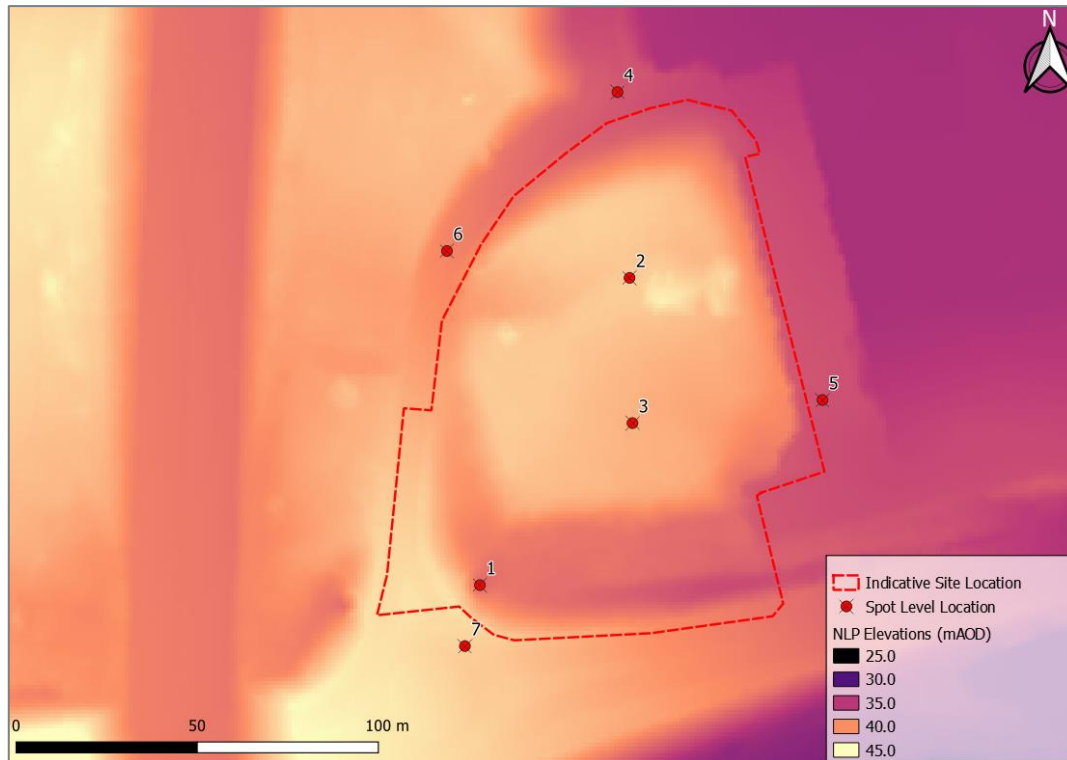


Figure 1.3: EA NLP Elevation Map with Spot Level Locations.

- 1.15 Furthermore, a topographic survey has been undertaken which provides accurate ground levels across the site including the eastern access to the underpass. However, the survey does not extend to the western side of the underpass. The Topographic Survey is included as Appendix C.
- 1.16 To determine the surface water flow characteristics at the underpass location, we need accurate ground level information on both sides. To verify the accuracy of the National Lidar Programme data, spot levels were extracted and compared from both the NLP data and the Topographic Survey at a variety of locations. Table 1.2 shows the difference in levels between the two sources of information at the spot levels shown in Figure 1.3.

Spot Level Reference	Topographic Survey level (mAOD)	NLP Level (mAOD)	Difference (m)
1	38.86	38.88	0.02
2	42.87	42.94	0.07
3	41.84	41.85	0.01
4	37.31	37.23	0.08
5	36.79	36.80	0.01
6	39.96	39.88	0.08
7	43.17	43.12	0.05

Table 1.2: Spot Levels comparison between NLP data and Topographic Survey.

- 1.17 Table 1.2 shows a high degree of correspondence between the Topographic Survey and the NLP elevation data, with a maximum error of less than 100mm. This provides a level of confidence in the NLP data which indicates it is suitable to use to determine the ground levels to the west of the underpass and inform the analysis of the likely flow paths.

Analysis and review of RoFSW map

- 1.18 A review of the RoFSW extent, depth and velocity outputs for the 1in100 year event was undertaken to understand if the outputs correspond with NLP data and Topographic Survey and thus determine whether it is appropriate to use to RoFSW map to inform flood risk decisions at the site.

Depth

- 1.19 The RoFSW depth output shown in Figure 1.4 shows ponding at the underpass location to a maximum depth of between 0.3 and 0.6m.

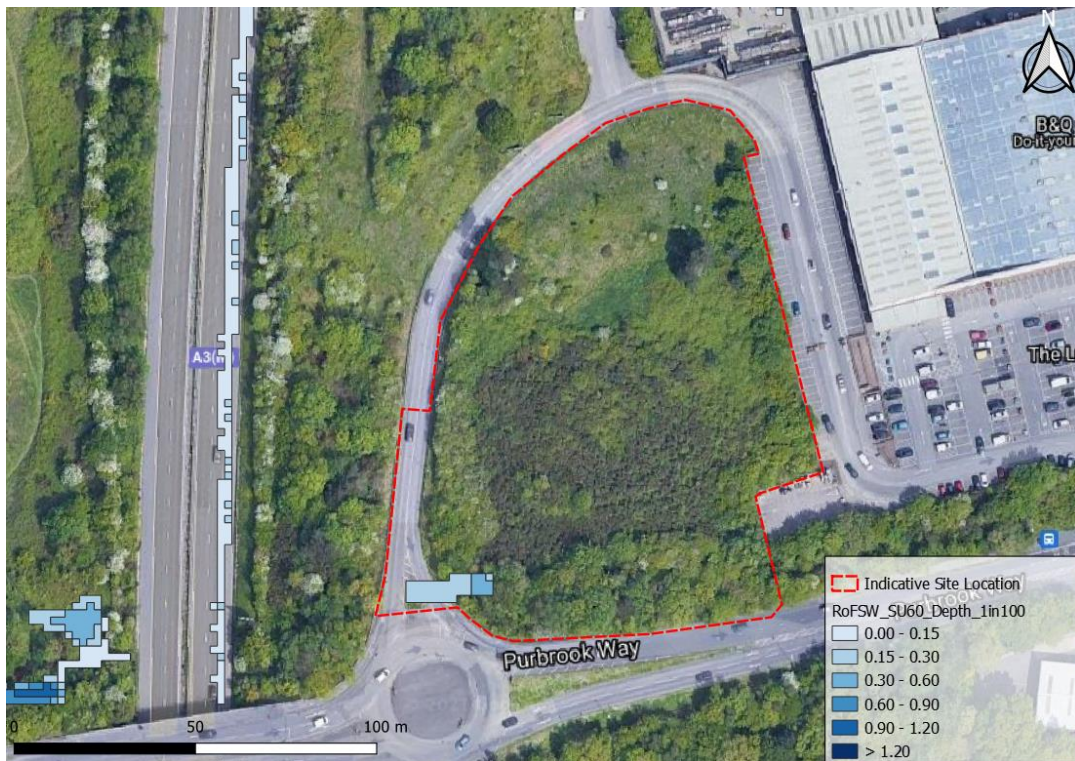


Figure 1.4: RoFSW Depth Output (1in100 year event).

- 1.20 Figure 1.5 shows that there is no depression present at the eastern entrance to the underpass that would allow ponding to occur. Ground levels continue to drop to the south west and therefore this depth map is considered out of date and/or inaccurate.



1.21 The RoFSW velocity output shown in Figure 1.6 shows very low velocities at the underpass location, up to a maximum of between 0.25 and 0.5 m/sec. This indicates ponding is occurring in the RoFSW model. However, as explained in paragraph 1.7 this ponding is not expected to occur in reality due to the consistent decrease in ground levels to the south east of the underpass location.

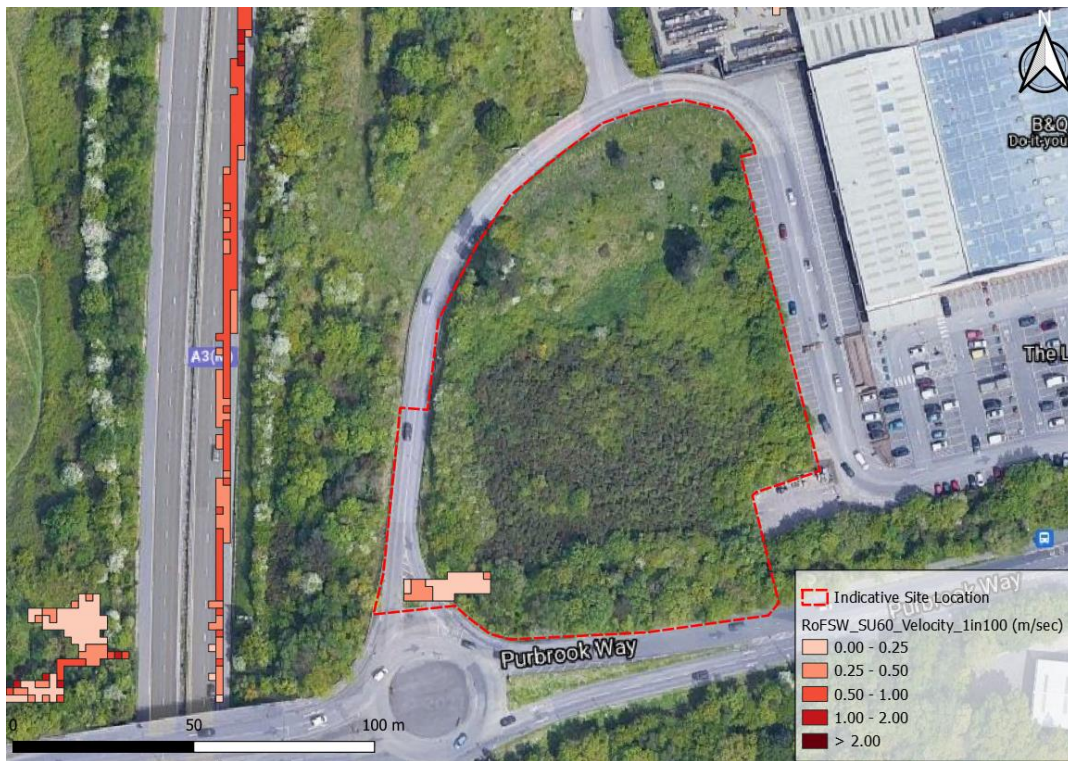


Figure 1.6: RoFSW Velocity Output (1in100 year event).

Extent

- 1.22 The RoFSW extent map (Figure 1.1) is considered to be inaccurate as a consequence of the erroneous depth and velocity outputs. It is expected that with accurate depth and velocity modelling, the 1in100year flood extent would not be present at the south west corner of the site.

Analysis and review of expected surface water flow paths

- 1.23 In consideration of the inaccuracies in the RoFSW model outputs, a review of the expected surface water flow paths was undertaken using the more recent NLP elevation data, which was shown to be accurate to within 100mm of Topographic Survey levels.
- 1.24 A surface water flow path analysis was undertaken in QGIS using the r.watershed tool. Figure 1.7 presents the expected surface water flow paths using the unedited NLP elevation data.

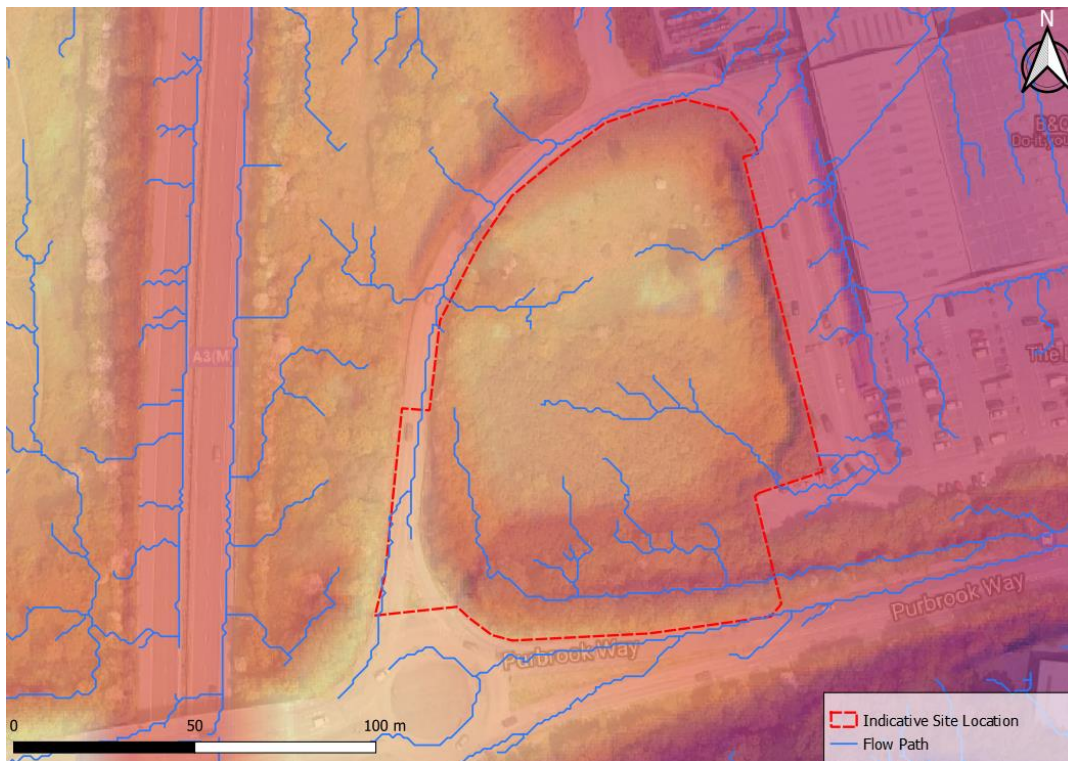


Figure 1.7: Unedited NLP data - expected flow paths.

- 1.25 A further flow path analysis was undertaken with processed NLP data where the underpass has been “burned” into the digital terrain model to allow connectivity of flows between the western and eastern access. Figure 1.8 presents this analysis.

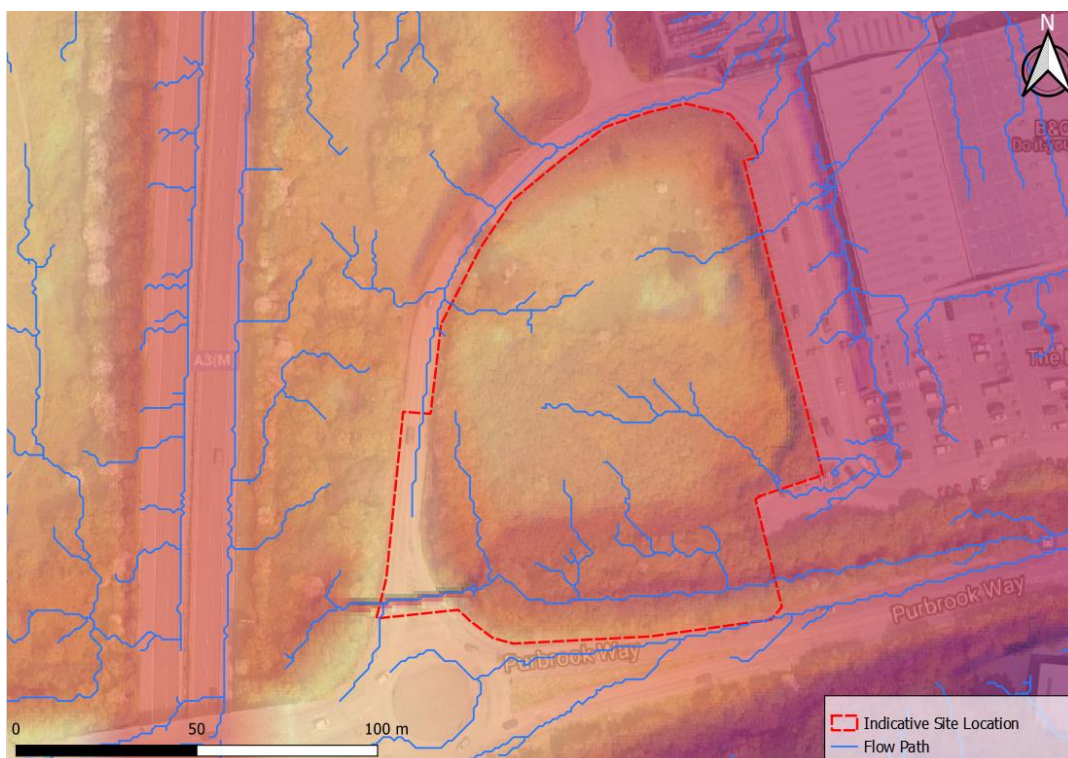


Figure 1.8: Processed NLP data - expected flow paths.

- 1.26 Figures 1.7 and 1.8 clearly shows no ponding would occur at the eastern entrance of the underpass. Instead, any surface water flows would be conveyed along the southern boundary of the site adjacent to Purbrook Way, before exiting the site boundary.

Conclusion

- 1.27 Considering the age of the RoFSW model, the relatively low spatial resolution, the suitability rating given, and the post processing that has occurred, there is sufficient reason to question the flood extent, depth and velocity at the site. Therefore, it is important to understand the local topography with the most up to date and accurate information to determine the likely flow paths and ponding locations.
- 1.28 Table 1.2 shows a high degree of correspondence between the Topographic Survey and the National Lidar Programme elevation data, with a maximum error of less than 100mm. This provides a level of confidence in the NLP data which indicates it is suitable to use to determine the ground levels to the west of the underpass and inform the analysis of the likely flow paths.
- 1.29 The RoFSW extent map (Figure 1.1) is considered to be inaccurate as a consequence of the erroneous depth and velocity outputs. It is expected that with accurate depth and velocity modelling, the 1in100year flood extent would not be present at the south west corner of the site. Therefore, when the most accurate and recent elevation data is considered, the site should not be classified as being at a “medium” risk of surface water flooding.
- 1.30 A surface water flow path analysis was undertaken in QGIS using the r.watershed tool. Figures 1.7 and 1.8 clearly shows no ponding would occur at the eastern entrance of the underpass. Instead, any surface water flows would be conveyed along the southern boundary of the site adjacent to Purbrook Way, before exiting the site boundary. This supports the conclusion that the classification of the RoFSW map showing the site to be at “medium” risk is erroneous.
- 1.31 The conclusion of this Technical Note is that in line with the National Planning Policy Framework, surface water flooding has been considered and determined to be a low risk at the site. Therefore, it is our professional judgement that the site should not be subject to the sequential test.

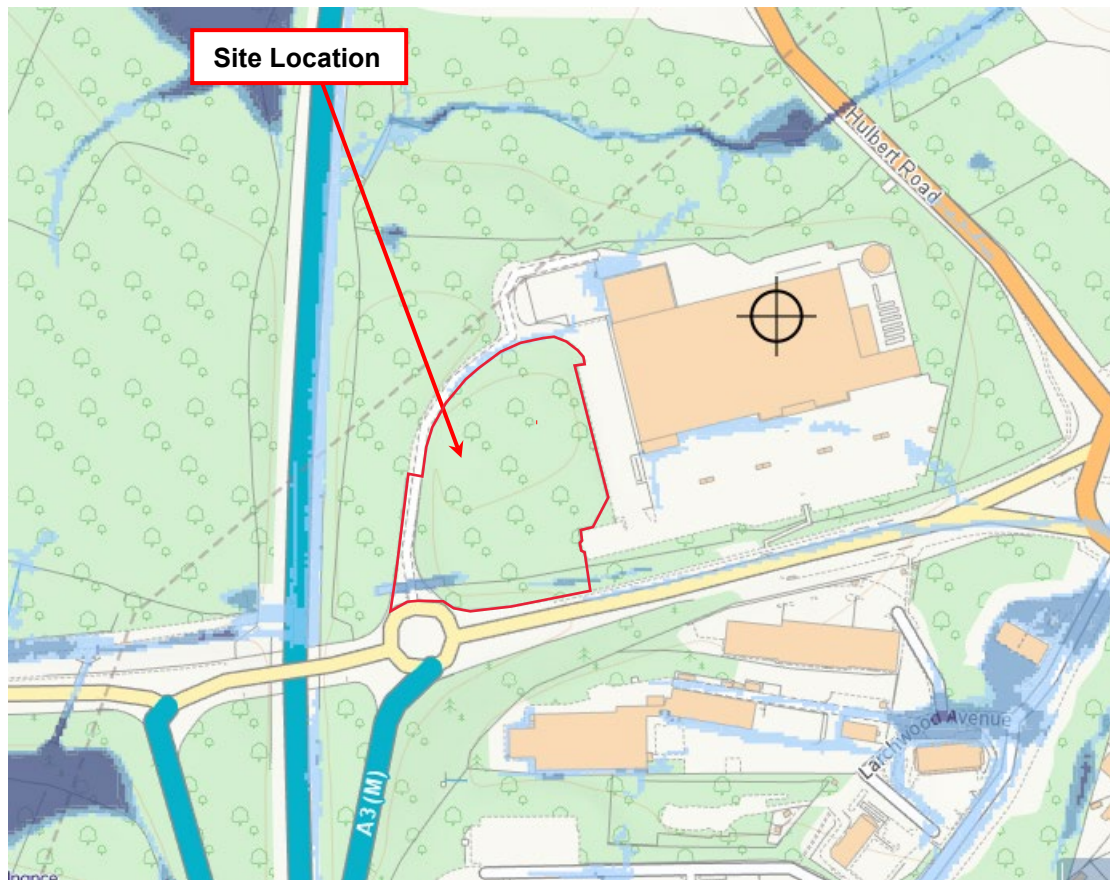
Author: AJB

Checked: SF

Date: 21st December 2021

APPENDIX A: EA Risk of Flooding from Surface Water

SURFACE WATER FLOOD MAP
(July 2021)
Lidl, Havant



Havant Borough Council, Post code: PO9 3QJ Co-ords: E469394, N107780

Risk of Flooding from Surface Water

Surface water flooding happens when rainwater does not drain away through the normal drainage systems or soak into the ground, but lies on or flows over the ground instead.

The shading on the map shows the risk of flooding from surface water in this particular area.

There are four different kinds of area shown on the Flood Map. They can be described as follows:

-  High Risk Area – Each year this area has a greater than 1in30 (3.3%) chance of flooding from surface water:
-  Medium Risk Area – Each year this area has between a 1in100 and a 1in30 (1%-3.3%) chance of experiencing flooding from Surface Water:
-  Low Risk Area – Each year this area has a between a 1in1000 and 1in100 (0.1%-1%) chance of experiencing flooding from Surface Water.
-  Very Low Risk Area – Each year this area has a less than 1in1000 (0.1%) chance of experiencing flooding from Surface Water.

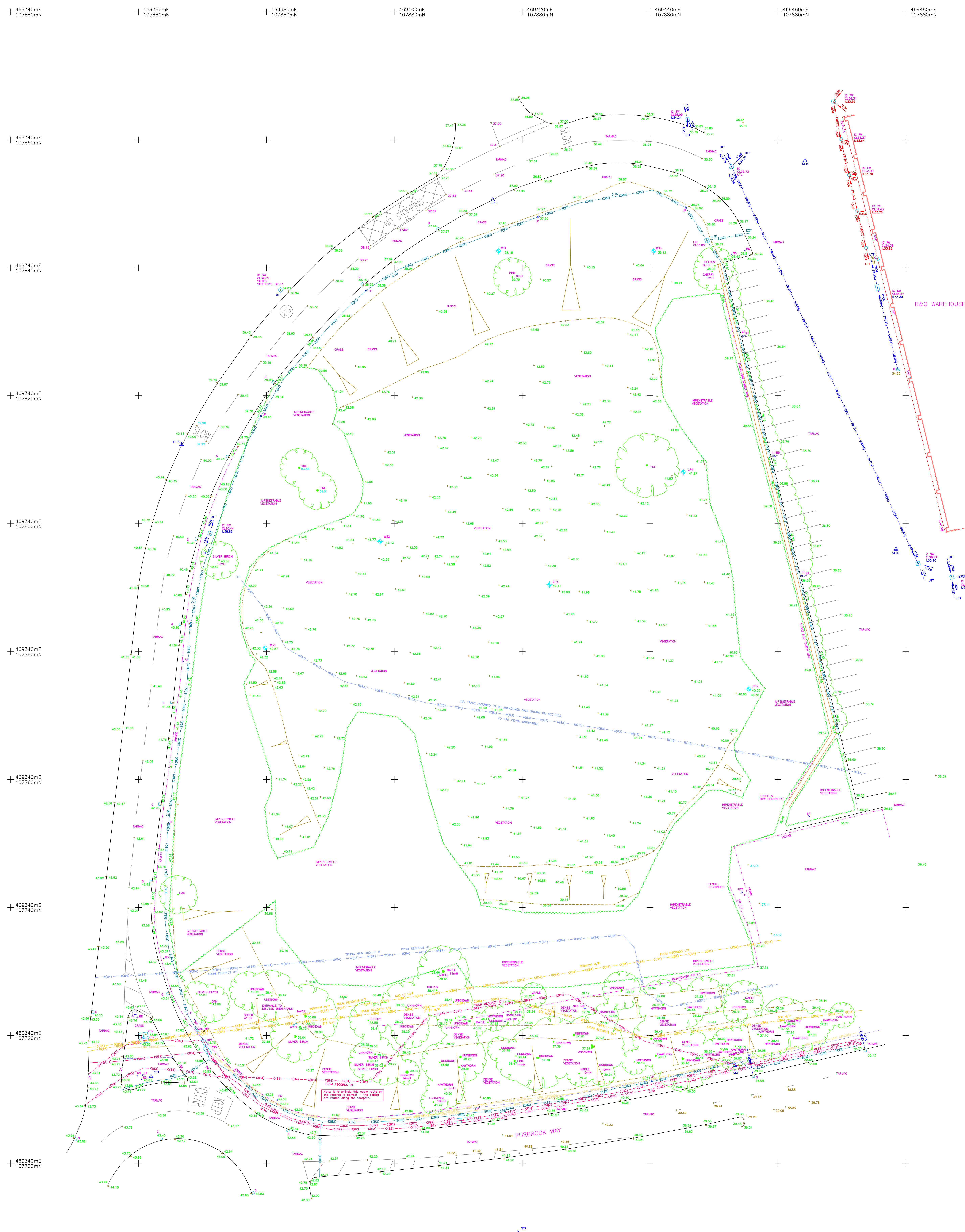
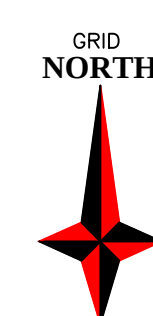
APPENDIX B: Photographs of Underpass

LIDL, HAVANT

PICTURES OF UNDERPASS UNDER HIGHWAY EMBANKMENT



APPENDIX C: Topographic Survey



NOTES:

The accuracy and content of this drawing are dependent on the original specification and ERI shall be consulted before use at other sites.

Where underground services are shown, all reasonable care has been taken within the spirit of the original specification and requirement. Before use of the information the user must satisfy themselves as to the completeness and accuracy of such data before undertaking any works. Due to the nature of this work and limitations imposed by ground conditions and the detection equipment no guarantee can be given that all services have been recorded. Trial holes should be dug at critical locations.

All reasonable care has been taken in the survey data represented on this drawing but any discrepancies must be reported to ERI immediately.

Our aim is to produce the best possible results within the specification and cost constraints of our clients. Any comments are most welcome.

Levels shown on kerbs are channel level unless stated.

[illegible]

Symbol	Feature
	Survey Station
	Canal
	Gate
	Planned Road Markings
	Edge of Vegetation
	Karts/Drain Cuts
	Tree
	Shrubbery
	Water pipes
	Gas
	Overhead Lines
	Overhead Building Detail
	Wall

[illegible]

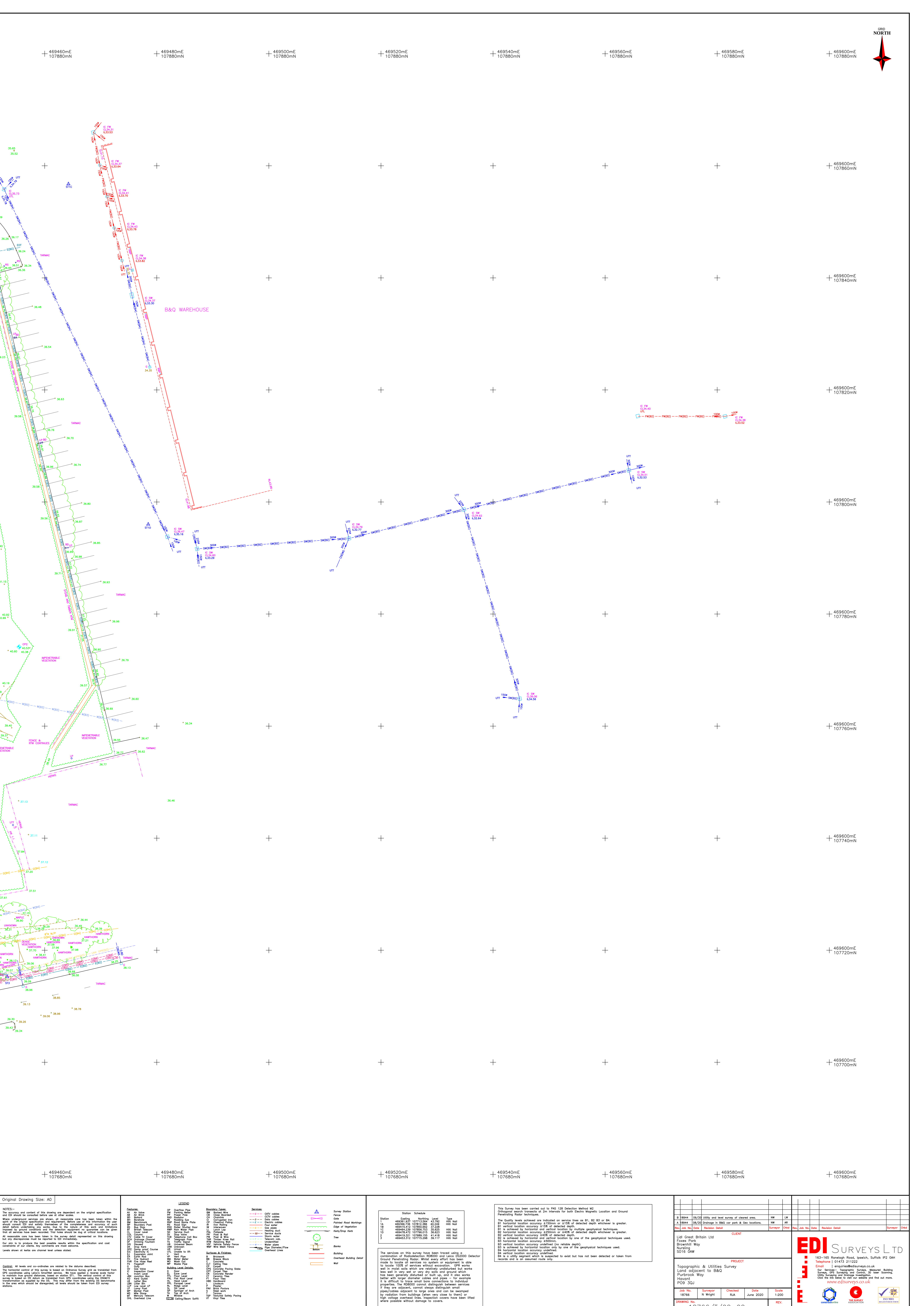
The Survey has been carried out to PAS 128 Detection Method M2
Orthogonal search trajectories of 2m intervals for both Electro Magnetic Location and Ground Penetrating Radar techniques.

The Quality levels achieved are indicated on a five level scale B1, B2, B3 or B4.
B1 horizontal location accuracy ±150mm or ±15% of distance detected whichever is greater.
B2 vertical location accuracy ±150mm or ±15% of depth detected whichever is greater.
B3 is achieved by horizontal and vertical location by multiple geophysical techniques used.
B4 is achieved by horizontal and vertical location by one geophysical technique used.
C1 vertical location accuracy ±40% of detected depth.
C2 vertical location accuracy ±40% of detected depth.
D1 horizontal location accuracy ±40% of detected depth.
D2 horizontal location accuracy ±40% of detected depth.
D3 horizontal location accuracy ±40% of detected depth.
D4 horizontal location accuracy ±40% of detected depth.
E1 horizontal location accuracy undefined.
E2 horizontal location accuracy undefined.
F1 horizontal location accuracy undefined.
F2 horizontal location accuracy undefined.
F3 horizontal location accuracy undefined.
F4 horizontal location accuracy undefined.

A note regarding the above quality levels to exist but has not been detected or taken from records and is an assumed route only.

B	H8944	06/70	Utility and level survey of cleared area.	NW	AR	
X	H8944	08/70	Drainage in B&Q car park & Geo locations.	NW	AR	
A	Revision No	Date	Description (Detail)	Surveyor	Checker	
Lidl Great Britain Ltd Fosse Park Bromwich Way Nunehampton SO16 6AW			CUMENT			
PRIORITY						
Topographic & Utilities Survey Land adjacent to B&Q Purbrook Way Havant PO9 3JL						
Job No:	18766	Surveyor	N Wright	Checked	RJA	Date June 2020
Scale	1:200					
DRAWING NO.	REV.					

Job No.	Date	Revision	Detail	Surveyor	Clerk
EDI SURVEYS LTD 163-165 Ranelagh Road, Ipswich, Suffolk IP2 0AH Telephone : 01473 211222 Email : enquiries@edisurveys.co.uk Our Services : Topographic Surveys, Measured Building Surveys, GPS Surveys and Control, 3D laser Scanning, Utility Surveys and Drainage Investigation. Click the link below to visit our website and find out more. www.edisurveys.co.uk    edisurveys THE SURVEY ASSOCIATION CML BEST PRACTICE ENDORSED					



Original Drawing Size: A0

NOTES:-
The accuracy and content of this drawing are dependent on the original specification and ED should be consulted before use of other scales.
Where underground services are shown, all records are to be taken within the limits of the original specification and requirements. Before use of the information the user should consult ED and verify the accuracy of the coordinates and accuracy of each point shown. Wherever possible, the user should verify the accuracy of each point shown. Wherever possible, the user should verify the accuracy of each point shown.
All reasonable care has been taken in the survey data represented on this drawing but any discrepancy must be reported to ED immediately.
Our aim is to produce the best possible results within the specification and cost constraints of our clients. Any comments are most welcome.
Levels shown at kerbs are channel level unless stated.

Caution: All levels and co-ordinates are related to the datum described.
The horizontal content of this survey is based on Ordnance Survey grid as translated from GPS coordinates using Leica's Smartlink software. We have applied a reverse scale factor to reproduce true ground dimensions based on datum DTN. The vertical content of this survey is based on OS datum as translated from GPS coordinates using the OS2005 transformation as supplied by the OS. The true north from the analysis OS benchmarks. The lines which would be disregarded, all lines should be taken from ED survey stations.

LEGEND

Features: A1 Air Valve A2 Air Valve B1 Boundary Line B2 Boundary Line B3 Boundary Line B4 Boundary Line B5 Boundary Line B6 Boundary Line B7 Boundary Line B8 Boundary Line B9 Boundary Line B10 Boundary Line B11 Boundary Line B12 Boundary Line B13 Boundary Line B14 Boundary Line B15 Boundary Line B16 Boundary Line B17 Boundary Line B18 Boundary Line B19 Boundary Line B20 Boundary Line B21 Boundary Line B22 Boundary Line B23 Boundary Line B24 Boundary Line B25 Boundary Line B26 Boundary Line B27 Boundary Line B28 Boundary Line B29 Boundary Line B30 Boundary Line B31 Boundary Line B32 Boundary Line B33 Boundary Line B34 Boundary Line B35 Boundary Line B36 Boundary Line B37 Boundary Line B38 Boundary Line B39 Boundary Line B40 Boundary Line B41 Boundary Line B42 Boundary Line B43 Boundary Line B44 Boundary Line B45 Boundary Line B46 Boundary Line B47 Boundary Line B48 Boundary Line B49 Boundary Line B50 Boundary Line B51 Boundary Line B52 Boundary Line B53 Boundary Line B54 Boundary Line 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This Survey has been carried out to PAS 128 Detection Method M2.
Orthogonal search transects at 2m intervals for both Electric Magnetic Location and Ground Penetrating Radar techniques.
The quality levels achieved are indicated on service lines as B1, B2, B3 or B4.
B1 horizontal location accuracy ±100mm or ±15% of detected depth whichever is greater.
B2 horizontal location accuracy ±15% of detected depth.
B3 horizontal location accuracy ±250mm or ±40% of detected depth whichever is greater.
B4 horizontal location accuracy ±500mm.
B5 horizontal location accuracy ±1000mm.
B6 horizontal location accuracy ±1500mm.
B7 horizontal location accuracy ±2000mm.
B8 horizontal location accuracy ±2500mm.
B9 horizontal location accuracy ±3000mm.
B10 horizontal location accuracy ±3500mm.
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B20 horizontal location accuracy ±8500mm.
B21 horizontal location accuracy ±9000mm.
B22 horizontal location accuracy ±9500mm.
B23 horizontal location accuracy ±10000mm.
B24 horizontal location accuracy ±10500mm.
B25 horizontal location accuracy ±11000mm.
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B39 horizontal location accuracy ±18000mm.
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B41 horizontal location accuracy ±19000mm.
B42 horizontal location accuracy ±19500mm.
B43 horizontal location accuracy ±20000mm.
B44 horizontal location accuracy ±20500mm.
B45 horizontal location accuracy ±21000mm.
B46 horizontal location accuracy ±21500mm.
B47 horizontal location accuracy ±22000mm.
B48 horizontal location accuracy ±22500mm.
B49 horizontal location accuracy ±23000mm.
B50 horizontal location accuracy ±23500mm.
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B63 horizontal location accuracy ±30000mm.
B64 horizontal location accuracy ±30500mm.
B65 horizontal location accuracy ±31000mm.
B66 horizontal location accuracy ±31500mm.
B67 horizontal location accuracy ±32000mm.
B68 horizontal location accuracy ±32500mm.
B69 horizontal location accuracy ±33000mm.
B70 horizontal location accuracy ±33500mm.
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B83 horizontal location accuracy ±40000mm.
B84 horizontal location accuracy ±40500mm.
B85 horizontal location accuracy ±41000mm.
B86 horizontal location accuracy ±41500mm.
B87 horizontal location accuracy ±42000mm.
B88 horizontal location accuracy ±42500mm.
B89 horizontal location accuracy ±43000mm.
B90 horizontal location accuracy ±43500mm.
B91 horizontal location accuracy ±44000mm.
B92 horizontal location accuracy ±44500mm.
B93 horizontal location accuracy ±45000mm.
B94 horizontal location accuracy ±45500mm.
B95 horizontal location accuracy ±46000mm.
B96 horizontal location accuracy ±46500mm.
B97 horizontal location accuracy ±47000mm.
B98 horizontal location accuracy ±47500mm.
B99 horizontal location accuracy ±48000mm.
B100 horizontal location accuracy ±48500mm.

CLIENT
Lidl Great Britain Ltd
Fosse Park
Brownhill Way
Nursling
S016 6AW

PROJECT
Topographic & Utilities Survey
Land adjacent to B&Q
Putnam Way
Havant
PO9 3QJ

Job No.	Surveyor	Checked	Date	Scale
18766	N Wright	RIA	June 2020	1:200

DRAWING No. 18766/T/02-02

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8

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