CAMBRIACONSULTING

CONSULTING CIVIL AND STRUCTURAL ENGINEERS

SUPPLEMENTARY SITE INVESTIGATION INFORMATION

PROPOSED MIXED USE DEVELOPMENT LAND AT MILL STREET, LEOMINSTER

ON BEHALF OF:

FRANK H. DALE LTD

REPORT REFERENCE:

CC1189/SSII/REP07 Rev.A

DATE

OCTOBER 2013

CAMBRIA CONSULTING LIMITED
AVON HOUSE
STANWELL ROAD
PENARTH
WALES
CF64 2EZ

REPORT CONTROL SHEET

CLIENT:	Frank H. Dale Ltd.
PROJECT:	Mill Street, Leominster
JOB NO:	CC1189
TITLE:	Supplementary Site Investigation Information
REPORT NO:	CC1189/SSII/REP07
PREPARED BY:	G. Mitchell BEng (Hons) CEng MIStructE FFB
REVIEWED BY:	E. Hoskins
AUTHORISED BY:	G. Mitchell BEng (Hons) CEng MIStructE FFB

Revision	Version	Date	Authorised
A	First Issue	8 October 2013	G. Mitchell

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APPENDICES

1.0 INTRODUCTION

1.1 During the planning process Cambria Consulting Ltd have responded to the Environment Agency regarding a number of concerns regarding contamination.

These are collated here and submitted as supplementary information for completeness.

CAMBRIA
Constructive Thinking

CC1189/GM/130816

23rd August 2013

Mr S.Brown
Technical Specialist (Hydrogeologist)
Environment Agency
West Area Office
Riversmeet House
Northway Lane
Tewkesbury
GL20 8JG

Dear Steve,

MILL STREET, LEOMINSTER – EA OBJECTION – SV/2013/106961/01-L01

Thank you for your recent correspondence and also meeting with the F H Dale team on 7th August 2013. We feel the meeting was very beneficial in clarifying both our key design philosophies and your requirements going forwards with regards to the proposed post-demolition testing.

As requested in our recent meeting we have addressed each of the specific objection points on a paragraph by paragraph basis, and whilst this will undoubted create a fairly cumbersome letter, it should enable concise answers to each of your concerns.

I hope the meeting and discussions held on each point within your letter will ensure no surprises or shortcomings within our responses and proposals. To this end, we would be grateful if the objection could be removed and suitable planning conditions recommended which will enable the project to progress. We append the following for your consideration.

Appendix A – Paragraph by Paragraph response to EA contamination objection
Appendix B – Further Testing Proposals by Terra Firma
Appendix C – Terra Firma – PFS Preliminary Environmental Risk Assessment
Appendix D - PFS Drainage and Forecourt Concept Plan
Appendix E – Terra Firma/Cambria – BH/TP locations and site coverage

Should you have any queries, please do not hesitate to contact me.

Yours sincerely,

Mr Gary Mitchell
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(Please be advised Cambria have recently rebranded however, the organisation and personnel remain the same).

APPENDIX A

Paragraph by Paragraph response to EA contamination objection

Document to provide paragraph by paragraph response.

Ref	Author	Comment
1	**EA**	Any contamination from the current land-use, steel fabrication works of FH Dale site (*and any previous historic land-uses including railway line, sidings*) which have the potential to contaminate the underlying Secondary aquifers should be assessed appropriately in-line with CLR11 guidelines including the assessment of all controlled waters pollutant linkages. Any groundwater underneath this site in the highly transmissive alluvium (*sand and gravels aquifer as indicated on the Terra Firma conceptual model and in the geological logs provided*) will be in direct hydraulic continuity with the River Lugg providing baseflows from groundwater to the river and also being in an SPZ 2 for a public water supply abstraction increases the risk to controlled waters. Mapping has indicated the site to be in an area called 'The Marsh' suggesting that the land could be marshy and the high groundwater table in your onsite boreholes supports that this is likely to be the case.
	Cambria	The précis of the ground conditions and likely relationship between groundwater and the River Lugg is agreed and is commensurate with our own appraisal contained within both the Phase 1 Environmental (Desktop) Assessment and Phase 2 Environmental (Intrusive Investigation) Assessment. It should also be noted (as reported within both studies) the client team always intended to undertaken further intrusive investigation, which can only be done post-demolition (see Appendix B).
2	**EA**	Because of the sensitive controlled waters issues surrounding this site, the assessment presented in the submitted report is not currently sufficient for a site specific controlled waters risk assessment and does not follow CLR11 guidelines. In this case, the assessment of leachate from soil samples (*for only speciated PAHs and no other parameters*) is not considered to be a detailed or robust enough assessment of the risks to groundwater in this sensitive controlled waters setting. We would query why groundwater sampling has not been undertaken, particularly as the groundwater table was found in all onsite boreholes and in trial pits at the clay/gravel interface. Your conceptual model shows a linkage to groundwater from the site yet no onsite groundwater testing has been carried out. Similarly there appears to be no supporting controlled waters risk assessment to support the *low risk* conclusion in the current report. Cambria Consulting in the desk-study identified the linkage of made ground to leaching into soils and controlled waters as *high risk* and without any detailed assessment of controlled waters the risk has been downgraded to low.
	Cambria	A full suite of testing was undertaken on the recovered soil samples and hence it seemed futile to further test the groundwater when no source had been established. We do not consider this to be a breach of CLR11 compliance. Hence this is why groundwater sampling was not taken during this first part of intrusive investigation. In considering the risk to groundwater is it essential to consider our surface water drainage strategy which was provided with the Planning Application submission. All surface water (excluding PFS – see later section) is collected and contained within a tanked sub-base attenuation vessel. This ensures that both trace hydrocarbons from any long term parked vehicles does not enter the groundwater system (cleansed through sub-base microbial action) and furthermore any of the trace elements found on site (and others which might be undetected) cannot be mobilised as the system is sealed.

		The high risk concluded within the desktop study was a conservative catch all assumption that had to remain until such time that we could understand the processes occurring on site and reclassify as appropriate. Terrafirma through their own findings throughout the site investigation, further review of the FH Dale processes and methods of operation and review of our sealed surface water system have reached their own conclusion. This change of classification from high to low risk on the basis of the above is accepted by Cambria Consulting.
3	**EA**	We would expect to see, in-line with CLR11, onsite groundwater quality sampling and appropriate risk assessment carried out for controlled waters particularly being in an SPZ 2 for drinking water supply and adjacent to the River Lugg SSSI.
	Cambria	See above response explaining current position and justification regarding CLR11 testing. Notwithstanding, it is agreed that FH Dale will commission a further three rounds of groundwater monitoring to ratify the assumptions and demonstrate compliance. We installed three wells as part of the initial site investigation. These wells are located in a line in the eastern half of the site and will be ideal to determine if groundwater contamination is flowing towards the river. The three rounds of monitoring to ensure that a representative data set so that any seasonal fluctuations are recorded.
4	**EA**	Table 6.2 on page 25 is a *qualitative* assessment of the aquatic environment and not *quantitative* as described. These conclusions are based on little information. We cannot understand the conclusions for the linkages identified as the leachate samples for soils have only considered PAHs and no other determinants. We would question whether this is a robust assessment for the aquatic environment as groundwater has not been sampled. We disagree that the risks to controlled waters are low in the absence of a robust assessment of controlled waters as described above and in our previous correspondence (*dated 5 March 2013, SV/2013/106771/01*).
	Cambria	We trust the above previous explanation of the drainage schematics provided within the submission, and agreed further testing will allay these fears, and the further testing will enable the evidence based justification as is preferable.
5	**EA**	We would query if all pollutant linkages have been adequately assessed effectively where risks to controlled waters are concerned. The chemical sampling suites presented in the report have also not included (but not limited to) other organic species such as BTEX nor SVOCs, including Chlorinated solvents for example which we would expect to see tested on a site with this previous land-use. PCBs may also need to be tested and assessed. CLR8 guidance from the Environment Agency sets out those priority contaminants on Brownfield sites which should be tested for and your sample suite should include those determinants of relevance to this site.
	Cambria	A full suite of testing was undertaken on the recovered soil samples and hence it seemed futile to further test the groundwater when no source had been established. We have undertaken to test all future samples in both the immediate 3 months groundwater sampling and the future post-demolition investigation (seen as more critical as we're able to target processes).

6	**EA**	We would query if the site investigation undertaken to date for mainly soil and leachate analysis was targeted to those known process areas which could have lead to contamination of the land. Does the FH Dale site have any obvious sources of contamination such as underground or above ground bulk fuel/ chemical storage tanks onsite as these have not be detailed in any report to date. We would require confirmation that the onsite drainage is not a pathway for contaminant migration from any potential areas for contamination. This information is usually provided by the company and plans are annotated with such features to decide on targeted areas for investigation.
	Cambria	Further to our meeting and your own subsequent tour of the site, you'll be aware that there are only limited potential sources of contamination and the FH Dale storage and utilisation processes are stringently monitored. FHD have full Environmental Management certification to ISO 14001:2004 and have incorporated this into their on screen based quality management system. In accordance with their environmental management procedures, rigorous planning and checking is employed throughout all areas of their production and site activities, minimising the impact on the environment. We have included the Terra Firma proposals within Appendix B, these shown their proposed testing locations in accordance with our site meeting.
7	**EA**	We acknowledge your further requirement to assess the possibility of the Victorian ash tip/ buried steel and we agree that further site investigation is required when the site is clear of buildings. An infilled stream is referred to in the Cambria Consulting desk-study information. Has this been assessed during the more recent Terra Firma site investigation and subsequent assessment?
	Cambria	No, the Terra Firma proposals (Appendix B) going forwards do include for investigating these potential items.
8	**EA**	Once the site have been cleared of structures and buildings, it is recommended that further site investigation is carried out in those areas which were not accessible during previous investigations as contamination may reside in these areas. These areas will require further consideration and risk assessment in-line with CLR11. Cambria Consulting in the desk-study have recommended this approach with a main investigation post demolition. We would welcome your clarification on this.
	Cambria	See previous responses – this was always the intention.
9	**EA**	We agree as discussed in your report that the high water table in onsite boreholes is not conducive to the use of groundwater soak-away's for the infiltration of the proposed site storm waters (SUDS). As stated above, the site is also within Flood Zone 3 and again during events SUDS would not work as anticipated due to the high water table. Please refer to our previous correspondence (dated 5 March 2013, SV/2013/106771/01) which discusses the issues of SUDS in more detail.
	Cambria	The reports and design submitted for the Planning Application clearly identify soakaways as unsuitable – hence the tanked sub-base attenuation philosophy on the Surface Water Drainage Strategy drawing.

10	**EA**	**Petrol Filling Station:** We note that a petrol filling station forms part of the proposals and we would offer the following comments in respect of this. We refer to Policy D3 'Sub-water table storage' (*Groundwater Protection: Policy and Practice (GP3), which is available at: http://www.environment-agency.gov.uk/research/library/publications/144346.aspx*) which states: "We will object to storage of hazardous substances below the water table in principal or secondary aquifers". We would expect proposals for underground storage of pollutants in principal and secondary aquifers to be accompanied by a risk assessment appropriate to the volume and type of pollutants being stored and the hydrogeological situation. More detailed risk assessments and an infrastructure design method statement that meets BAT would be expected for storage within source protection zones or close to other vulnerable receptors.
	Cambria	As discussed in our meeting, we are fully expecting and prepared to provide a full PFS Environmental Risk Assessment which will not only establish the desktop based protocols and HazOp considerations for spillage etc but will also consider the existing hydrogeological situation. Terra Firma Wales Ltd will undertake borehole investigations to collect aquifer soil for chemical and geotechnical analysis. The results of this testing will allow Terra Firma Wales Ltd to construct a hydro-geological model, using computer software, which can be used to model the predicted flow of groundwater and dissolved phase contaminants. We have also had recent experience of deriving site specific organic carbon partition coefficients (Koc) at the Cardiff University laboratories which provides a higher level of confidence for a site specific hydrological model. In addition, the boreholes would be used to determine hydraulic gradients which will be fed into the hydro-geological model. The boreholes would also allow long-term monitoring should this be necessary, and emergency monitoring should the storage system alarms trigger. We are very confident that we can provide a thorough risk assessment showing a very robust procedure for the prevention of leaks (double skins tanks, double skin fusion pipework, all PFS equipment installed with monitored leak detection). This will conclusively prove a negligible risk of pollution to the immediate groundwater and local River Lugg. Once the hydro-geological model has been determined to inform the risk assessment, we should be able to provide the complete assessment within two weeks. We would also hope at this time to have knowledge of the PFS equipment provider and specification. We would expect the manufacturer to be able to provide additional information regarding monitoring protocols etc. For the short term consideration, Terra Firma have produced a Preliminary Environmental Risk Assessment (see find attached).
11	**EA**	Related to the above we would raise a concern in relation to Policy D2 regarding underground storage (including fuel storage tanks). It states that objections will be raised to proposals on principal and secondary aquifers (outside of SPZ1) unless "there is evidence of overriding reasons" which indicate a) the activity cannot take place on unproductive strata (elsewhere); and b) the storage must be below ground.

		In the first instance, with reference to the above, we would expect the applicant to demonstrate that this site is the most suitable for the proposed use in this sensitive location i.e. it is unclear if there is a recognised need for a petrol station in this location; and if there may be more appropriate, alternative sites. We would require the applicant to justify that underground storage is essential i.e. that an above ground solution would be impossible.
	Cambria	(a) We have previously issued to the EA the Planning Consultants report (Barton Willmore), which identifies the reasoning behind the store and associated PFS being required in this location. Furthermore there is precedent for this location set by an adjacent BP PFS on the A49 roundabout to the east. In terms of reduced price supermarket PFS's in Leominster, there is only one other single outlet owned by Morrsison and therefore it is largely in the consumer interest for another. (b) As you are likely aware The Association for Petroleum and Explosives Administration and Energy Institute Publication Design, Construction, Maintenance and Decommissioning of Filling Stations recommends that fuel be stored underground. The citing of tanks below ground • Reduces risk to operatives and users • Reduces risk to local residents • Reduces risk of vehicle impact (users and operatives) • Reduces risk of potential vandalism/malicious attack • Reduces risk of attempted theft • Reduces risk of flammable vapours collecting • Reduces risk of radiant heat • Reduces risk of a range potential combustible situation.
12	**EA**	Adequate groundwater protection measures should be put in place to protect controlled waters from the possibility of any future underground fuel tanks (USTs) and associated fuel lines to dispensing pumps leaking. Historically, USTs do leak and contaminate the underlying aquifer, supply wells and boreholes and nearby watercourses. The PFS should be designed to highest of modern protection measures specification in order to protect the precious groundwater resource in the underlying aquifer(s) and the nearby watercourse.
	Cambria	Please find attached PFS Surface Water Drainage proposals and expected performance specification for the PFS equipment. The surface water drainage philosophy will satisfactorily collect all surface spillage over the impermeable area and successfully deliver it to a class 1 full retention petrol interceptor. We are still talking to specialist suppliers with regard to PFS equipment and leak detection capabilities. We would be very pleased to provide these details as soon as they are available.
13	**EA**	General Environment Agency pollution prevention guidance for PFS can be obtained from http://www.environment-agency.gov.uk/business/topics/pollution/39083.aspx PPG7 Safe Operation of Refuelling Facilities is a useful pollution prevention guidance document which can be obtained from the above link.

	Cambria	We are utilising all documents and guidance as listed therein.
14	**EA**	The previous desk-study by Cambria Consulting found in Annex A supported the assessment of groundwater risks by the drilling of onsite boreholes and then sampling for water quality from those boreholes. A proposed site investigation plan is also provided in Part 2 of the report page 126. Is this plan where Terra Firma have drilled in the current investigation or is it the proposed Cambria Consulting plan from the desk-study report? The resolution of this plan is poor and it is hard to read in any detail. Does this location plan fit with the works already undertaken onsite? Are the borehole locations targeted to known contamination source/ process areas as discussed above? We would request an up to date location plan for the Terra Firm site investigation locations.
	Cambria	As suggested in previous responses the targeted approach is specific to the post demolition investigation. The initial investigation (which has been provided) was a matter of providing coverage (see attached Terra Firma plan)

APPENDIX B
Further Testing Proposals by Terra Firma

GCL/12107/let3

14th August 2013

Cambria Consulting
Cambria House
16 Plas St Pol de Leon
Penarth Marina
Cardiff
CF64 1TR

For the attn. of Mr Gary Mitchell

Dear Gary

SUPPLEMENTARY GROUNDWATER MONITORING AT MILL STREET DEVELOPMENT, LEOMINSTER

Further to our recent site meeting with FH Dale and the Environment Agency (EA) and the need for additional testing I would comment as follows:

As stated in your minutes of the meeting I disagreed with Steve Brown of the EA when he commented that our report was not compiled to CLR11. Our report was compiled to the requirements of CLR11 and our risk assessment of harm to controlled waters based upon the lack of contamination in the made ground and superficial deposits was negligible risk.

The fact that Steve Brown disagreed with the findings does not make the report non CLR11 compliant.

The upshot, however, is that the EA require groundwater monitoring to be carried out. We installed three wells as part of the initial site investigation. These wells are located in a line in the eastern half of the site and will be ideal to determine if groundwater contamination is flowing towards the river.

The EA require these wells to be monitored on three separate occasions in order to confirm that groundwater is uncontaminated. They require three rounds of monitoring to ensure that a representative data set so that any seasonal fluctuations are recorded.

In addition, it was stated in our original report that following demolition of the factory additional investigation works should be undertaken to confirm that levels of contamination beneath and around the building were the same as the rest of the site. At this time further as requested by the EA groundwater monitoring adjacent to the paint store could be carried out.

It was also stated in our original report and referred to by Steve Smith that anecdotal evidence suggests that an old Victorian Ash tip exists on site, together with an area where steel has been buried. He concurred with the recommendations given in our report that additional investigation should be undertaken to either locate these areas or prove that they are not on site.

Based upon the requirements of the EA and the recommendations given in our original report I present below my suggested scope of works and associated costs.

Item No.	Description of Works	Quantity	Rate(£)	Sub total (£)
	Monitoring of Existing Boreholes			
1	Groundwater monitoring of existing boreholes by two qualified Geo-technical engineers including purging boreholes to current protocols	3Vistis	700.00/v	2100.00
2	Laboratory groundwater analysis for metals, BOD, COD, hardness, speciated PH, speciated PAH, VOC, SVOC and chlorinated solvents	9No	195.00	1755.00
3	Collating the results and preparing letter reports for submission to the EA following each visit	3No	150.00	450.00
4	Liaison with the EA, attending meetings etc	r/o	50.00/hr	-
	Travelling to meetings	r/o	45.00p/m	-
	Supplementary Investigation and Groundwater Monitoring			
5	Mobilisation of mini percussive drilling rig and the sinking of up to 6 holes in a day including in-situ strength testing	1Day	800.00	800.00
6	Diamond coring of concrete to allow drilling to commence	1Day	250.00	250.00
7	Supervision of the drilling works by a qualified geo-technical engineer including logging the boreholes and taking samples	1Day	350.00	350.00
8	Laboratory chemical testing for arsenic, cadmium, chromium, mercury, nickel, zinc, lead, PAH copper, phenol, sulphate and pH	10No	70.00	700.00
9	Laboratory chemical testing for speciated PH	10No	65.00	650.00
10	Laboratory chemical testing for speciated PAH	10No	45.00	450.00
11	Laboratory chemical testing for chlorinated solvents	4No	70.00	280.00
12	Installation of groundwater monitoring stations including lockable covers	4No	175.00	700.00 -
13	Groundwater monitoring as in Item1	1Visit	700.00	700.00
14	Groundwater testing as in Item 2	4No	195.00	780.00
15	Trial pitting by a qualified geotechnical engineer including the hire of a JCB and hydraulic breaker in order to locate ash tip and buried steel.	1Day	750.00	750.00
	Collating the results and preparing an updated Geo-technical and Geo-environmental Report(4 copies)	Sum	-	600.00
			Total Estimated Cost ex. VAT	**11315.00**

Please note that the above costs are presented on a re-measurable basis.

Should the old ash tip and/or area of buried steel be found then addional chemical testing and groundwater monitoring will be required.

I trust that the above is to your satisfaction, however, if you have any queries or require any further information please do not hesitate to contact me. In the meantime I await your further instructions.

Yours sincerely
for: Terra Firma (Wales) Ltd

Dr Gwyn C Lake

APPENDIX C

Terra Firma – PFS Preliminary Environmental Risk Assessment

GROUNDWATER RISK ASSESSMENT
FOR PETROL FILLING STATION AT F H DALE SITE
LEOMINSTER

Prepared for:
F H Dale Limited

August 2013

Job No: 12107/1

REPORT TITLE	**:**	**Groundwater Risk Assessment Report: Proposed Filling Station Commercial and Residential Development Leominster**
REPORT STATUS	**:**	**Final**
JOB NUMBER	**:**	**12107/1**
DATE	**:**	**August 2013**
PREPARED BY	**:**	**……..** **(Dr. Gwyn C Lake)**
REVIEWED BY	**:**	**……..** **(Miss Louise Dow)**
APPROVED BY	**:**	**……..** **(Dr G. C. Lake)**

Executive Summary

F H Dale Limited are proposing the commercial and residential development of their site in Leominster.

As part of the commercial phase of the development a petrol filling station is to be constructed. As the site located within an outer zone 2 of a source protection zone and the site has high groundwater the environment Agency requires a ground water risk assessment to be carried out.

The report details this risk assessment and uses data obtained by a previous site investigation carried out by Terra Firma (Wales) for the site.

The risk assessment conforms that there are potential risks to the aquatic environment form the construction of a petrol filling station on the site concludes that with appropriate mitigation measures the risk to the aquatic environment should be negated.

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SECTION 1 Introduction and Proposed Development

F H Dale Limited are proposing the commercial and residential development of their site in Leominster.

Cambria Consulting are the Consulting Civil and Structural Engineers for the proposed development.

Terra Firma (Wales) Limited were commissioned to undertake a geo-technical and geo-environmental investigation of the site. The findings of this report were published in Report No 12107 dated January 2013. For completeness elements of that report are included in the current document.

As part of the commercial development it is proposed to construct a petrol filling station. Following a site meeting with the Environment Agency (EA) a Groundwater Risk Assessment was required for the filling station.

The main objectives of the Groundwater Risk Assessment were to:

- Identify the potential environmental liabilities at the site associated with the construction of a new petrol filling station in particular the potential for groundwater contamination from any future hydrocarbon spillages/leakages of tanks and fuel lines.
- Provide a summary of the environmental conditions at the site, together with any necessary mitigation works to ensure that the aquatic environment remains unaffected.

The current document should be read in conjunction with Geotechnical and Geo-environmental Report No 1217 dated January 2013.

1.1 Limitations and Exceptions of Investigation

The Groundwater Risk Assessment was conducted and this report has been prepared for the sole internal reliance of F H Dale Limited and their design and construction team. This report shall not be relied upon or transferred to any other parties without the express written authorisation of Terra Firma (Wales) Limited. If an unauthorised third party comes into possession of this report they rely on it at their peril and the authors owe them no duty of care and skill.

The report represents the findings and opinions of experienced geo-environmental and geo-technical consultants. Terra Firma (Wales) Limited does not provide legal advice and the advice of lawyers may also be required.

SECTION 2 Review of Existing Data

2.1 Physical Setting, Current Use and Site Conditions

The site is land to the Rear of Dale Ltd and that of Dale Ltd Steel Fabrication Site off Mill Street, Leominster, HR6 8EF at a National Grid Reference of 349810 259600, see **Drawing 01**.

The site is roughly square in shape and covers a total area of 5.64 hectares.

The topography of the site is relatively flat. The northern half of the site is roughly vegetated whilst the southern half of the site is laid to gravel hardstanding with reinforced concrete around the Industrial Units.

2.2 Geology

The 1:50,000 scale geological map of the area (Sheet 181 and 198 solid and drift editions) was consulted. The site is underlain by Raglan Mudstone Formation of Silurian Age which typically consists of siltstones and mudstones.

Superficial deposits in the form of Alluvium of Quaternary age are indicated on site. This Alluvium is indicated as possibly Clay, Silt or sand and Gravel. Fluvioglacial Gravel is recorded to the north east of the site and may extend under the site.

Significant Made Ground is not anticipated across the site.

2.3 Hydrogeology

The underlying Raglan Mudstone Formation has been classed by the Environment Agency as a Secondary A Aquifer. A Secondary A Aquifer is defined as permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

2.4 Hydrology

Shallow groundwater flow will primarily be in a south easterly direction following the local river direction.

The River Lugg locates approximately 25m to the north east of the site and 100m to the east of the site. The River Lugg flows in a southerly direction.

The groundwater beneath the site, and the River Wye have been assessed by the Environment Agency, and can be summarised in the table shown on the following page.

Table 2.1 Summary of Environment Agency Hydrological Data

Groundwater	
Water body ID	GB40902G204100
Water body name	Wye Minor
River basin district	Severn
Current quantitative quality	Good
Current chemical quality	Good
Upward chemical trend	Yes
2015 predicted quantitative quality	Good
2015 predicted chemical quality	Good
Overall risk	At Risk
Protected area	Yes
River Lugg	
Water body ID	GB109055042030
River basin district	R Lugg - conf Norton Bk to conf R Arrow
Typology Description	Mid, Medium, Calcareous
Hydromorphological Status	Not Designated
Current ecological quality	Good Status
Current chemical quality	Good
2015 predicted ecological quality	Good Status
2015 predicted chemical quality	Good
Overall risk	At Risk
Protected area	Yes
Pinsley Bk - source to conf R Lugg	
Water body ID	GB109055041940
River basin district	Pinsley Bk - source to conf R Lugg
Typology Description	Mid, Medium, Calcareous
Hydromorphological Status	Not Designated
Current ecological quality	Moderate Status
Current chemical quality	Does not require assessment
2015 predicted ecological quality	Moderate Status
2015 predicted chemical quality	Does not require assessment
Overall risk	At Risk
Protected area	Yes

2.5 Environmental

The Environment Agency online 'What's in Your Back Yard' database was consulted. The relevant information is summarised below.

2.5.1 Flooding

The Environment Agency database confirms that the site situates within a flood zone. The area has a moderate chance of flooding. The chance of flooding each year is 1.3% (1 in 75) or less, but greater than 0.5% (1 in 200). This takes into account the effect of any flood defenses that may be in this area.

2.5.2 Groundwater Source Protection Zones

The site locates within a groundwater source protection outer zone 2.

SECTION 4 Field Investigation

4.1 Site Works

A geo-technical and geo-environmental site investigation was carried out in January 2013 comprising 14 trial pits, 6 mini percussive boreholes and 6 cable percussion boreholes.

The trial pits were sunk using a JCB mechanical excavator.

The mini percussive boreholes were sunk using a Terrier 2000 window sample drilling rig.

The cable percussion boreholes, 200mm in diameter were drilled using a Dando 2000 drilling rig. Within the boreholes standard/Cone Penetration Tests were carried out at close and regular intervals. The boreholes were terminated within competent in-situ strata after a minimum of 1 hours chiselling in each hole for a nominal penetration.

The fieldworks were supervised by Terra Firma (Wales) Limited and the boreholes were logged to the requirements of BS5930:1999/Eurocode 7.

4.2 Ground Conditions

The ground conditions encountered can in general be summarised as shown in **Table 4.1.**

Table 4.1 Summary of Ground Conditions

Depth (m)	Thickness (m)	Stratum
GL - 0.3/0.50	0.30/0.50	Topsoil over//Limestone hardcore underlain by teram over
0.3/0.50 - 1.40/2.80	1.40/2.80	Soft to firm brown sandy **CLAY//MADE GROUND** soft dark brown sandy **CLAY**
1.40/2.80 - >9.50m	-	Medium dense brown grey fine to coarse subrounded to rounded **GRAVEL** of mudstone and sandstone

In BH4 very soft clay was recorded at 1.00m to 2.00m depth

BH5 recorded Gravel at 1.70m to 2.90m underlain by very stiff Clay to 3.70m which was further underlain by medium dense becoming dense GRAVEL to the maximum depth of the borehole at 8.00m.

BH6 recorded Gravel at 2.90m to 4.30m underlain by very stiff red brown gravelly CLAY with cobbles to the maximum depth of the borehole at 5.00m.

Soft brown clayey Peat was recorded in TP 13 at 2.40m to 2.70m depth.

4.3 Water Strikes

Groundwater was encountered in all of the boreholes and trial pits at the clay/gravel interface.

Groundwater monitoring standpipes were installed in three of the boreholes (BH4, BH5 and BH6) Groundwater was monitored on the 22nd January 2013. The results of this monitoring are presented in Table 4.2 below:

Table 4.2 Results of Groundwater monitoring

Borehole	Depth below ground level (m)
BH3	1.54
BH4	1.45
BH5	2.31

SECTION 5 Groundwater Risk Assessment

The contaminated land regime is set out in Part IIA of the Environmental Protection Act (EPA) 1990 and was introduced on the 1st April 2000 in England and 1st July 2001 in Wales. A similar regime was introduced in Scotland on 14th July 2000.

Part IIA was introduced to achieve two aims:

(1) The identification of contaminated land
(2) The remediation of contaminated land that poses an unacceptable risk to human health and/or the environment

Under Part IIA the statutory definition of 'contaminated land' is:

"any land which appears to the local authority in whose area it is situated, to be in such a condition, by reason of substances in, on, or under the land, that:

(a) Significant harm is being caused or there is a significant possibility of such harm being caused; or
(b) Pollution of controlled waters is being, or is likely to be, caused."

For land to be classified as 'Contaminated Land' there must be a '**pollutant linkage**'.

For our definitions of pollution linkage and how we define risk please refer to **Annex A** which includes our classifications of consequence and probability and risk assessment matrix.

5.1 Potential Sources of Contamination

The potential source of contamination for this exercise is form the petrol filling station beneath the site entering the groundwater. The location of the proposed filling station is shown in **Drawing 02**.

5.2 Construction of the Petrol Filling Station

It is clear from the site investigation Data that the proposed buried fuel storage tanks will be below the ground water table for the site.

The following Risk Assessment with respect to the Aquatic Environment has been complied. has, therefore, been complied.

Table 5.1 Risks to the Aquatic Environment From Petrol Filling Station

Source	Pathway	Target	Risk Assessment
Construction of the filling Station	Surface water run-off/direct contact with the groundwater	Groundwater/ River Lugg and water abstraction point	**Medium to High Risk during construction**
Petrol leak from buried storage tanks	Downward migration into groundwater	Groundwater, River Lugg and water abstraction point	**Medium Risk in the Long Term**
Petrol Leak for fuel lines	Downward migration into groundwater	Groundwater, River Lugg and water abstraction point	
Spillages of petrol/diesel from vehicles using the facility and tankers supplying the site	Downward migration into groundwater	Groundwater, River Lugg and water abstraction point	

5.2 Construction of the Petrol Filling Station (Continued)

In order to negate these risks **Table 5.2** details the necessary mitigation measures.

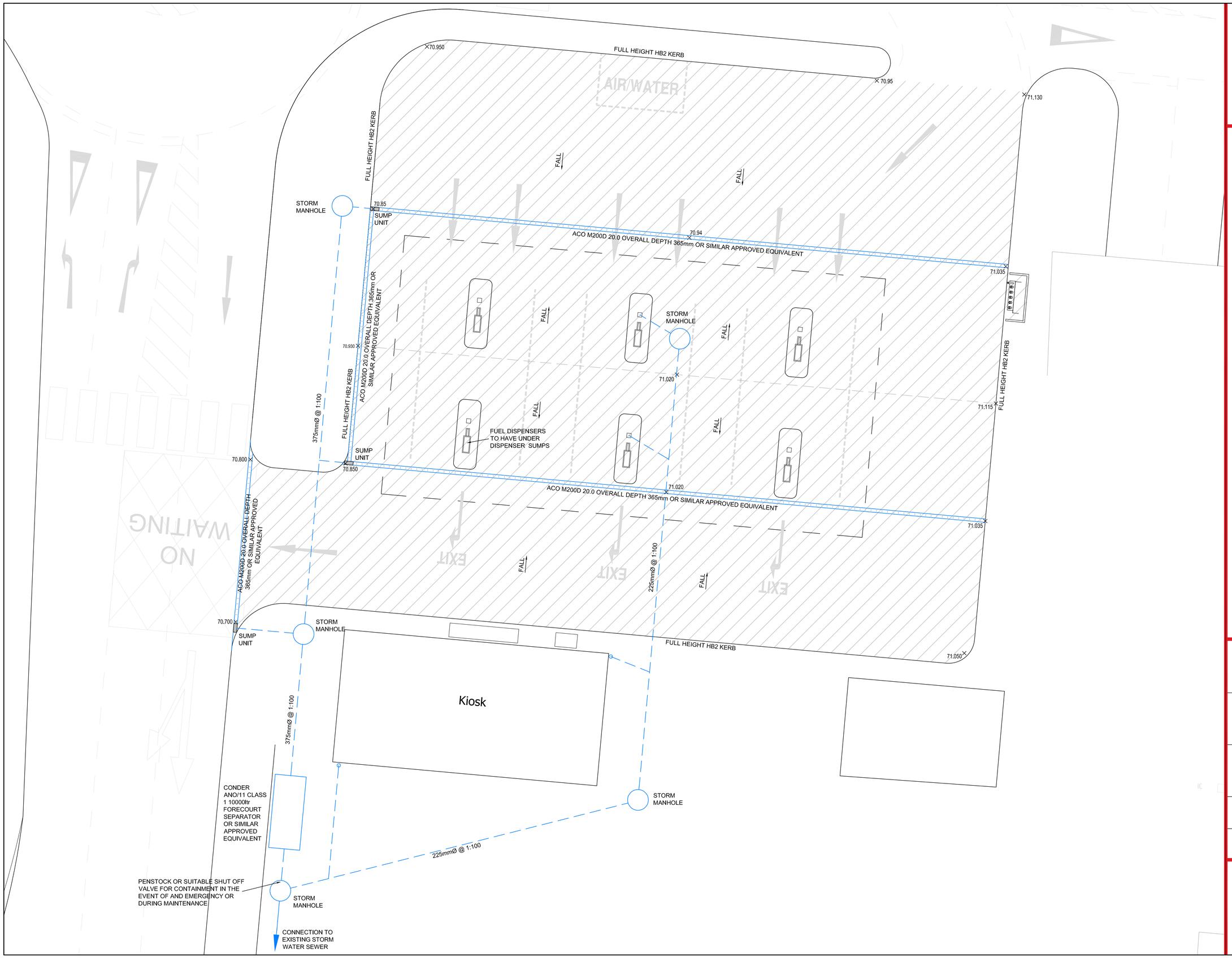
Table 5.2 Mitigation of the Risk to the Aquatic Environment From Petrol Filling Station

Source	Mitigation Measures
Construction of the filling Station	For the construction of the buildings and above ground equipment good construction practise conforming to current guidelines. For the construction of the below ground fuel storage tanks the construction of a caisson type structure to dewater the area while the tans are installed
Petrol leak from buried storage tanks	The mitigation measures to for tank leakage would be two fold. The Primary Mitigation Measures would be to use proprietary equipment suitable for use within a groundwater environment with double protection for the tanks installed by Specialist Contractors with a proven track record of construction in similar environment The Secondary Mitigation Measures would be to have the tanks inspected on a regular basis by independent contractors to ensure the integrity of the tanks Groundwater monitoring stations should also be constructed around the facility and monitored on a regular basis for hydrocarbon contamination, used as an early warning system in conjunction with the integrity checks of the tanks Should contamination be detected then the boreholes can be used to clear up the pollution by pumping
Petrol Leak for fuel lines	All fuel lines and entry points to pumps and tanks should be enclosed in proprietary conduit system with exit points connected to the drainage system
Spillages of petrol/diesel from vehicles using the facility and tankers supplying the site	All storm drainage should be connected to petrol interceptors prior to entering the site system

ANNEX A
Terra Firma Definitions and Methodologies

APPENDIX D

PFS Drainage and Forecourt Concept Plan



Drainage Pipe work should be

- Polyethylene to EN14125
- Sealed at all joints.
- Resistant to the effects of light hydrocarbon liquids and alcohols when tested as specified in EN 752.
- Tested in accordance with Approved Document H, EN 752 and EN 1610 Construction and testing of drains and sewers.
- Certified as complying with the regulations cited above.

Manhole Covers to load class D400 complying with EN 124 and to have a watertight seal

Drainage channel gratings to load class D400 and to comply with EN 124

Forecourt Surfacing to be either

Concrete complying with

BS 8500-1 Concrete, Complementary British Standard to BS EN 206-1, Method of specifying and guidance for the specifier, EN 206-1 Concrete, Specification, performance, production and conformity.Sealed at all joints.

or

Sealed Block Paving with a concrete sub base which extends at least 150mm beyond the paved surface. Block paving to comply with

EN 1338 Concrete paving blocks. Requirements and test methods.
EN 1339 Concrete paving flags. Requirements and test methods.
BS 7533-1 Pavements constructed with clay, natural stone or concrete pavers. Guide for the structural design of heavy duty pavements constructed of clay pavers or precast concrete paving blocks.

Underground Tanks to be double skinned with a class 1 interstitial space leak detection system. Tanks to be steel or glass reinforced plastic complying with

EN 12285-1 Workshop fabricated steel tanks. Horizontal cylindrical single skin and double skin tanks for the underground storage of flammable and non-flammable water polluting liquids.

UL 1316 Standard for Safety glass-fiber-reinforced plastic underground storage tanks for petroleum products, alcohols, and alcohol-gasoline mixtures.

Fuel and ancillary pipework to have secondary containment and should be certified in accordance with the requirements of EN 14125 Thermoplastic and flexible metal pipework for underground installation at petrol filling stations

A	FIRST ISSUE FOR COMMENT	AWN	GM
		15/08/13	

Client:

DALE

Project:

NEW STORE
LEOMINSTER

Drawing Title:

PETROL FILLING STATION
GENERAL ARRANGEMENT

Project No.:	Drawing No.:	Revision:
CC1189	220	A

Status:	Scale:
PRELIMINARY	AS SHOWN @ A1

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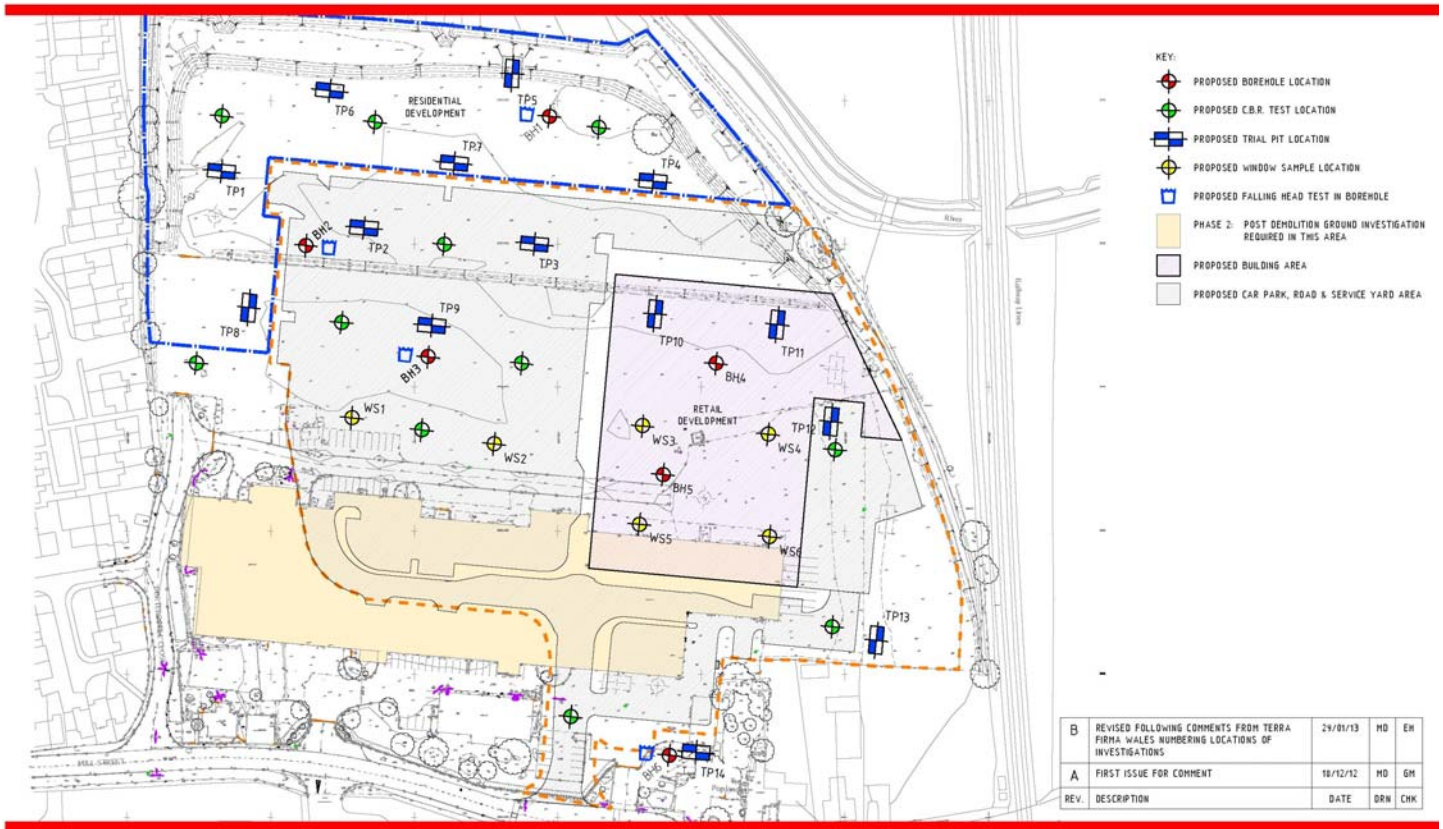
APPENDIX E

Terra Firma/Cambria – BH/TP locations and site coverage



REV.	DESCRIPTION	DATE	DRN	CHK
B	REVISED FOLLOWING COMMENTS FROM TERRA FIRMA WALES NUMBERING LOCATIONS OF INVESTIGATIONS	29/01/13	MD	EH
A	FIRST ISSUE FOR COMMENT	18/12/12	MD	GM

- [ ] CONCEPT
- [ ] PRELIMINARY
- [ ] TENDER
- [ ] CONSTRUCTION
- [ ] CDMC O&M AS-BUILT
- [ ] REPORT

PROJECT: NEW STORE, LEOMINSTER

SCALE(S): 1:1250 @A3

DRAWING TITLE: SITE SURVEY REQUIREMENTS

PROJECT No: CC1189

DRAWING NUMBER: SK 010

REVISION: B

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terrafirma

Job Number:
12107

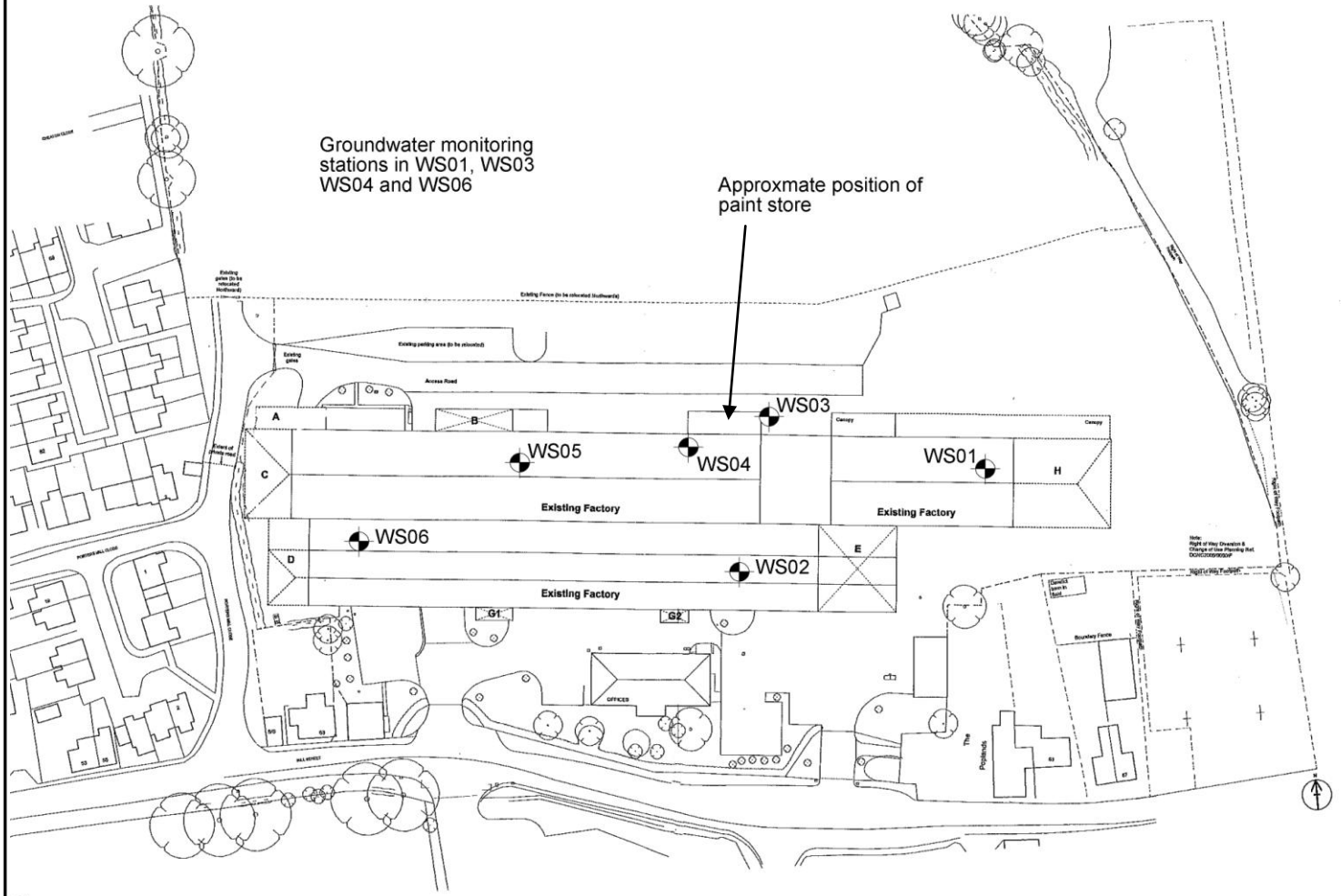
Job Title:
Leominster

Drawing Title:
Site Layout

Drawing Number:
02

Scale:
NTS

Legend:



terrafirma

Job Number:

12107

Job Title:

Leominster

Drawing Title:

Proposed Exploratory Hole Locations

Drawing Number:

N/A

Scale:

Not To Scale

Legend:

Proposed position of windowless sampling borehole

North