



GROUNDTECH
CONSULTING

AFAN WAY, PORT TALBOT

PILING RISK ASSESSMENT – STARBUCKS

ALDI STORES LTD

NOVEMBER 2025

Document Control Form	
PROJECT	AFAN WAY, PORT TALBOT
REPORT NAME	PILING RISK ASSESSMENT - STARBUCKS DRIVE THRU
REPORT REFERENCE	GRO-21252-6009
STATUS	FINAL
ISSUE DATE	01 SEPTEMBER 2025
REVISION	1.1 24 NOVEMBER 2025
CLIENT	ALDI STORES LTD
CLIENT CONTACT	-
For and Behalf of Groundtech Consulting	
SIGNATURE	
AUTHOR	Jamie Parr BSc (Hons) FGS
SIGNATURE	
CHECKED	Luke Harrison BSc (Hons) FGS
SIGNATURE	
REVIEWED	James Doyle BSc (Hons) CGeol FGS

CONTENTS

1.0	INTRODUCTION.....	1
1.1	PROJECT OBJECTIVES	1
1.2	SITE DETAILS.....	1
1.3	PROPOSED DEVELOPMENT.....	2
1.4	SOURCES OF INFORMATION.....	2
1.5	REGULATOR LIAISON.....	3
1.6	LIMITATIONS.....	3
2.0	SUMMARY OF CONTAMINATIVE SOURCES.....	4
2.1	SITE HISTORY AND CONSULTATIONS.....	4
2.2	GEO-ENVIRONMENTAL TESTING RESULTS - SOIL.....	4
2.3	GEO-ENVIRONMENTAL TESTING RESULTS - GROUNDWATER	5
3.0	GROUND MODEL	7
3.1	GROUND CONDITIONS	7
3.2	GROUNDWATER	7
4.0	RECEPTOR.....	8
4.1	HYDROGEOLOGY.....	8
4.2	HYDROLOGY	8
5.0	PRELIMINARY ASSESSMENT AND INITIAL PILE SELECTION.....	9
6.0	HAZARDS AND ADVERSE IMPACTS	11
6.1	ASSESSMENT CONTEXT AND APPROACH.....	11
6.2	POLLUTION SCENARIO(S).....	12
7.0	SITE SPECIFIC RISK ASSESSMENT	16
8.0	CONFIRMATION OF PILING METHOD	17
8.1	FINAL ASSESSMENT	17
8.2	QUALITY ASSURANCE AND QUALITY CONTROL	17
9.0	RELEVANT INDUSTRY REFERENCES	19

APPENDIX 1 - PLANS

APPENDIX 2 - NOISE/VIBRATION CALCULATION SHEETS

APPENDIX 3 - PILING CONTRACTOR INFORMATION

APPENDIX 4 - LIMITATIONS

Plans		
<i>Plan Reference</i>	<i>Revision</i>	<i>Title</i>
GRO-20289-P01	-	Project Location Plan
GRO-20289-P02	-	Preliminary Development Constraints Plan
GRO-20289-P06	-	Soil Contamination Plan
GRO-20289-P13	-	Site Specific Risk Assessment - Piling

1.0 INTRODUCTION

1.1 Project Objectives

Groundtech Consulting Limited have been instructed by Craddys on behalf of Aldi Stores Ltd to undertake a Piling Risk Assessment for the proposed Starbucks Drive Thru at Afan Way in Port Talbot.

Neath Port Talbot Council and Natural Resource Wales (NRW) have concerns over foundations and piling as activities with the potential to cause, or allow the migration of, pollution into controlled waters. In general this consists of sites which are underlain by aquifers and penetration of a clay layer previously providing protection to an underlying aquifer. Penetrating foundation solutions such as piles have the potential to cause negative environmental effects when utilised on contaminated sites. This is largely due to the downdrag associated with these solutions.

Neath Port Talbot Council have concerns over the noise generated by driven piles due to the surrounding residential areas. Discussions with National Resource Wales have been undertaken and NRW have suggested any piling solution will be accepted provided the current guidance has been followed and the risks of contamination have been kept as low as reasonably possible.

This assessment determines the appropriate piling method and any mitigation and monitoring measures required for piling on the subject site which is affected by contamination. Mitigation measures are discussed, and Quality assurance and quality control, and longer-term monitoring recommended.

The main constraints which will be addressed as part of this risk assessment are as follows:

- *Polluting substances in the ground that are in a leachable or mobile form*
- *The piling or ground improvement method of choice breach a low permeability layer (aquitard) or the basal liner of a closed landfill site, or penetrate an aquifer*
- *Hydraulic gradient that could cause contaminants in near surface deposits to migrate into an underlying aquifer or surface water body*
- *The pile made out of a material that could allow passage of contaminants*
- *The piling method of choice have the potential to create a preferential flowpath for the migration of contaminated perched water or leachate into an aquifer or surface water body*
- *The breaching of impermeable covers ('caps') by piling allowing the escape of landfill or ground gases*
- *Contaminated arisings being brought to the surface by piling work, with the risks of subsequent exposure to site workers and residents, and the need for appropriate handling*

There is the recognition of a lack of available scientific knowledge on the environmental implications and effects of piling resulting in a precautionary approach.

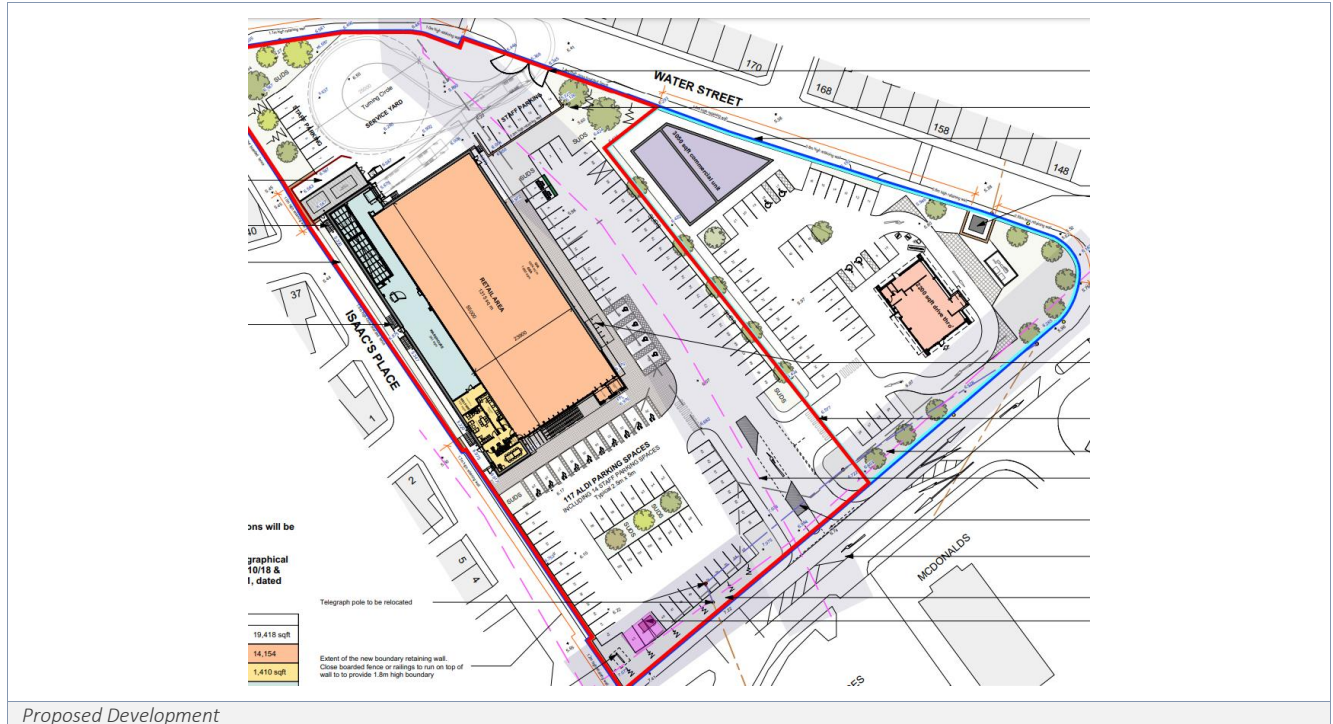
1.2 Site Details

The area of the proposed starbucks is roughly triangular in shape covering an area of approximately 0.1 hectares, site elevations fall slightly from west to east in conjunction with the rest of site.

The majority of the site is currently surfaced by grassland and shrubs with several stockpiles of material from previously demolished buildings. The area of the proposed Starbucks falls in the north eastern section of the site, near the position of the former PFS. Currently, a large stockpile demolition material and topsoil resides over the footprint of the proposed store.

1.3 Proposed Development

The proposed development is commercial end use comprising the erection of a class A1 food store and drive thru unit with associated access, car parking and soft landscaping.



Proposed Development

1.4 Sources of Information

In preparing this Piling Risk Assessment the following documents were reviewed and should be read in conjunction with this report:

- Groundtech Consulting Geo-Environmental Appraisal, dated 8th December 2021 (Ref. GRO-21252-3003).
- Groundtech Consulting Permanent Ground Gas Risk Assessment, dated 22nd April 2022 (Ref. GRO-21252-3237).
- Quantum Geotechnical Supplementary Phase II Ground Investigation – Interpretive Report dated June 2016 (Ref. G762/IR).
- Arcadis Ground investigation Report dated April 2018 (Ref. 10013618-AFS-GLR-G001).
- Groundtech Consulting Supplementary Environmental Appraisal referenced GRO-21252-5257 and dated June 2024.
- Groundtech Consulting Planning Condition Letter referenced GRO-21252-5916 and dated July 2025
- Groundtech Consulting Supplementary Investigation Letter referenced GRO-21252-5917 and dated July 2025

A Piling Risk Assessment has been previously produced for the proposed Aldi Store referenced GRO-21252-4745_1.1 and dated 30 July 2025.

1.5 Regulator Liaison

Neath Port Talbot Council

Neath Port Talbot Council have expressed concerns regarding the noise and vibrations arising from the proposed pile foundation solution.

Appropriate mitigation measures to be implemented onsite during the piling works to prevent noise and nuisance to adjoining noise and vibration sensitive receptors is discussed in *Section 5.0*.

Natural Resources Wales (NRW)

NRW have previously queried the depth, strata, location and density of proposed piles, this information has been obtained by the chosen piling contractor and is summarised in the report and provided in *Appendix 3*.

NRW have also advised that there are uncertainties with the CSM at the risk and have recommended that the piling risk assessment is carried out after these details have been confirmed.

Groundtech have recently provided an updated letter referenced *GRO-21252-6178* providing additional details requested by NRW. A timeline has also been produced highlighting the historical report/source of information at the site since 2002 to clarify the details.

1.6 Limitations

Other conditions may exist on the site that have not been taken into account in this assessment as they are outside the scope of works. Groundtech Consulting are not responsible for these circumstances that are not outlined in the report.

The assessment has been prepared for the exclusive use of the client. No third parties may rely on or reproduce the contents of the report without the written permission of Groundtech Consulting Limited. If any unauthorised third party comes into possession of the report, they rely on it at their own risk and Groundtech Consulting Limited will not be obliged to provide a duty of care.

2.0 SUMMARY OF CONTAMINATIVE SOURCES

2.1 Site History and Consultations

History

The larger site was occupied by Burrows Tin Plate Works with numerous other buildings from 1881. In 1900 a pond in the western area of the site was infilled and redeveloped into railway tracks. A tank was placed in the centre of the site in 1939 and several buildings were constructed in the eastern area at the position of the proposed drive thru unit. In 1950, these buildings were listed as Talbot Works Bakery Engineering, additional tanks and chimneys being added to the existing tin plate works. Residential dwellings and a well were constructed in the northern area. Between 1957 and 1962 a mortuary was developed east of the residential homes, the rest of site was occupied by buildings associated with a corporation yard. In 1964 the bakery engineering works, at the position of the proposed drive thru, was redeveloped into sign post works. Between 1989 and 1993, the works in the east were demolished and replaced with a smaller building, indicated to be a petrol fuelling station.

Environmental Information

The following environmental information was identified:

- No radon protection is indicated to be required within the proposed development at the site.
- The site does lie in a Coal Mining Reporting area.
- There are three recorded landfill/waste sites within 250m.
- There are 21 pollution incidents or discharge consents within 250m of site.
- The site is within a flood risk zone.

2.2 Geo-Environmental Testing Results - Soil

Geo-Environmental testing was scheduled by both Groundtech Consulting, Arcadis and Quantum as part of their respective investigations across the entire site listed in *Section 1.4*, the results are summarised in the table below based on commercial end use for the entire site area:

Contaminants of Concern	No. samples tested	No. elevations	Details
Metals	40	1	1 elevation for arsenic
Polycyclic Aromatic Hydrocarbons (PAHs)	44	1	1 elevation for Dibenzo(ah)anthracene
TPH CWG	50	5	2 elevations for p&m-xylene 1 elevation for o-xylene 1 elevation for ethylbenzene 1 elevated sample of benzene
Polychlorinated Biphenyl (PCBs)	30	0	-
Asbestos	45	27	Between <0.001% mass and 0.075% mass
Cyanide	40	2	2 elevations for cyanide

The locations of the contamination present within the soils are represented spatially on the Groundtech Soil Contamination Plan *GRO-21252-P06*. It can be seen that the highest concentrations were typically recorded in the north eastern area of site at the PFS, these concentrations were typically limited to metals, PAHs and asbestos however elevated TPH (C16-C21) were recorded in ATP06 at 2.0m bgl at the top of the natural clay. The elevated concentrations were indicated to be related to residual contamination associated with the PFS.

Additional investigation undertaken by Groundtech in 2024 (GRO-21252-5257) recorded high levels of PAHs including Benzo(b)fluoranthene, Benzo(a)pyrene and Dibenzo(ah)anthracene in the granular Made Ground of WS105. Low concentrations of aliphatic hydrocarbons (C6-C35) and aromatic hydrocarbons (EC8-EC35) were also recorded.

2.3 Geo-Environmental Testing Results - Groundwater

Groundwater testing was also undertaken by Quantum, Arcadis and Groundtech Consulting which is summarised in the table below:

Contaminant of Concern	No. samples tested	No. elevations	Details
<i>Metals</i>	<i>32</i>	<i>68</i>	<i>1 elevation of chromium</i> <i>24 elevations of copper</i> <i>21 elevations of zinc</i> <i>4 elevations of lead</i> <i>2 elevation of nickel</i> <i>1 elevation of mercury</i> <i>2 elevations of Cadmium</i> <i>13 elevations of Manganese</i>
<i>Polycyclic Aromatic Hydrocarbons (PAHs)</i>	<i>32</i>	<i>3</i>	<i>3 elevations of PAHs.</i> <i>Elevations of Naphthalene</i>
<i>TPH CWG</i>	<i>38</i>	<i>5</i>	<i>5 elevations of TPH C10-C40</i>
<i>Cyanide</i>	<i>7</i>	<i>0</i>	-

Quantum

Quantum tested samples from the perched groundwater. Of the samples tested by Quantum, extremely high concentrations of speciated TPH were recorded in five of the samples. Four of these elevations were from the area of site close to the former petrol filling station and are within the perched groundwater within the Made Ground. Elevated concentrations of heavy metals including Arsenic, Copper, Nickel, Tin and Zinc were also encountered across the site particularly in the vicinity of the former PFS, council yard and former pond areas. All of these elevated concentrations were associated with the perched groundwater.

Arcadis

Twenty-one groundwater samples were collected from the mobile groundwater within the Secondary Undifferentiated Aquifer and screened for metals. Thirteen exceedances in Copper, Manganese and Zinc were recorded. Zinc concentrations were recorded at 7 to 8 times the EQS. The metal contamination were commonly recorded in the aquifer which is indicative of the surrounding area.

All 21 No. groundwater samples screened for speciated PAHs were below the laboratory limit of detection in all three monitoring rounds.

All 21 No. groundwater samples screened for TPH CWG and BTEX were below the laboratory limit of detection. This indicates that previous results from the Quantum investigation in 2015 were a “false positive” and representative of water quality encountered in shallow excavations.

Groundtech Consulting

Four groundwater samples obtained from the aquifer were tested for a range of CoC by Groundtech, one elevation of chromium was recorded.

Groundtech Consulting - Supplementary 2024

Groundtech Consulting undertook additional groundwater sampling in the north eastern section of site during the supplementary PFS investigation.

Three samples of groundwater were obtained from the granular Glaciofluvial Deposits underlying the cohesive Made Ground and Alluvium at shallow depths.

Based on the EQS screening values, no elevated contaminants of concern were recorded in the underlying Secondary A Aquifer. In addition, no visual or olfactory evidence of contamination was recorded in the aquifer during the investigation or groundwater sampling.

Groundtech Consulting – Supplementary 2025

Supplementary testing was undertaken BY Groundtech Consulting in the PFS area and in CP04. All groundwater samples were obtained from the natural granular Secondary A Aquifer from beneath the site.

Exceedances of zinc, lead and pyrene were recorded in CP04, the contamination is attributed to the previous industrial land in the surrounding area.

No elevated concentrations of hydrocarbons were recorded in the samples screened from the underlying aquifer.

There has been no recorded impaction of the aquifer since the Quantum investigation, which are considered to be a false negative.

3.0 GROUND MODEL

3.1 Ground Conditions

Made Ground

During the sites previous phases of Ground Investigation in the north eastern area, predominantly granular Made Ground consisting of dark brown grey slightly gravelly ashy sand/sandy gravel with minor constituents of brick, concrete and clinker was recorded to depths of between 0.7m and 2.7m begl.

Natural Strata

In the PFS area, natural cohesive deposits were encountered immediately beneath the Made Ground and comprised soft to firm sandy clay (Alluvium) to depths of between 2.1m and 3.5m begl. Silt was encountered locally to ABH04 however this is likely a result of the sandy nature of the clay. The thickness of the Clay ranged between 0.5m and 2.3m in this area.

Beneath the clay, brown sandy Gravel of igneous rock and sandstone was identified immediately beneath the clay deposits.

Bedrock was not encountered during any investigation conducted on the site.

3.2 Groundwater

Perched Groundwater was encountered in the Made Ground beneath the former PFS in the initial investigation undertaken at the site, however this is indicated to be a result of heavy rainfall during the investigation as no perched groundwater has been encountered during the several phases of supplementary investigation.

Groundwater was recorded beneath the Made Ground and superficial clay (Alluvium), in the granular Secondary A Deposits at a depth of circa 3.0m begl.

4.0 RECEPTOR

4.1 Hydrogeology

The superficial Estuarine Alluvium Deposits in this area are classified by NRW as a Secondary Undifferentiated Aquifer. The South Wales Middle Coal Measures Formation bedrock is classified as Secondary A Aquifer.

The site is not within 500m of a Source Protection Zone and there are no groundwater or potable water abstractions within 2000m of the site.

4.2 Hydrology

The nearest named watercourse is the River Afan which is circa 86m south. The nearest active surface water abstraction is circa 107m south east relating to process water for usage by Tata Steel UK Ltd.

5.0 PRELIMINARY ASSESSMENT AND INITIAL PILE SELECTION

Shallow foundations were not considered suitable by Groundtech consulting and Quantum Geotechnical due to low strength Clay at foundation depth. Pile foundations were recommended for the proposed development by Groundtech Consulting.

The thickness of the impermeable aquitard separating the shallow perched groundwater and contaminated Made Ground and the deeper groundwater has ranged from a minimum of 0.5m to a maximum thickness of 2.3m in the vicinity of the proposed Starbucks development. SPT 'N' values and site descriptions have classified the Clay to be soft to firm in consistency. Quantum and Groundtech Consulting have classified the Clay as being of medium plasticity based off the Geotechnical testing undertaken as part of their investigations. The Clay is considered to be malleable.

NRW have requested details of the depth, density, strata and location of the proposed piles. The piling contractor has been consulted, and it is proposed to install 24 No. 140mm diameter steel tabular piles. It is proposed to install the piles to a depth of circa 6m bgl in the Sand and Gravel deposits. The driving shoe is consist of a steel pointed end.

Neath Port Talbot Council have raised concerns about the noise pollution caused by driven piles and requested details mitigation measures to be implemented to reduce the impact on the surrounding residential areas. The proposed piling contractor has been consulted to confirm the mitigation measures and a summary of the relevant information is provided below.

A vibration calculation prediction sheet has been carried out based on site specific information and propose piling plant, to determine the potential vibration levels in accordance with BS 5228. A site specific noise calculation sheet based on the proposed piling method has also been produced. In the vicinity of the proposed Starbucks Store, the nearest house is circa 30m north east of the proposed store, a vibration level of less than 3ppv mm/second has been calculated at this distance and is below the acceptable threshold of 5 to 10mm/second. A noise level of less than the typical recommended value of 75dB has been calculated, in addition the measures discussed below should be implemented to minimise noise. The noise contour plan and vibration calculation sheet is provided in *Appendix 2*.

The proposed piling contractor have carried out many trials with regards to noise levels and implementing noise control measures suggested in BS 5228, and have found that levels of noise are to be reduced by the following:

1. *Use of a non-metallic dolly*
2. *Use of timber under packs between the pile head and hammer*
3. *Fully shrouded hammer (see photo below)*
4. *Throttling back the engine when high revs are not required*
5. *Drop heights of the hammer are kept to a minimum while maintaining efficient driving of the pile*

The piling contractor has confirmed that the proposed rigs have the above facilities and are operated to suit the above conditions. An extract of the shrouded hammer is provided below.



Proposed piling Rig with Shrouded hammer

In addition, the rig will be oriented, where possible, such that the hammer faces away from the potential receptor, the rig itself and mast then act as an acoustic screen.

Prior to commencement on site, the piling contractor has also recommended a public relations exercise informing local occupants of the works to be carried out and their expected duration. It is important to note that driven precast concrete piling is the quickest form of piling installation, therefore any disruption to the local environment if for the shortest possible duration.

Driven piles therefore remain to be the most suitable foundation solution for the proposed development transferring the load of the proposed store through the low strength soft Clay deposits into the underlying granular soils.

6.0 HAZARDS AND ADVERSE IMPACTS

6.1 Assessment Context and Approach

The installation of pile foundations can have significant environmental constraints if not adequately considered and adequately managed during the planning stage. The Environment Agency document '*Piling and penetrative ground improvement methods on land affected by contamination: Guidance on pollution prevention*' considers six pollution scenarios which could occur when installing piled foundations on contaminated sites.

The six scenarios considered are as follows:

1. *Creation of preferential pathways, through a low permeability layer (an aquitard), to allow potential contamination of an underlying aquifer*
2. *Creation of preferential pathways, through a low permeability surface layer, to allow upward migration of landfill gas, soil gas or contaminant vapours to the surface*
3. *Direct contact of site workers and others with contaminated soil arisings which have been brought to the surface*
4. *Direct contact of the piles or engineered structures with contaminated soil or leachate causing degradation of pile materials (where the secondary effects are to increase the potential for contaminant migration)*
5. *The driving of solid contaminants down into an aquifer during pile driving*
6. *Contamination of groundwater and, subsequently, surface waters by concrete, cement paste or grout*

It is important to consider the potential pollution hazards associated with piling and ground improvement works in the context of the environment in which sites are located using Source-Pathway-Receptor (S-P-R) linkage. The overall level of risk is a product of the probability of harm occurring and the consequence of that harm (Environment Agency, 2000b).

The groundwater Vulnerability as discussed in *Section 4.0* is of principal in Concern, a Secondary Undifferentiated Secondary A Aquifer and the River Afan are the receptors identified.

In the case of piling and ground improvement works, concerns about water protection are likely to be most acute when:

- *Contaminants are present on the site and ground works could allow them to migrate*
- *Piling would breach a low permeability layer or connect two previously discrete aquifers*
- *The site overlies an Aquifer*
- *The site is located within a Source Protection Zone*
- *Groundwater is currently of good quality*
- *The water table is shallow or likely to be intersected by piles*
- *The geological strata are fractured or fissured*
- *Works are close to a surface water body and run-off from arisings could pollute those waters*

NRWs stance to proposals for piling on contaminated sites will be based on the overall level of risk that piling is likely to present, the techniques, any mitigation measures and the quality assurance and control (QA/QC) methods discussed in *Section 8.2*.

6.2 Pollution Scenario(s)

Pollution Scenario 1

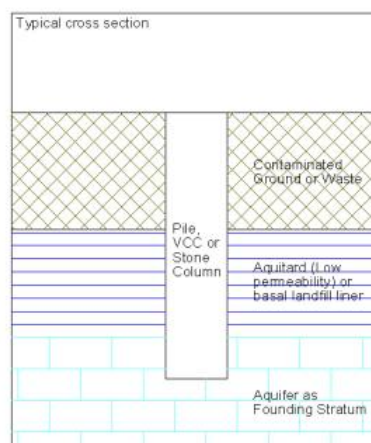
Upon review of 'Piling and penetrative ground improvement methods on land affected by contamination: Guidance on pollution prevention' it can be seen that the site corresponds to Pollution Scenario 1 - Creation of preferential pathways, through a low permeability layer (an aquitard), to allow potential contamination of an aquifer.

In this scenario a preferential pathway is created when an aquitard layer sits between perched water in overlying soils and an underlying aquifer. The disturbance of the aquitard layer when installing the piled foundation has the potential to create a migration pathway along the pile-soil interface and through the disturbed ground between the overlying perched water and the underlying aquifer when the aquitard is breached.

The soil surrounding the pile is densified and high stresses are induced in the surrounding ground when driving displacement piles. These stresses increase with size of pile and magnitude of displacement, large diameter piles are not proposed for the development. In soft or firm consistency soils these stresses will tend to force the soil to close up around the pile shaft, which means that the development of preferential flow paths around the outside of the piles is unlikely.

Piles with small cross sections may be prone to a "whipping" action when driven percussively, especially in soft soils. This could conceivably cause soil to be displaced further outwards than necessary to make room for the pile. In soft Clay, it is unlikely to be a problem as the surrounding soil will deform with the pile. Issues relating to whipping are overstated and that, by careful selection of pile, it can be eliminated in soft soils (SCI, 2001).

In general, it is considered that provided the aquitard layer is of a reasonable thickness and the piles driven through have a cross section without re-entrant angles, the likelihood of creating preferential flow paths for downward migration of leachate is very low.



Pollution Scenario – Breaching an aquitard.

Deformation of an aquitard by installation of pile foundations is a key factor in the creation of preferential pathways due to the potential for the permeability of the aquitard to be altered. The change in observed permeability is greatly affected by pile shape. A study by the Environment Agency 'Piling in layered ground: risks to groundwater and archaeology, 2006' shows the relative deformations and impacts on permeability of CFA and driven piles.

Both square and cylindrical driven piles are able to form a seal when driving through a clay layer with a thickness of at least two pile diameters. Whereas, piles with re-entrant angle such as H section piles have the potential to become plugged with overlying soil and do not seal as well as solid driven piles. In contrast, CFA piles are also likely to form a seal provide that good workmanship is practiced. Due to the thickness of the clay aquitard at between 0.5m and 2.3m beneath the footprint of the proposed Starbucks and the medium plasticity of the Clay soils, a change of piling method from driven to non-displacement CFA piles is not required as it is considered that a sufficient seal will form around the pile. It is recommended that a reduced pile diameter is utilised for the proposed development to increase the thickness of the seal as a precaution. Based on a 140mm diameter pile, the thickness of the clay aquitard is at least 3 times the thickness of the pile. However, it is important to note that a minimum thickness of 0.5m has been achieved in the south eastern area of the store, the thickness is much greater in other areas including the north.

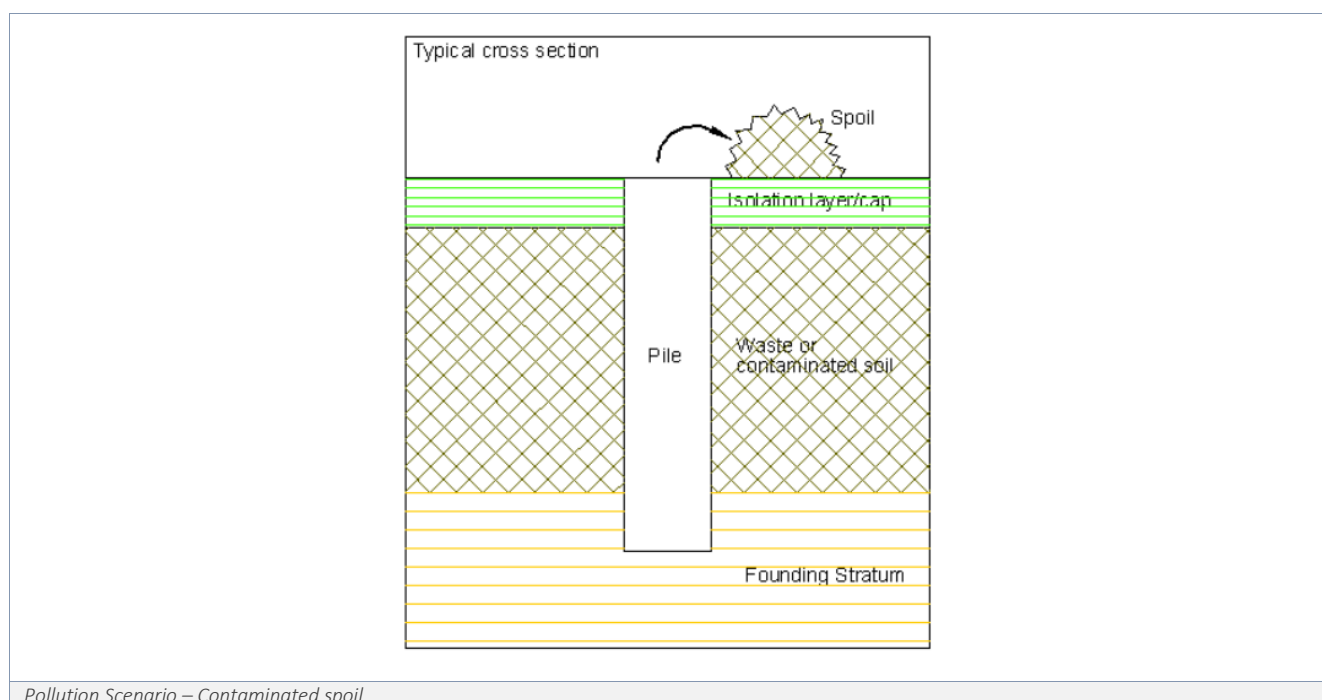
The piling contractor has been consulted and have indicated that by using driven piles, the pile will be densified and the high soils stresses during driving will inhibit groundwater flow.

Any impacted material identified during the enabling works including possible NAPL will be removed in accordance with the Remediation Specification. Turnover works will be deepened in the PFS area and NRW are welcomed to site to observe the works. If areas are identified where no cohesive deposits are present, a new permeable cohesive barrier/aquitard will be installed in accordance with the Remediation Specification. This barrier will act as an aquitard and create a suitable seal around the pile. The barrier thickness will be a minimum of 0.5m in the PFA area.

Although the proposed Starbucks building is inside the petrol filling station area, the building is located south west of the former USTs and outside the main potential source zone. This is shown on the Conceptual Site Model referenced GRO-21252-P13.

Pollution Scenario 3

Pollution Scenario 3: Direct contact of site workers and others with contaminated soil arisings that have been brought to the surface. Based on the piling method being driven piles, this pollution linkage no longer applies.



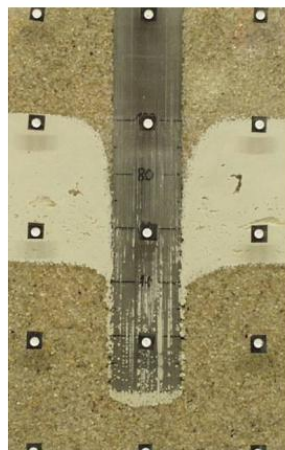
Pollution Scenario 5

Pollution Scenario 5: The driving of solid contaminants down into an aquifer during pile driving is applicable to the piling assessment for the subject site. This comprises the primary movement of soil during piling is in a lateral direction, but there is potential for soil in contact with the sides of a driven pile and material below the butt end of a solid or closed-end pile to be dragged down slightly before it is displaced laterally.

Driven displacement piles may drag down contaminated material as they penetrate underlying strata. This drag down may occur by a frictional mechanism along the shaft of the pile, or by pushing material ahead of the pile shoe. Geotechnical research on driven piles has shown that the magnitude of these effects is normally low (Hayman et al, 1993; Boutwell et al; 2000). Material dragged down by shaft friction is unlikely to be displaced by more than a few centimetres, and theoretical calculations by Boutwell et al (2000) indicate that at most a few kilograms of soil may be pushed ahead of the pile shoe, as the primary mechanism of soil displacement during pile driving is horizontal.

Penetrative ground improvement methods involve horizontal displacement and densification of the soil through which the column is constructed. In normal circumstances this will not lead to soil being dragged downwards. A small amount of contaminated soils can be trapped beneath the base of a flat ended pile during driving which can result in potentially contaminated soils being dragged into the underlying aquifer. This soil may shed around the sides of the pile when driving through a cohesive stratum.

Boutwell et al (2000) present a volumetric calculation which confirms that the magnitude of the impact of this mechanism is unlikely to be significant in most cases, and that any impact will be reduced by between one and three orders of magnitude by the use of a conical driving shoe.



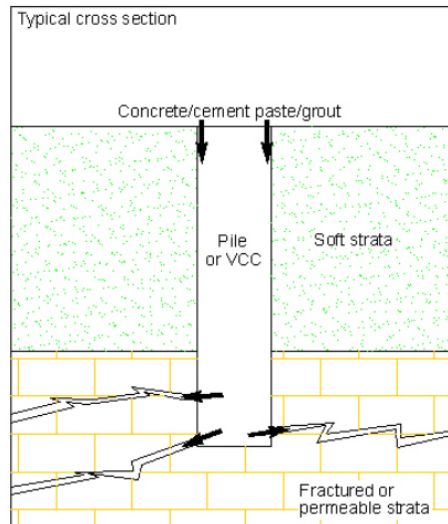
Downdrag of soil beneath a square pile.

This potential problem will also be minimised by using small displacement piles because small sections tend to cut through or push material aside. Based on a 140mm diameter pile, greater than three pile widths will be present. The pile diameter has been reduced to 140mm as a precautionary measure with a smaller pointed driving shoe. The pointed driving shoe is solid and pathway will be created inside the pile.

The piling contractor has confirmed that the steel tubular pile is supplied with a pointed end, which will further reduce the risk of driving down contaminants.

Pollution Scenario 6

Pollution Scenario 6: Contamination of groundwater and, subsequently, surface waters by wet concrete, cement paste or grout. Based on the piling method being driven piles, this pollution linkage does not apply.



Pollution Scenario – Injection of concrete into groundwater.

7.0 SITE SPECIFIC RISK ASSESSMENT

A site-specific risk assessment has been undertaken to identify any realistic pollution linkages which may arise from the proposed piling works in order to quantify the risk controlled waters. The site specific risk assessment is presented as Groundtech Plan GRO-21252-P13.

The objective of this section is to propose a robust, effective and transparent decision making process that allows designers to select an appropriate piling method and mitigation measures, if required, when piling on contaminated sites.

Sufficient information is available in order to allow judgements regarding the applicability of each potential S-P-R linkage at the site and the potential for the preferred piling method to create additional linkages.

The following Pollution Scenarios are not considered applicable to the subject site:

- *Pollution Scenario 2: Creation of preferential pathways, through a low permeability surface layer, to allow migration of landfill gas, soil gas or contaminant vapours to the surface – **groundwater table not a gas source. Displacement piles will not provide a pathway for underground gases or vapours. Starbucks area classified as CS2 with vapour membrane proposed which will mitigate risk.***
- *Pollution Scenario 3: Direct contact of site workers and others with contaminated soil arisings that have been brought to the surface - **displacement piles remove this risk as no arisings will be generated.***
- *Pollution Scenario 4: Direct contact of the piles or engineered structures with contaminated soil or leachate causing degradation of pile materials - **The driven steel tubular piles proposed are capable of resisting the levels of pre-remediation contamination indicated, and so no significant risk exists.***
- *Pollution Scenario 6: Contamination of groundwater and, subsequently, surface waters by wet concrete, cement paste or grout – **method statement to be produced by piling contractor and implemented by QC and QA.***

8.0 CONFIRMATION OF PILING METHOD

8.1 Final Assessment

Based on the information gathered by the site-specific risk assessment, the most appropriate foundation solution for the proposed development is considered to be driven piles. Within the buildings footprint 0.5m to 2.3m of soft cohesive clay exists.

The cohesive material is considered malleable and will create a good seal around the pile which will prevent migration of the contaminated shallow perched groundwater and leached contaminants through the cohesive deposits into the underlying Sand and Gravel aquifer along the pile-soil interface. Based on a 140mm diameter pile, at least three pile widths of the soft Clay aquitard exists between the Made Ground and the underlying aquifer.

If areas are identified where the clay layer is absent during the turnover exercise and deeper excavations in PFS area, this layer will be replaced in accordance with the Remediation Specification. The replacement layer will act as an aquitard and create a sufficient seal around the barrier.

Another consideration is the groundwater testing undertaken by Groundtech Consulting, Arcadis and Quantum as part of their investigation which demonstrates that the underlying deeper aquifer is impacted from surrounding site sources. Arcadis suggested from their investigation that there is a local background level of metal that impact site. There is no evidence that the hydrocarbon contaminated perched shallow groundwater has affected the deeper groundwater body, all testing of the deeper groundwater aquifer has shown no elevated TPH in comparison to the elevated TPHs in the perched water. The perched groundwater encountered is no longer present and is associated with the past development and influenced by heavy rainfall. Perched water has not been encountered in the PFS area through the recent supplementary investigations, however residual contamination exists in the Made Ground. The proposed development will consist of a new drainage system which will reduce the buildup of rainfall and therefore perched water in heavy rainfall events. One of the reasons for a piling risk assessment is if the groundwater quality in the aquifer is good, this is not the case in this instance due to offsite sources impacting the groundwater quality. The site is not located within 500m of a groundwater Source Protection Zone.

The piling contractor has been consulted and have indicated that by using driven piles, the pile will be densified and the high soils stresses during driving will inhibit groundwater flow to the aquifer.

The piling risk assessment has confirmed that no monitoring requirements are necessary.

The hardsurfacing and drainage strategy will prevent infiltration and perched groundwater levels will be permanently lowered.

The piling contractor will apply extra precautions listed in *Section 5.0* to ensure the vibration and noise level is kept to an acceptable level.

8.2 Quality Assurance and Quality Control

The selected specialist piling contractor should be responsible for undertaking Quality Assurance and Quality Control processes.

A method statement will be produced by the piling contractor which will include a watching brief being maintained during the piling works. Good workmanship will be required when installing the piles to ensure the assumptions in this report are met, including additional measures outlined in *Section 5.0*.

The Quality Assurance and Control procedures should ensure the pile type/material is durable to contaminated land. The procedures implemented should also prevent contamination of groundwater and, subsequently, surface waters by wet concrete, cement paste or grout.

In general, all site works should be carried out under an appropriate quality assurance and quality control (QA/QC) regime, which should be rigorously specified in the contract. In the case of potential environmental impacts, appropriate methods and measures for quality assurance and quality control need to be detailed. Groundwater monitoring may be necessary where the overall risks to groundwater are greatest, taking account of the level and mobility of contamination, engineering techniques applied and environmental setting. Groundwater monitoring will generally only be required on areas of Principal Aquifers, or within Source Protection Zones unless there are specific issues of local concern that justify monitoring in others locations.

Those responsible for workmanship should be made aware of the reasoning behind the required procedures discussed above.

9.0 RELEVANT INDUSTRY REFERENCES

Building Research Establishment (1986). Choosing Piles for New Construction, BRE Digest 315.

Boutwell, G.P., Nataraj, M.S. and McManis, K.L. (2000). Deep Foundations on Brownfields Sites. PRAGUE 2000 Conference, Prague.

Chellis, R.D. (1961). Pile Foundations. 2nd Edition. McGraw-Hill.

DoE & CIRIA Piling Group (1980). Survey of Problems Associated with the Installation of Displacement Piles. PSA Civil Engineering Technical Guide 26.

Environment Agency (1998). Policy & Practice for the Protection of Groundwater. The Stationery Office.

Matheson, N.C. & Wain, D.E. (1989). Methods of Constructing Piles on Heavily Contaminated Sites. Proceedings of the 3rd International Conference of Piling and deep Foundations. London. AA Balkema: Rotterdam.

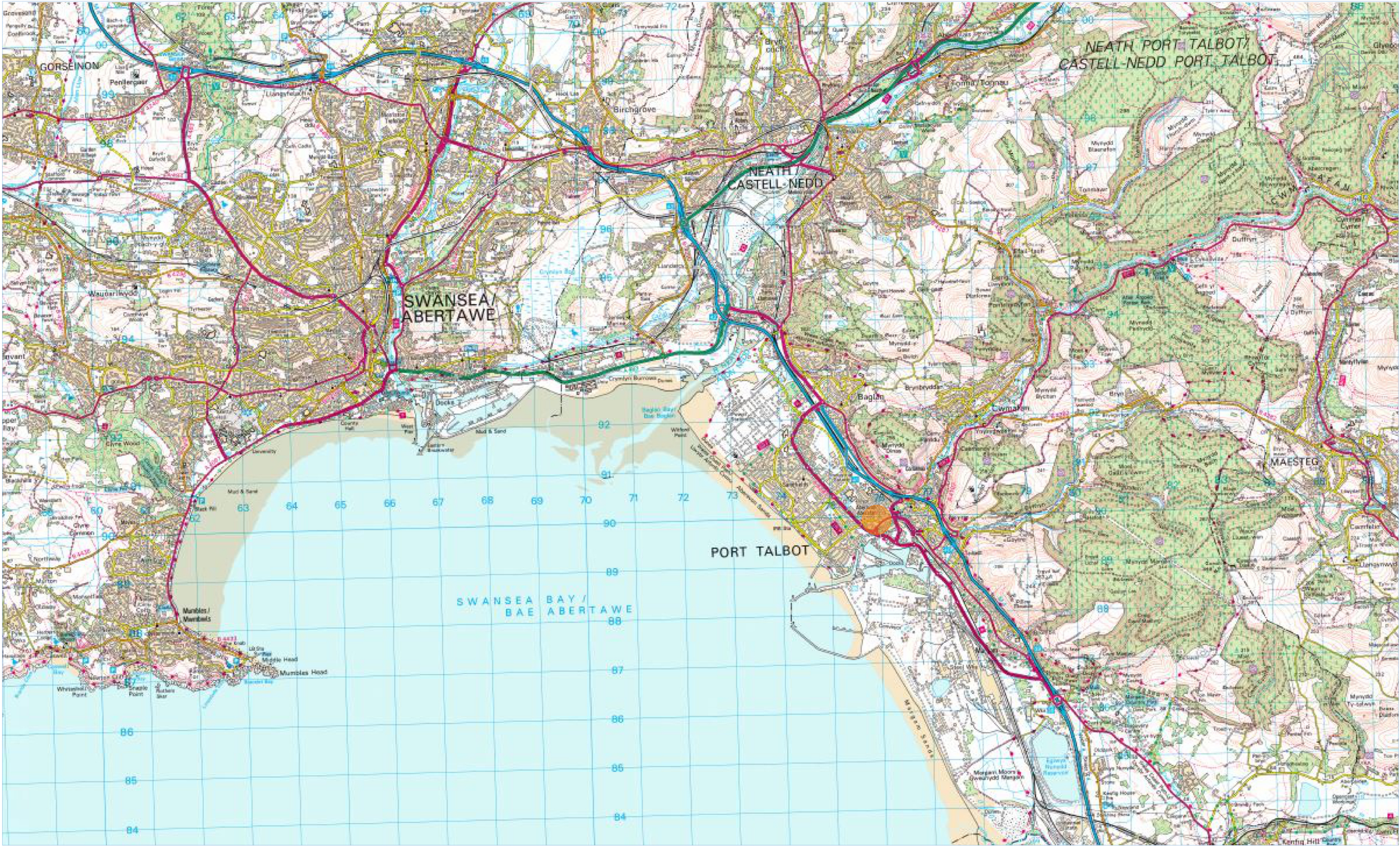
Piling and penetrative ground improvement methods on land affected by contamination: Guidance on pollution prevention. Environment Agency, 2001.

Piling into contaminated sites. Environment Agency, 2002.

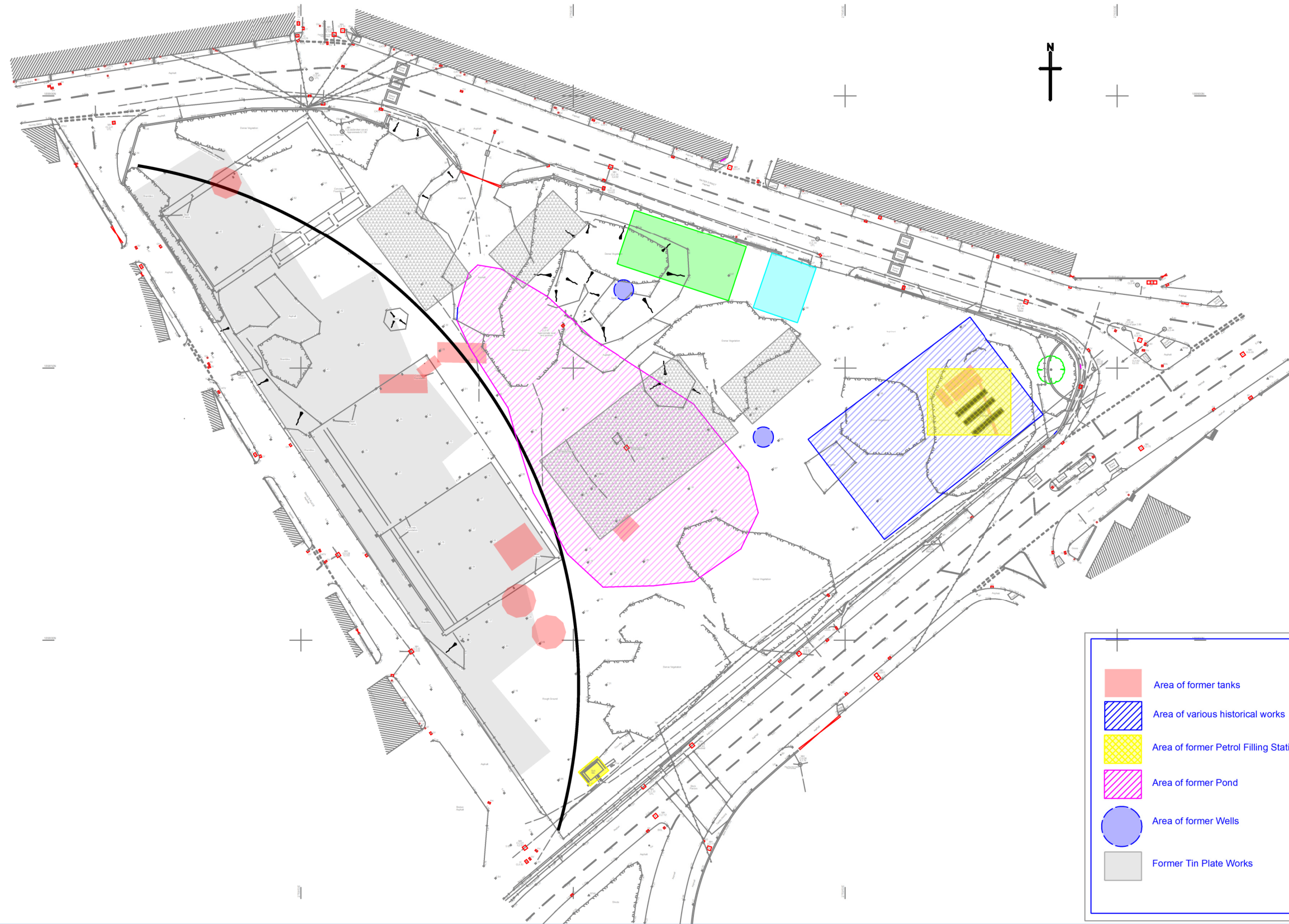
Piling in layered ground: risks to groundwater and archaeology. Environment Agency, 2006.

Piling in layered ground: risks to groundwater and archaeology summary. Environment Agency, 2006.

APPENDIX 1 - Plans



GROUNDTECH CONSULTING 	CLIENT	DATE			Status		Notes SITE LOCATION 
	ALDI STORES LTD	NOVEMBER 2021			Preliminary		
	PROJECT TITLE	SCALE			Draft		
	AFAN WAY, PORT TALBOT	NTS			Issued		
	PLAN TITLE	PLAN NUMBER			For Comment		
	PROJECT LOCATION PLAN	GRO-21252-P01	Rev.	Details	Date	Approved	

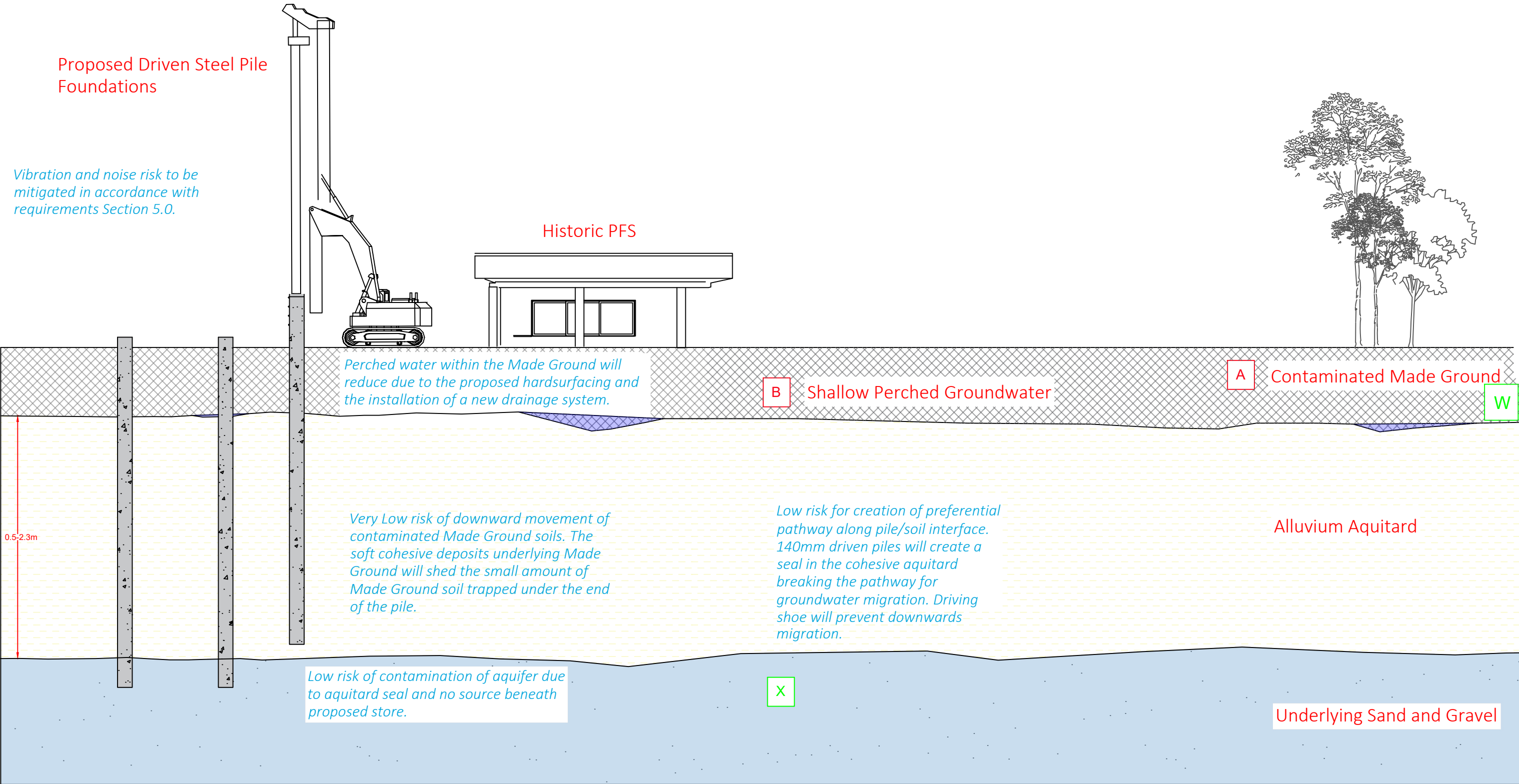


LEGEND	
	Area of former tanks
	Area of various historical works
	Area of former Petrol Filling Station
	Area of former Pond
	Area of former Wells
	Former Tin Plate Works
	Former residential buildings
	Former Mortuary
	Substation
	Former Corporation Depot
	Historical Railway

SOURCES
A. Contaminated Soils / Made Ground. B. Contaminated Shallow Perched Groundwater

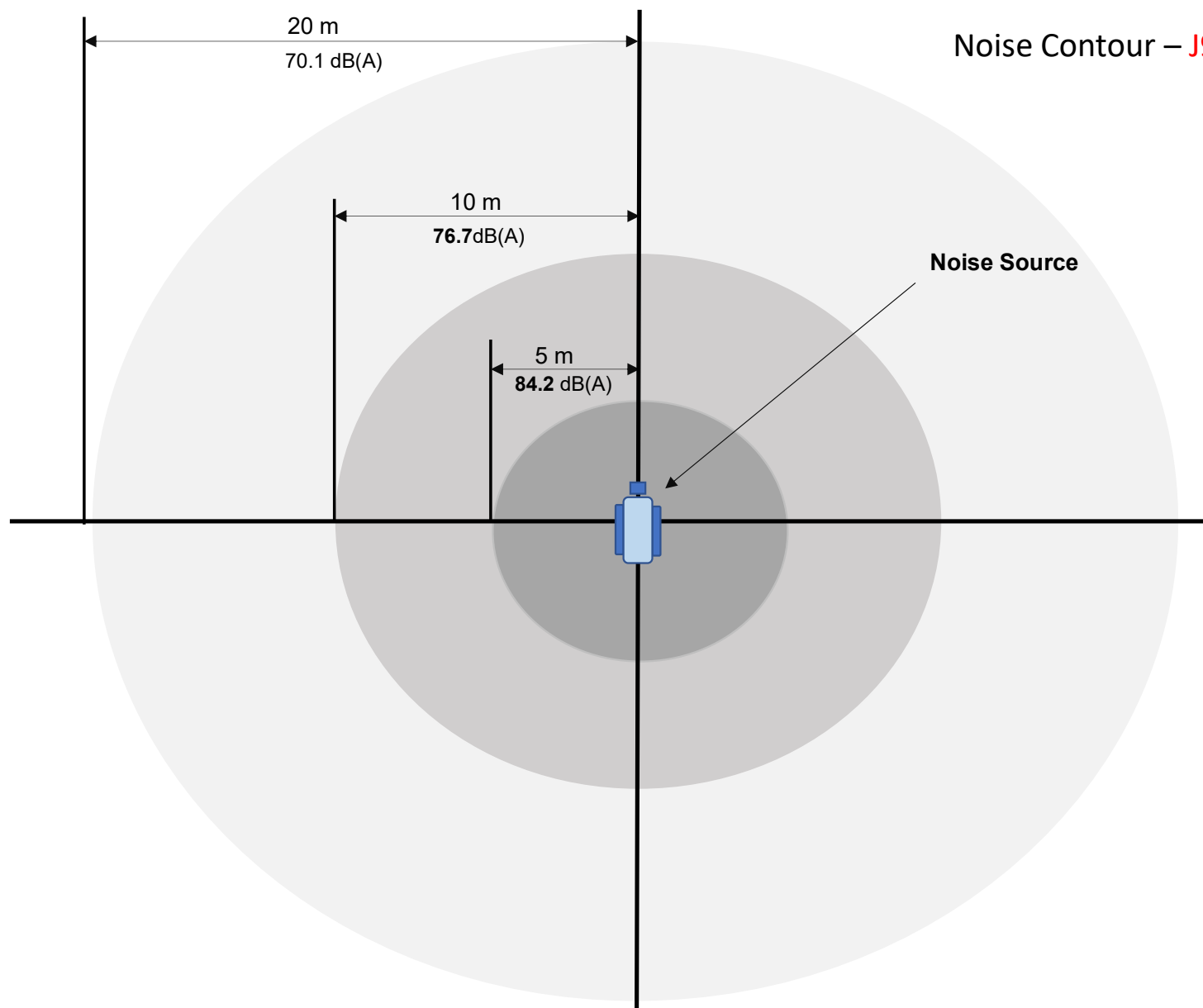
POLLUTION LINKAGES
P1. Creation of Preferential Pathway. P2. Downdrag. P3. Perched Water. P4. Contamination of Underlying Aquifer.

RECEPTORS
W. Afan River located c.86m south. X. Groundwater within the underlying Sand and Gravel Aquifer.



GROUNDTECH CONSULTING 	CLIENT	DATE				Status		Notes
	ALDI STORES LTD	MAY 2023				Preliminary		
	PROJECT TITLE	SCALE				Draft		
	AFAN WAY, PORT TALBOT	NTS				Issued		
	PLAN TITLE	PLAN NUMBER	1.1	Piling type amended to driven piles	29/07/2025	For Comment		
	SITE SPECIFIC RISK ASSESSMENT - PILING	GRO-21252-P13	Rev.	Details	Date	Approved		

APPENDIX 2 - Noise/Vibration Calculation Sheets



Noise Contour – J9 was PMX22-6



Installing 250mm Precast concrete Piles

5t Hammer driving 250mm piles – drop height 200mm

Date – 24th May 2023

Equipment details
Pulsar Nova Model 44 Class 2
Integrating Sound Level Meter
Serial number PN1745 / 84861
Calibration date 27/09/2022

Enquiry/Project Name: Port Talbot - Aldi,
Water Street

Enquiry/Project Number: 2031456

Calculations by : AB
Status: Preliminary
Date: 25-Jul-2025
Revision: 0

Checked By:
Approved by:
(approval if required in accordance with QMS PG03)
Revised by:

Date:
Date:
Date:



Hawton Lane
Balderton
Newark
Nottinghamshire
NG24 3BU
Tel: 01636 611140
Fax: 01636 611142
e-mail : piling@aarsleff.co.uk

	Prediction of vibration levels due to impact driving of piles	Remarks

Prediction of vibration levels due to impact driving of piles.

Source: - TRL Report 429 entitled "Groundborne vibration caused by mechanised construction work"

The expression recommended in the above document is as follows: -

Port Talbot - Aldi, Water Street

$$V_{res} \leq \frac{k_p (W)^{1/2}}{r^{1.3}} \quad \text{(expression 19 on page 52)}$$

This expression will be incorporated into the 2008 revision of BS 5228

2031456

where V_{res} = resultant peak particle velocity in mm/second

AB = hammer energy in joules

Piling hammer details		
Hammer weight	5	tonnes
Fall height	200	mm
Efficiency	80	%

25/07/2025 = distance in metres **from pile toe** to the point of concern

k_p = an empirical scaling factor related to soil conditions, choose from range of loose/soft through medium dense/stiff and dense/very stiff to refusal

Soil conditions
loose or soft soil

At the site in question, the following values of the above parameters apply: -

W	=	7848	joules								
R	=	1	2	3	4	5	10	15	20	radial distance in metres	
d	=	1	1	1	1	1	1	1	1	depth to pile toe in metres	
r	=	1	2	3	4	5	10	15	20	metres	
k_p	=	1	for a pile being driven through				loose or soft soil				

Consequently the peak particle velocity can be calculated as: -

V_{res}	< or =	56	31	20	14	11	4	3	2	mm/second
-----------	--------	----	----	----	----	----	---	---	---	-----------



Prediction of vibration levels due to impact driving of piles.

Source: - TRL Report 429 entitled "Groundborne vibration caused by mechanised construction work"

The expression recommended in the above document is as follows: -

Port Talbot - Aldi, Water Street

$$V_{res} \leq \frac{k_p (W)^{1/2}}{r^{1.3}} \quad (\text{expression 19 on page 52})$$

2031456

where V_{res} = resultant peak particle velocity in mm/second

AB = hammer energy in joules

25/07/2025 = distance in metres **from pile toe** to the point of concern

k_p = an empirical scaling factor related to soil conditions, choose from range of loose/soft through medium dense/stiff and dense/very stiff to refusal

This expression will be incorporated into the 2008 revision of BS 5228

Piling hammer details

Hammer weight **5** tonnes
Fall height **200** mm
Efficiency **80** %

Soil conditions

loose or soft soil

At the site in question, the following values of the above parameters apply: -

W	=	7848	joules	
R	=	1	2	3
d	=	3	3	3
r	=	3	4	4
			5	6
			10	15
			20	

radial distance in metres
depth to pile toe in metres
metres

k_p = **1** for a pile being driven through loose or soft soil

Consequently the peak particle velocity can be calculated as: -

$V_{res} \leq$ **20** **17** **14** **11** **9** **4** **3** **2** mm/second



AARSLEFF PILING

Prediction of vibration levels due to impact driving of piles.

Source: - TRL Report 429 entitled "Groundborne vibration caused by mechanised construction work"

The expression recommended in the above document is as follows: -

Port Talbot - Aldi, Water Street

$$V_{res} \leq \frac{k_p (W)^{1/2}}{r^{1.3}} \quad \text{(expression 19 on page 52)}$$

This expression will be incorporated into the 2008 revision of BS 5228

2031456

where V_{res} = resultant peak particle velocity in mm/second

AB = hammer energy in joules

Piling hammer details		
Hammer weight	5	tonnes
Fall height	250	mm
Efficiency	80	%

25/07/2025 = distance in metres **from pile toe** to the point of concern

k_p = an empirical scaling factor related to soil conditions, choose from range of loose/soft through medium dense/stiff and dense/very stiff to refusal

Soil conditions
refusal conditions

At the site in question, the following values of the above parameters apply: -

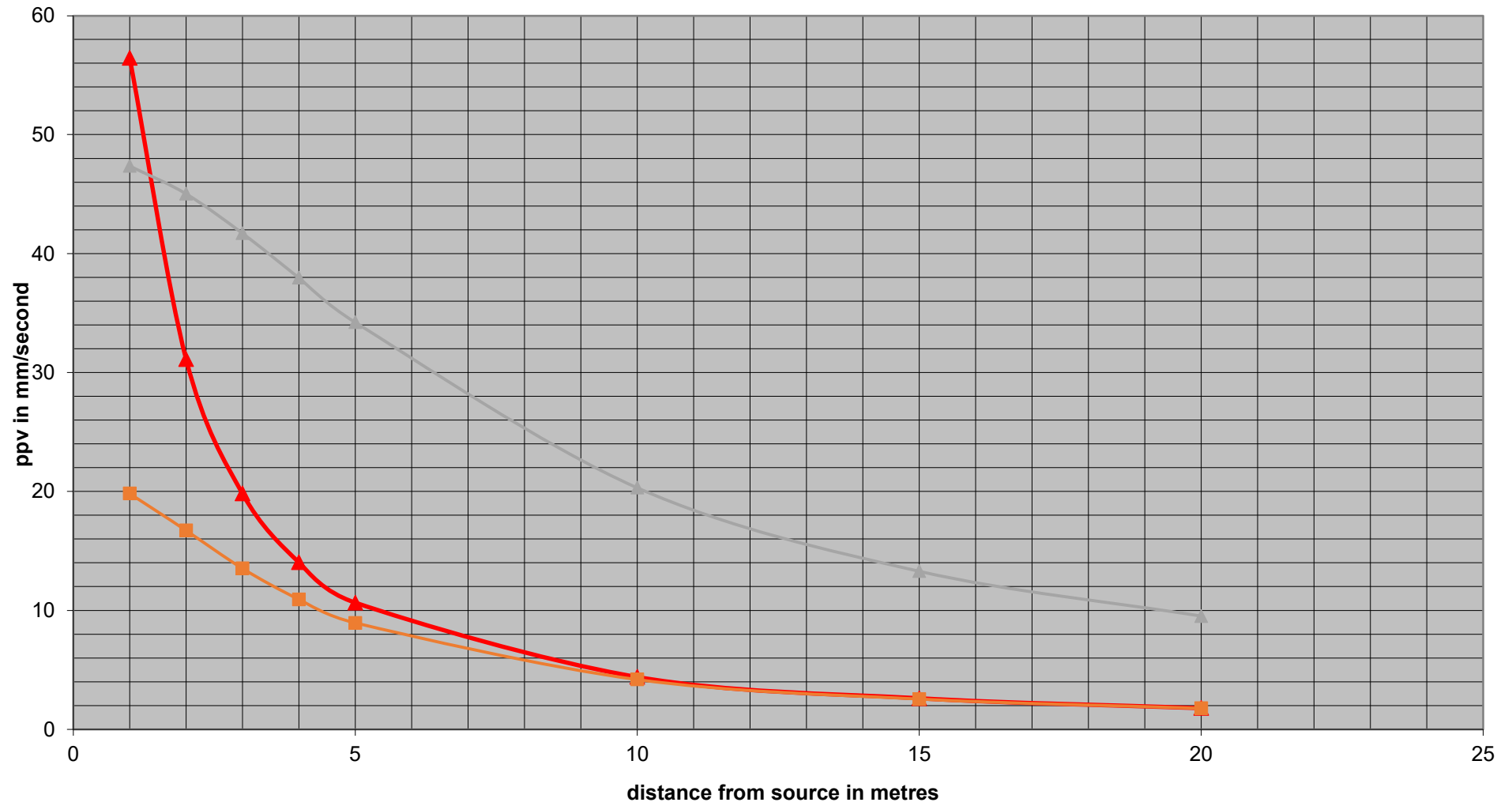
W	=	9810	joules											
R	=	1	2	3	4	5	10	15	20	radial distance in metres				
d	=	6	6	6	6	6	6	6	6	depth to pile toe in metres				
r	=	6	6	7	7	8	12	16	21	metres				
k_p	=	5								for a pile being driven through			refusal conditions	

Consequently the peak particle velocity can be calculated as: -

V_{res}	< or =	47	45	42	38	34	20	13	10	mm/second
-----------	--------	----	----	----	----	----	----	----	----	-----------



Variation of peak particle velocity (ppv) with radial distance from source (TRL 429)



strains associated with a given vibration velocity magnitude are higher, the guide values for the building types corresponding to line 2 are reduced. Below a frequency of 4 Hz where a high displacement is associated with a relatively low component PPV a maximum displacement of 0.6 mm (zero to peak) should be used.

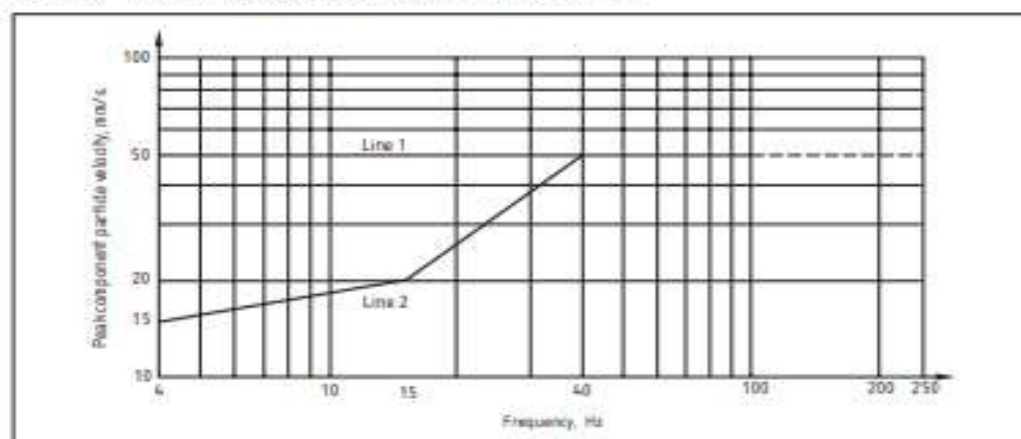
Table B.2 Transient vibration guide values for cosmetic damage

Line (see Figure B.1)	Type of building	Peak component particle velocity in frequency range of predominant pulse	
		4 Hz to 15 Hz	15 Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	50 mm/s at 4 Hz and above
2	Unreinforced or light framed structures Residential or light commercial buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

NOTE 1 Values referred to are at the base of the building.

NOTE 2 For line 2, at frequencies below 4 Hz, a maximum displacement of 0.6 mm (zero to peak) is not to be exceeded.

Figure B.1 Transient vibration guide values for cosmetic damage



Minor damage is possible at vibration magnitudes which are greater than twice those given in Table B.2, and major damage to a building structure can occur at values greater than four times the tabulated values. Definitions of the damage categories are presented in BS ISO 4866:2010, 12.6.

The guide values in Table B.2 relate predominantly to transient vibration which does not give rise to resonant responses in structures, and to low-rise buildings. Where the dynamic loading caused by

APPENDIX 3 - Piling Contractor Information

Project Name: Port Talbot Starbucks

Project Number: 2031458

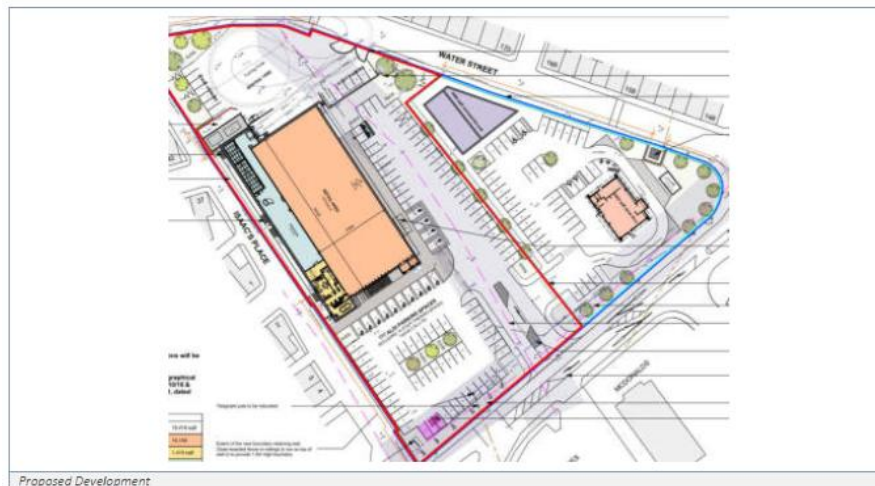
Author: Dan Broadley

Status: Preliminary Issue

Date: 20.11.2025

Revision: 00

This document relates to the installation of 24Nr 140dia. steel tubular piles with an anticipated driven length of circa 6m below PPL for a new Starbucks – Port Talbot.



Environmental Assessment for Foundation Piling

Port Talbot ALDI - 2031456

Selection of Piling Method - Driven steel tubular piles are proposed

The purpose of this assessment is to identify what risks to the environment piling may introduce and to put in place mitigation measures that will remove any significant adverse environmental impacts.

The assessment will be carried out using the risk assessment flowchart from National Groundwater & Contaminated Land Centre Report NC/99/73 (figure 6.1)

The six pollution scenarios suggested in Report NC/99/73 are considered in terms of their potential Source-Pathway-Receptor linkages and how our proposed precast pile deals with each scenario:

Pollution Scenario 1

Creation of preferential pathways, through a low permeability layer to allow potential pollution of an aquifer.

Creation of preferential pathways down the pile shaft is a potential risk on any site with contaminated soils. In this particular instance there is also the consideration of contaminants being allowed a preferential pathway into the gravel and thereby into nearby watercourses. By using driven piles a predominantly granular fill will be densified as it is displaced laterally and the high soil stresses set up during driving will inhibit groundwater flow in the fill. A suitable analogy would be to compare the driving of a nail into a block of wood; the harder the wood, the more difficult it is to extract the nail because of the grip that the wood exerts.

Once piles penetrate any soft clays and silts these cohesive soils will remould and adhere to the pile shaft and an improvement in the soil/pile shaft contact will result rather than a reduction caused by creating gaps.

This is in fact the same action that permits the effects of surcharging such soft materials to exert negative skin friction on piles in addition to the pile head load (this effect is routinely accounted for in pile design). If a 'gap' had been created, there would be no negative skin friction and hence no need to calculate the value.

This pollution scenario is not considered to present a significant risk in the context of the risk assessment process carried out, which has been in accordance with Government guidance.

Pollution Scenario 2

Creation of preferential pathways, through a low permeability surface layer, to allow migration of landfill gas, soil gas or contaminant vapours to the surface.

For the reasons stated previously, the creation of preferential pathways up the pile shaft to allow migration of gas or vapours is not considered to be a significant risk. However, the proposed development will need to include appropriate gas/vapour protection measures, incorporated largely as a precautionary measure.

Pollution Scenario 3

Direct contact of site workers and others with contaminated soil arisings, which have been brought to the surface.

During the pile driving process there is normally no removal of soil, and consequently this is not a significant risk. If obstructions are encountered that impede the driving of piles, safe procedures for handling and disposal of contaminated soil will be followed.

Pollution Scenario 4

Direct contact of the piles or engineered structures with contaminated soil or leachates causing degradation of pile materials.

The driven steel tubular piles proposed are capable of resisting the levels of pre-remediation contamination indicated, and so no significant risk exists.

Pollution Scenario 5

The driving of solid contaminants down into an aquifer during pile driving.

It is widely recognised that driven piles displace soil laterally rather than downwards. The steel tubular pile is supplied with a pointed end, further reducing the risk of driving down contaminants.

Pollution Scenario 6

Contamination of groundwater and, subsequently, surface waters by concrete, cement paste or grout.

As the proposed pile is steel, there is no contamination of groundwater with wet concrete, cement paste or grout.

Conclusion

Should contaminants be present the choice of a driven steel tubular piling system will not worsen the situation in respect of contamination of groundwater or exposure of human beings to contaminants within the ground.

By displacing soil outward instead of pulling it down, and blocking direct soil and water entry, a domed-ended precast pile helps ensure that contaminants remain isolated during deep foundation construction.

There are no practical alternative construction methods that will avoid a potential worsening of the present situation.

APPENDIX 4 - Limitations

