Proposed Hydrocarbon Exploratory Borehole at Broadford Bridge, West Sussex (Willow #1)

Groundwater Risk Assessment

Final Report

Prepared by

Eric Cooper SiLC

for

Celtique Energie Petroleum Ltd

Hydrock Ref: R/12049/001

May 2012

DOCUMENT CONTROL SHEET

Issued by: Hydrock Consultants Limited
Churchill House
Regent Road
Hanley
Stoke on Trent
ST1 3JJ

Tel:01782 261919
Fax:01782 262020
www.hydrock.com

Client: CELTIQUE ENERGIE PETROLEUM LTD

Project: PROPOSED HYDROCARBON EXPLORATORY BOREHOLE AT BROADFORD BRIDGE, WEST SUSSEX (WILLOW #1)

Title: GROUNDWATER RISK ASSESSMENT

Status: FINAL

Date: MAY 2012

Document Production Record

Issue Number:	**1**	**Name**	**Signature**
Prepared		Eric Cooper SiLC	
Checked		Terry Wraxton	
Approved		Eric Cooper SiLC	

Document Revision Record

Issue number	**Date**	**Revision Details**
1	22 May 2012	Original issue.

Hydrock Consultants Limited has prepared this report in accordance with the instructions of the above named Client for their sole and specific use. Any third parties who may use the information contained herein do so at their own risk.

CONTENTS

APPENDICES

1.0 INTRODUCTION

1.1 Background

Celtique Energie Petroleum Limited (Celtique) is a company that is engaged in the exploration for oil and gas. It holds exploration and development licences granted by the UK Department of Energy and Climate Change covering large areas of the onshore United Kingdom. Exploration in connection with one such licence, PEDL 234, is the purpose of a proposed hydrocarbon exploratory borehole at Broadford Bridge, near Billingshurst, West Sussex. The exploratory hole, referred to as Willow #1, will be to a drilled depth of10114 ft (3083m) deep, which is 8771 ft (2673m) below ground level at the point of termination.

Relevant location maps are attached at Appendix A, including the licence areas (Drawing 12049/001) and the site location (Drawing 12049/002), both in map form and as an aerial photograph (Drawing 12049/003).

1.2 Objectives

Drilling a borehole of this depth and diameter is a large undertaking and amongst the potential environmental impacts that need to be considered is the potential effect on groundwater resources, in local aquifers, including any consequential effects on surface waters with which such aquifers may be in hydraulic continuity.

The objective of this report is to identify any such effects on groundwater and to demonstrate that the risks are either too low to be of significance and/or to propose mitigation measures that show how significant risks, if any, will be effectively mitigated.

1.3 Issues to Consider

Based on assessments carried out in respect of similar sites, a check list of issues that require consideration in this assessment is considered to be:

- an interpretation of the hydrogeological conditions that characterise the area within reasonable influence of the drilling proposals;
- identification of aquifers and groundwater resources that may be put at risk;
- a review of site surface operations and their potential effect on controlled waters;
- a review of the proposed drilling operations, their potential to affect groundwater resources, and proposed mitigation measures;
- well abandonment proposals to ensure that no long term adverse effects will be experienced; and
- proposals to mark the location in the event that the exploratory borehole is abandoned.

1.4 Terms of Reference

Terms of Reference (ToR) have been agreed with Celtique and are presented at Appendix B.

1.5 Sources of Information

A full list of references is presented at Section 8.

2.0 PHYSICAL SETTING

2.1 Site Location and Layout

Relevant location maps are attached at Appendix A, including the licence areas (Drawing 12049/001) and the site location (Drawing 12049/002), both in map form and as an aerial photograph (Drawing 12049/003). Drawing 12049/004 is a plan showing the drill site area, and Drawing 12049/005 shows the trajectory of the proposed exploratory borehole.

2.2 Landscape and Topography

The drill site is located 2-3km south-south-east of Billingshurst, just off the B1233 to the west of the village of Broadford Bridge. The area is open farmland with small areas of woodland. Pocock's Wood is to the north of the site and Prince's Wood is to the east, with Broadford Bridge Farm House beyond that (Drawing 12049/002). The drill site is approximately +27m AOD with the land sloping generally south eastwards towards an un-named brook that is marked on maps as a 'drain'. Broadford Bridge Village is approximately 600m east of the drill site.

The proposed borehole deviates to the north-north-west and will terminate at a point 950m away, approximately at Jackman's Farm.

2.3 Site History

Previous edition Ordnance Survey maps are contained within the ***Groundsure*** report at Appendix C. The maps, which date back to 1875, indicate that the site is previously undeveloped farmland.

2.4 Hydrology and Drainage

2.4.1 General

Drainage and flood risk issues are dealt with in a separate report. Hydrological conditions are discussed here insofar as they interact with groundwater.

2.4.2 Surface Water Features

The features referred to are shown on the drawings attached at Annex A and as Figure 5d of the ***Groundsure EnviroInsight*** section of the Groundsure report at Appendix C.

The drill site is in the catchment of the River Adur, which has a distinctly dendritic drainage configuration and reaches the sea at Shoreham. A north-east flowing tributary brook of the

Adur is located on lower ground some 400m south east of the drill site and flows through Broadford Bridge.

In addition, a small pond is located in Prince's Wood with a drainage outflow to the north that connects with another tributary of the River Adur. The pond is 250m east of the drill site.

There are no licensed surface water abstractions within 1km of the drill site.

2.5 Protected Sites

Reference to the Natural England website indicates that there are no protected sites within influential distance of the drill site, the closest being >10km distant. Map 7 of the EnviroInsight section of the Groundsure Report also confirms that there are no environmentally sensitive sites within 500m of the drill site boundary.

Given the distances to these sites from the drill site area, and the reliance of the sites on factors that are unaffected by the drilling operation, no adverse impact on these protected sites is anticipated.

It is reported that Prince's Wood is designated Ancient and Semi-Natural Woodland with a requirement that root zones will need to be protected. In the main, Prince's Wood is upstream or cross-gradient from the drill site and access track in groundwater flow terms. (see below).

2.6 Geology

2.6.1 Geological Setting

This section briefly describes the geological conditions in the area relevant to the drilling proposals, which are presented separately and in more detail in Section 3.

The Willow#1 site is located on the southern side of the Weald Basin. The geological conditions are illustrated on Drawing 10121/007 at Appendix A, which has been compiled from the BGS 1:50,000 sheets 317/332 (Chichester and Bognor) and 318/333 (Brighton and Worthing) as the site is close to the border between the two. Local geological information is provided in the ***Groundsure GeoInsight*** section of the Groundsure report presented at Appendix C.

In summary, it is an area where Lower Cretaceous Wealden Beds dip southwards towards the South Downs where they become overlain by younger Lower Greensand and Chalk sequences. There are no superficial deposits in the vicinity of the drill site and the Wealden Beds are underlain by a progressively older sequence of Mesozoic and Palaeozoic rocks.

2.6.2 Stratigraphy

It is expected that the proposed Willow#1 borehole will penetrate the geological sequence listed in Table 2.1 below. It may be noted that because of the slightly deviating nature of the proposed exploratory borehole there are minor differences between metreage drilled and cased and the actual depths below ground level where the formations are encountered.

Table 2.1 Geological Succession Expected at the Willow#1 Borehole (Numbers rounded to nearest ft or m)

Unit Name and Age			Estimated Drilled Depth to top of Formations Shown		Unit Thickness Penetrated	
			ft	m (rounded)	ft	m (rounded)
Lower Cretaceous (Wealden Beds)		Weald Clay	0		922	281
	Hastings Beds	Upper Tunbridge Wells Sand	922	281	173	53
		Grinstead Clay	1095	334	97	30
		Lower Tunbridge Wells Sand	1192	363	90	27
		Wadhurst Clay	1282	391	185	56
		Ashdown Beds	1467	447	535	163
Upper Jurassic		Upper Purbeck Beds	2002	610	259	79
		Middle Purbeck Beds	2261	689	279	85
		Lower Purbeck Beds	2540	774	457	139
		Purbeck Anhydrite	2999	914	98	30
		Portland Beds	3097	944	197	60
		Kimmeridge Clay	3296	1005	1473	449
		Corallian Beds	4587	1398	418	129
		Fault	5356	1633	-	-
		Oxford Clay	NP		NP	
Middle Jurassic		Kellaways Beds	NP		NP	
		Cornbrash	NP		NP	
		Great Oolite	NP		NP	
		Fullers Earth	NP		NP	
		Inferior Oolite	5355	1632	372	113
Lower Jurassic		Upper Lias	5967	1819	414	126
		Middle Lias	6747	2056	612	187
		Lower Lias	7756	2364	774	236
Triassic		Triassic	8608	2624	840	256
		Sherwood Sandstone	9501	2896	387	387
-		Palaeozoic	9914	3022	189+	58+
		Total Depth	**10114**	3083		

Available geological mapping shows Weald Clay underlying the site and surrounding area with no superficial cover. The Upper Tunbridge Wells Sand formation lies below the Weald Clay but does not crop out in this area, doing so some 10km to the north-west.

BGS Sheet 318/333 differentiates the Wealden Beds stratigraphy in more detail and by reference to this map and the BGS Lexicon it is possible to define the stratigraphy more precisely.

The key features are that the Tunbridge Wells Sand Formation is separated into Upper and Lower parts by the Grinstead Clay. The Lower Tunbridge Wells Sand is then underlain by the Wadhurst Clay Formation and the Ashdown Formation, the latter overlying the Purbeck Beds. Beds between the Upper Tunbridge Wells Sands and the Ashdown Beds are collectively known as the Hastings Beds, and these, combined with the Weald Clay, are referred to as the Wealden Beds.

2.6.3 Lithology

The lithological characteristics of the individual units are summarised in Table 2.2. The information presented is taken from regional geological mapping and associated reports.

Table 2.2: Lithological Descriptions

Stratigraphic Unit	Lithological Description
Weald Clay	Pale to dark grey clay or mudstone, locally with subordinate lenticular sandstone and limestone layers.
Upper Tunbridge Wells Sand	Interbedded siltstone, silty mudstone and sandstone.
Grinstead Clay	Principally shale and mudstone.
Lower Tunbridge Wells Sand	Coarse-grained quartzose sandstone overlying interbedded siltstone and sandstone.
Wadhurst Clay	Dark grey shale and mudstone plus minor sandstone.
Ashdown Beds	Fine-grained silty sandstone and mudstone.
Purbeck Beds	Calcareous claystones, grading to silty claystone, locally with subordinate interbeds of limestone and coal.
Purbeck Anhydrite	Anhydrite with claystone, fossiliferous limestone and coal interbeds.
Portland Sandstone	Firm to moderately hard fine grained sandstone or siltstone.
Kimmeridge Clay	Thick sequence of moderately calcareous and silty claystone with thin limestone stringers.
Corallian Beds	Argillaceous limestone grading to calcareous claystone, interbedded with siltstone, sandstone and thin limestone stringers.
Oxford Clay	These formations will not be encountered due to faulting.
Kellaways Beds	
Cornbrash	
Great Oolite	
Fullers Earth	
Inferior Oolite	Shelly limestone, calcareous mudstone and sandy limestone.
Upper Lias	Calcareous mudstone and shale.
Middle Lias	Micaceous mudstone grading upwards into siltstone, sandstone and limestone.
Lower Lias	Alternating shale, mudstone and limestone.
Triassic	Mercia Mudstone overlying Sherwood Sandstone and the Rhaetic.
Palaeozoic	Not known.

The Weald Clay formation contains minor and sometimes discontinuous bands of sandstone, the location of which, in relation to the drill site, is evident on Map 1.3 (Page 9) of the ***Groundsure GeoInsight*** section of the Groundsure report at Appendix C . The closest outcrops are approximately 500m north and 400m south of the site.

2.7 Structure

There are no superficial deposits in the drill site area, the closest ones being the tracts of alluvium and Head Deposits approximately 3km east of the drill site.

The shallower rock sequence represented by the Wealden Beds dips gently southwards to pass beneath the South Downs. There is no evidence of faulting in the rocks in the vicinity of the site in the Cretaceous formations but there is faulting at depth in the Jurassic and older strata.

2.8 Hydrogeology

2.8.1 The Aquifer System

The stratigraphy and lithology summarised in Tables 2.1 and 2.2 results in the aquifer system presented in Table 2.3 below. The Aquifer Designation accords with the latest Environment Agency Groundwater Protection Policy (GP3).

Table 2.3: The Aquifer System

Stratigraphic Unit	Aquifer Designation	Inferred or Recorded Aquifer Characteristics
Weald Clay Formation	Mostly unproductive strata but includes minor sandstones and limestone which are given Secondary A status (formerly designated a minor aquifer of low vulnerability)	Sandstone inferred to have moderate primary and secondary porosity and permeability with resource value constrained by limited lateral extent.
Upper Tunbridge Wells Sand	Secondary A	Recorded as sandstone and siltstone. Presumed in parts to have moderate to high primary and secondary porosity and permeability.
Grinstead Clay	Unproductive strata	
Lower Tunbridge Wells Sands	Secondary A	Recorded as sandstone and siltstone. Presumed in parts to have moderate to high primary and secondary porosity and permeability.
Wadhurst Clay	Mostly unproductive strata but includes minor sandstones and limestone which are given Secondary A status	Sandstone inferred to have moderate primary and secondary porosity and permeability with resource value constrained by limited lateral extent.
Ashdown Beds	Sands and sandstone layers are given Secondary A status	Sandstone inferred to have moderate primary and secondary porosity and permeability with resource value constrained by limited lateral extent.

Stratigraphic Unit	Aquifer Designation	Inferred or Recorded Aquifer Characteristics
Purbeck Beds	Formations below this depth (i.e. > 400m begl) are generally not recognised as aquifers in this region, being too deep to exploit and likely to contain poor quality groundwater	Mostly low permeability argillaceous formations not used as aquifers.
Purbeck Anhydrite		
Portland Sandstone		
Kimmeridge Clay		
Corallian Beds		
Oxford Clay		
Kellaways Beds		
Cornbrash		
Great Oolite		A Principal Aquifer outside of this region, whose aquifer properties are mainly dependent on extensive secondary porosity and permeability which is unlikely to be extensively developed at the depth at which it occurs in this region.
Fullers Earth		Mostly low permeability argillaceous formations not used as aquifers.
Inferior Oolite		
Upper Lias		
Middle Lias		
Lower Lias		
Triassic		Includes the Sherwood Sandstone, which is a Principal Aquifer outside of this region. Unlikely to contain freshwater at this depth (>1500m) and thought to be hydrocarbon-bearing.
Palaeozoic		

The geological structure is such that the proposed exploratory borehole:

- will not penetrate any of the Secondary Aquifers formed by the superficial deposits to the east;
- will not encounter the Upper Tunbridge Wells Sand until a drilled depth of approximately 281m begl has been reached; and
- may penetrate the Secondary Aquifers formed by the sandstone and limestone lenses within the Weald Clay but down-dip or cross-strike of any water supply boreholes that penetrate them.

Map 5b of the GeoInsight section of the Groundsure Report at Appendix C shows the distribution of aquifers within 500mm of the dill site. The only ones present are the Secondary A aquifers associated with sandstones in the Weald Clay Formation, some of which are clearly discontinuous. The remaining area is classified as ‘Unproductive Strata’.

2.8.2 Groundwater Levels and Flow

There are no data on groundwater levels and flow in the area. However it may be inferred that:

- the Weald Clay materials directly beneath the drill site are likely to be characterised by a low overall permeability with little deep infiltration of rainfall and shallow down-slope interflow only;

- groundwater in the superficial deposits and in the Secondary Aquifer sandstones and in the Weald Clay:

    - is locally recharged and unconfined at outcrop with subsequent down-dip flow into a confined zone;

    - is characterised by a low overall throughput of water;

- groundwater in the deeper Secondary Aquifers, starting with the Upper Tunbridge Wells Sand:

    - will be recharged on the outcrop area, which is some 10km to the north east and beyond;

    - will flow southwards according to the regional dip of the strata; and

    - has no practical connection with groundwater beneath the site or with the strata through which the proposed hydrocarbon exploratory borehole will penetrate.

Regarding the southerly groundwater flow in the deeper Secondary Aquifers, the actual depth of the aquifers beneath the drill site may be such that there is little actual groundwater movement in that area. Hydrochemical processes may then be such that the groundwater is of poor quality.

2.8.3 Groundwater Utilisation

The EnviroInsight section of the Groundsure Report included at Appendix C includes a record of licensed groundwater and surface water abstractions in an area up to 1000m away from the drill site. There are no licensed groundwater abstractions in this area, nor are there are any Source Protection Zones, the closest being those associated with the Lower Greensand formations to the south, which are not penetrated by the proposed borehole.

Drawing 12049/006 shows the location of a series of water wells in the area as recorded by BGS. None would be expected to be hydraulically connected to the proposed exploratory borehole, being either up-gradient, in different groundwater catchments, or in aquifers not penetrated by the proposed borehole.

2.8.4 Groundwater Vulnerability

The Groundwater Vulnerability Map for the area (Sheet 45, West Sussex and Surrey) indicates the Secondary Aquifers referred to above (termed Minor Aquifers on the map) to be characterised by low vulnerability, which means that they are relatively resistant to pollution occurring at the surface.

2.9 Summary of Hydrogeological Conditions

The aquifer system in the assessment area includes a series of Secondary Aquifers that are either not encountered by the proposed exploratory borehole or are only encountered at significant depth. There are no licensed water supply boreholes within 1km of the site, and the nearest Source Protection Zone is > 10km away. Generally this is not an area where groundwater is used for water supply or makes a significant contribution to river baseflow.

It may be reasonably stated that, overall, the area around the drill site and the geological sequence through which the borehole penetrates are both characterised by a low vulnerability to pollution.

3.0 EXPLORATORY DRILLING PROPOSALS

3.1 General

Specific issues relevant to this groundwater risk assessment are presented below.

A photograph and graphic of a drilling operation similar to that to be used at Willow#1 is attached at Appendix D.

For clarification the terms 'well' and 'exploratory borehole', as used in this Hydrock report and in Appendices supplied by others, may be regarded as synonymous.

3.2 Well Location and Trajectory

3.2.1 Location

The wellhead location is at a location 600m west of Broadford Bridge. However, the exploratory borehole is deviated (i.e. drilled non-vertically) so the point below which it terminates is some 950m north west of where it starts.

3.2.2 Well Plan

The main components of the well plan relevant to this Groundwater Risk Assessment are:

- Installation of a 20" conductor pipe pre-driven to refusal or augured and grouted in place (approximate depth 20m (65ft)) before the rig is moved onto location;
- Drill 17½" vertical hole some 40 ft (12m) into the Wadhurst Clay using a fresh water drilling fluid and bentonite to minimize damage to any local aquifers expected to be encountered in the Lower Cretaceous formations;
- Run 13⅜" casing to the same depth and cement back to the cellar;
- Drill out of the casing shoe with a 12¼" drill bit and at 2500 ft, kick off the well on a 348º azimuth and build angle at 1.15º/100 ft.
- Continue to drill ahead building angle and maintain the tangent at 58º;
- Drill ahead into the top of the Upper Lias;
- Run and cement 9⅝" casing to approximately that depth and cement to surface;
- Drill out the casing shoe in 8½" hole with a K_2CO_3/Polymer/Glycol mud system;

- Drill ahead in 8½" hole through the Upper Lias and Middle Lias to hit the top of the Sherwood Sandstone;
- If the Sherwood Sandstone appears to be hydrocarbon bearing stop drilling;
- Run and cement 7" liner allowing 150 ft overlap in the 9⅝" casing;
- After cleaning out and testing the 7" liner, drill out the casing shoe and drill ahead in 6" hole with a cleaned $KaCO_3$/Polymer/Glycol mud system.
- Total depth is prognosed to be approximately 175 ft into the Palaeozoic.
- Contingent upon the results of mud and wireline log analysis and visual core indications, the well may be completed to facilitate testing once the rig has moved off location. If the tests are encouraging, the well will be suspended pending installation of production facilities.
- If the well is unsuccessful, it will be plugged and abandoned according to an approved program.

3.3 Site Preparation

Site preparation is described at Appendix E. Key features are:

- installation of an impermeable HDPE membrane protected above and below to prevent rupture (see photographs at Appendix E); and
- installation of a protected drainage system that prevents release of contaminated fluids into the off-site drainage system.

In respect of the last point about drainage:

- any water contaminated with oil will be collected for off-site disposal at an appropriate facility; and
- both the site and the connected drainage ditches are lined to the point where water discharges off site via an interceptor.

Thus contamination of the surface water system outwith the site is fully prevented by the interceptor.

3.4 Timescale

Typically the drilling of this borehole would be expected to be completed in 3-4 weeks.

3.5 Mud Programme

In principle, the objective is to create a mud with a weight (measured in pounds per gallon, or ppg) that is sufficiently dense (i.e. balanced) to balance the formation pressures but minimises invasion of mud into the formation (overbalanced). In productive horizons, such invasion may result in formation damage, thereby inhibiting the capacity of the formation to release hydrocarbons. Both there and in non-productive horizons the loss in circulating volumes arising from mud invasion needs to be made up, which is an additional cost.

Therefore, the onus is on the drilling contractor to keep mud invasion and losses to an absolute minimum.

3.6 Lost Circulation Issues

It is recognised that mud infiltration and formation damage need to be avoided, and this will be achieved by drilling close to balance with a non-damaging mud system.

On that basis, lost circulation is not anticipated to be a significant issue at this site.

3.7 Casing and Cementing

All casing is threaded, not welded, thereby reducing the potential for corrosion. Cement is pumped into place either through the drill string which is stabbed into the float collar, or through the casing separated by drillable rubber plugs.

4.0 WELL ABANDONMENT ISSUES

4.1 Context

Concerns are sometimes raised regarding the long-term risks associated with the well when its working life ceases. This could be:

- in the event of the well being abandoned as a dry hole; or
- if it becomes a production well that is subsequently abandoned.

This section of the report reviews the issues and presents a general commitment to abandonment proposals.

4.2 Industry Best Practice

4.2.1 Objectives

Well abandonment occurs wherever hydrocarbon production bores are installed and is thus an issue to be considered world-wide by the industry. Whilst there is no UK industry-specific guidance or set of regulations to follow concerning this issue, Celtique is committed to following a best practice approach to abandonment of the Willow#1 borehole, whether it be dry hole abandonment or post-production.

The general approach to be adopted is exemplified by the Environment Agency guidance and the technical paper presented herein at Appendix F. The key objectives are:

- protecting freshwater resources;
- preventing surface pollution;
- meeting all regulatory requirements; and
- protecting remaining hydrocarbon reserves.

In the technical paper presented at Appendix F it is suggested that the abandonment installation must prevent transfer of fluids created by pressure gradients between different horizons. It is noted that this may be achieved by a combination of original casing and cementing programmes and by post abandonment cement plug installations, which is the basis of the approach to be taken by Celtique. Filling the entire bore with cement is noted as not being cost-effective, nor does it meet sustainability criteria.

4.2.2 Specific Issues

Use of a drilling rig to complete well abandonment

A drilling rig will be used when cementing to plug the hydrocarbon-bearing formation and other critical parts of the well.

Cementing

Cement plugs will be designed in accordance with the hole conditions at the required setting depth. If necessary the well will be cleaned prior to pumping in the cement to ensure a good bond to the pipe wall. The cement plugs will be circulated in place and will be of adequate length to seal off the required horizons, including any perforated zones. Pressure will be applied to ensure that the cement enters the perforations, where these exist.

Isolating freshwater Intervals

The proposed construction of the borehole, with all formations down to the Portland Sandstone being cased and cemented off, will ensure no exposure of the cretaceous minor aquifers to hydrocarbons arising from the deeper strata.

Surface Isolation

A 0-250ft (76m) cement plug will be placed to avoid the risk of surface pollution occurring.

Surface clean-up

The site will be fully restored upon completion and the well will be be sealed with a steel plate over the 9 ⅝” casing.

In the event of any contamination due to hydrocarbon spillage or other related matters, remediation proposals will be drawn up for Local Authority and Environment Agency approval.

Insurances

Celtique maintains insurances that cover the cost of environmental impairment attributable to its operational activities. However, it may be noted that of the 2000+ hydrocarbon exploratory boreholes drilled onshore in the UK, none has cause significant pollution of ground or surface waters.

4.3 Materials Durability

4.3.1 Issues to Consider

The issues to consider are the life expectancy of the cement and the casing, so as to maintain the isolation between the formations. In practice there is little published information relevant to this issue and first-principles assessment is required.

The principal issues are considered to be the failure of the cement plugs and casing.

4.3.2 Cement

Cement, in the form of mortar or concrete, is normally exposed to deterioration above, at or close to the ground surface. Deterioration occurs due to chemical attack, weathering, or a combination of both. Chemical deterioration is often associated with the presence of sulphate at unacceptably high levels and classes of cement vary according to the sulphate content of the soil to which it may be exposed.

Use of cement at the depths involved will eliminate the issue of weathering, leaving chemical change as the only potential cause of deterioration. Sulphate in the shallower zones would be expected to be normal for freshwater conditions. Generally, therefore, the cement lining in this section would be expected to be stable for the foreseeable future.

At depth, some formations may be sulphurous and pyrite-rich. Therefore sulphate attack on cement in, say, the 7” casing zone, is a possibility. A class of cement resistant to such attack will be used in that section, both for cementing the casing and for the cement plugs. As with the section of hole above that, if the appropriate class of cement is used the cement lining in this section would be expected to be stable for the foreseeable future.

4.3.3 Casing

The casing used in the well construction has a high column strength, which is attributable to a substantial wall thickness of approximately 0.4 in (10mm). When in place, the outside of the casing is protected from corrosion by the cement linings so out-to-in corrosion will not occur. In-to-out corrosion is a possibility, however, the timescales would be expected to be very long because of the sealed environment created by the cement plugs and the filling of the space between the cement plugs with a pH-balanced drilling mud.

Whilst there is no proof of corrosion rates the conditions created are indicative of it being an extremely slow process.

5.0 CONCEPTUAL RISK MODEL

5.1 General

The conceptual risk model is presented in the form of a source-pathway-receptor assessment to identify pollution linkages that may be considered to be plausible. Initially these factors are presented as potential sources, pathways and receptors, which may subsequently be shown not to connect to form a significant pollution linkage.

5.2 Sources of Contamination

The principal potential sources of contamination are:

- materials stored at the surface in the wellhead area;
- substances present in the drilling mud used in the drilling process; and
- hydrocarbons and other contaminants present in formations encountered.

5.3 Pathways

The potential pathways are:

- leakage of substances stored at the surface and their downward migration to contaminate groundwater in water bearing horizons;
- as above, directly via the drilled borehole;
- the release of contaminants to surface water via contaminated runoff; and
- the upward escape of hydrocarbons or other contaminants to contaminate aquifers present above them:
    1. during drilling;
    2. during a potential production phase ; and
    3. post-abandonment.

5.4 Receptors

The principal receptors are:

- groundwater resources in the Secondary Aquifers;
- the off-site surface water system; and
- surface waters in hydraulic continuity with either of the above aquifers.

5.5 Pollution Linkages

Using these Source-Pathway-Receptor relationship components the resulting pollution linkages are evaluated in Section 6 below.

5.6 Non-Pollution Risks

The only potential non-pollution risk is the potential effect on soil moisture in Princes Wood. This matter is also dealt with in Section 6.

6.0 RISK ASSESSMENT AND MITIGATION

6.1 Approach

Each of the issues mentioned in Section 5 can be rationalised into a series of plausible pollution linkages, that is, source-pathway-receptor relationships, each of which is given separate consideration below.

6.2 Downward Leakage of Substances Stored or In Use at the Ground Surface

Substances stored or in use at the surface include:

- substances and additives used to make up drilling fluids;
- substances used in routine maintenance of mechanical equipment;
- wastes derived from the drilling operation, possibly containing hydrocarbons; and
- stored hydrocarbons if the well is productive.

Irrespective of the substances concerned this pathway is broken by:

- the naturally low permeability of the Weald Clay that underlies the site; and
- the presence of an impermeable artificial liner.

As such, this potential pollution linkage is not viable.

6.3 Off-Site Migration of Contaminated Run-off

All site run-off will drain to a lined ditch and a Class 2 interceptor. All accidental spills from any on-site source will therefore be contained and contamination of the surface water system is prevented.

6.4 Direct Transfer of Surface Runoff etc into the Borehole During Drilling

The HDPE membrane is sealed around the concrete rings forming the cellar, which will prevent ingress of contaminated surface water.

6.5 Contamination of the Hastings Beds During Drilling

Drilling of the 17½" hole through the Hastings Beds creates the possibility of drilling fluids entering the Upper and Lower Tunbridge Wells Sand Secondary Aquifers, although the

water-based mud has an inherently low contaminative effect and the consistency of the drilling mud will be managed to minimise lost circulation.

In addition, the expected hydraulic properties and hydrogeological setting of these formations in relation to the length of time that they are exposed to drilling fluids prior to casing installation are such that the likelihood of significant mud invasion across any distance is very low.

6.6 Risks Associated with Hydrocarbons

6.6.1 During Drilling

Hydrocarbons will not be encountered until after the 13 ⅜" steel casing is installed and cemented in across the Upper and Lower Tunbridge Wells Sand. Thus there is no risk to these aquifers during drilling.

After installation of the 13 ⅜" steel casing a blow out preventer will be fitted at well head. This will prevent any uncontrolled escape of hydrocarbons during drilling, thereby eliminating the consequential environmental risk.

6.6.2 During Production

The cemented 13 ⅜" steel casing will remain in place, thus preventing aquifer contamination.

Recovered crude oil will be produced through a string of 2⅞" tubing run in the well. It will be stored at the surface in bunded tanks and will be taken off site in tankers. Currently there are no plans for off-site transfer pipelines. In the event of any spillage the HDPE lining and ditch/interceptor system will prevent surface and groundwater pollution.

6.6.3 Post Abandonment

Prior to abandonment the well will be fitted with cement plugs. In the long term there is a theoretical risk of deterioration of the casing and screen, thereby linking the hydrocarbons to the aquifers. Noting that there is a general commitment to abandonment using best practice-industry standards it is suggested that for all practical purposes this risk is remote because:

- perforated casing sections in the production zones will be plugged with cement, thereby preventing the escape of residual hydrocarbons left in the reservoir (noting that, by that time, production will have removed most of the hydrocarbons present);
- the cement plugs and cement used in the casing will be placed in neutral pH environments, thereby minimising the risk of attack by acidisation;
- where necessary, sulphate-resistant cement will be used to minimise the risk of sulphate attack; and

- the steel casings will be protected:

    1. externally by the cement lining and;

    2. internally by creation of a pH neutral environment and the development of anaerobic conditions.

6.7 Non-Pollution Risks

As noted above, he only potential non pollution risk is the potential effect on soil moisture in Princes Wood.

Whilst the access track is upstream of the wood in terms of groundwater flow, due to the low permeability soil conditions, this is a very small component of the water balance and no significant adverse effects would be expected. The landscape is such that the access track hardly constitutes a break in slope and the depth of ground disturbance to create it is no more than 300mm. As such, the access track will not interrupt either transmission of down-slope run-off or shallow interflow.

In practice, soil moisture in the woodland is most likely to be controlled by rainfall falling on it balanced by losses due to evapotranspiration.

7.0 CONCLUSIONS

The following conclusions are drawn from this assessment:

- the proposed drill site location is some 300m west of the village of Broadford Bridge;
- the hole will terminate beneath a location 950m north west of the drill site at Jackman's Farm;
- there are no protected sites within 10km of the drill site and those beyond the influence of it in terms of groundwater;
- the moisture content of soils beneath Prince's Wood is not expected to be significantly affected by the drill site or its access track to the road network because soil moisture in the wood is mostly controlled by rainfall and evaporation within the woodland boundary;
- in practice, the design and configuration of the access road is such that it will not intercept either runoff or interflow (shallow subsurface flow in the otherwise unsaturated zone) and no significant effect on the water balance is anticipated;
- the trajectory of the borehole is such it will penetrate only two formations regarded as aquifers, the Upper and Lower Tunbridge Wells Sand formations, both of which have Secondary A aquifer status;
- however, in both cases the location at the point of intersection is substantially down dip or otherwise away from the nearest outcrop area and the depth below ground level at the point of intersection with the top of the Upper Tunbridge Wells Sand is 280m;
- the lack of aquifers at a reasonably shallow depth in this area accords with there being no licensed groundwater abstractions within 1km of a hypothetical line drawn between the drill site and the surface location of the well termination position;
- no wells beyond this 1km boundary will be affected by the drilling works because the formations penetrated by the proposed borehole will not be connected to them;
- there is a stream approximately 350m south east of the drill site and a precautionary approach will still be taken in respect of all drilling operations, as typified by the following methodologies and commitments:
    - construction of an engineered site, including a HDPE lining, to prevent downward escape of any spillages;
    - incorporation of a ditch to prevent uncontrolled off-site runoff;
    - use of non-toxic drilling fluids and careful control to prevent mud invasion; and
    - adoption of industry-standard, state-of-art techniques in respect of well abandonment.

The overall conclusion is that the risk to controlled waters as a result of the proposed drilling operation is very low and no adverse effect on Princes Wood is anticipated.

8.0 REFERENCES

Sources of information include principal reports and publications as referenced below plus correspondence and other items as referenced in the report text.

Publications

BGS/Environment Agency, 2000; The Physical Properties of Minor Aquifers in England & Wales. Technical Report WD/00/04.

BGS 1:50,000 sheets 317/332, Chichester and Bognor (solid and drift) and 318/333, Brighton and Worthing (solid and drift)

Kelm, C. K and Faul, R.R, Well Abandonment: A “Best Practices” Approach Can Reduce Environmental Risk, 1999, Society of Petroleum Engineers, SPE54344

Environment Agency, Decommissioning Redundant Boreholes and Wells

Websites

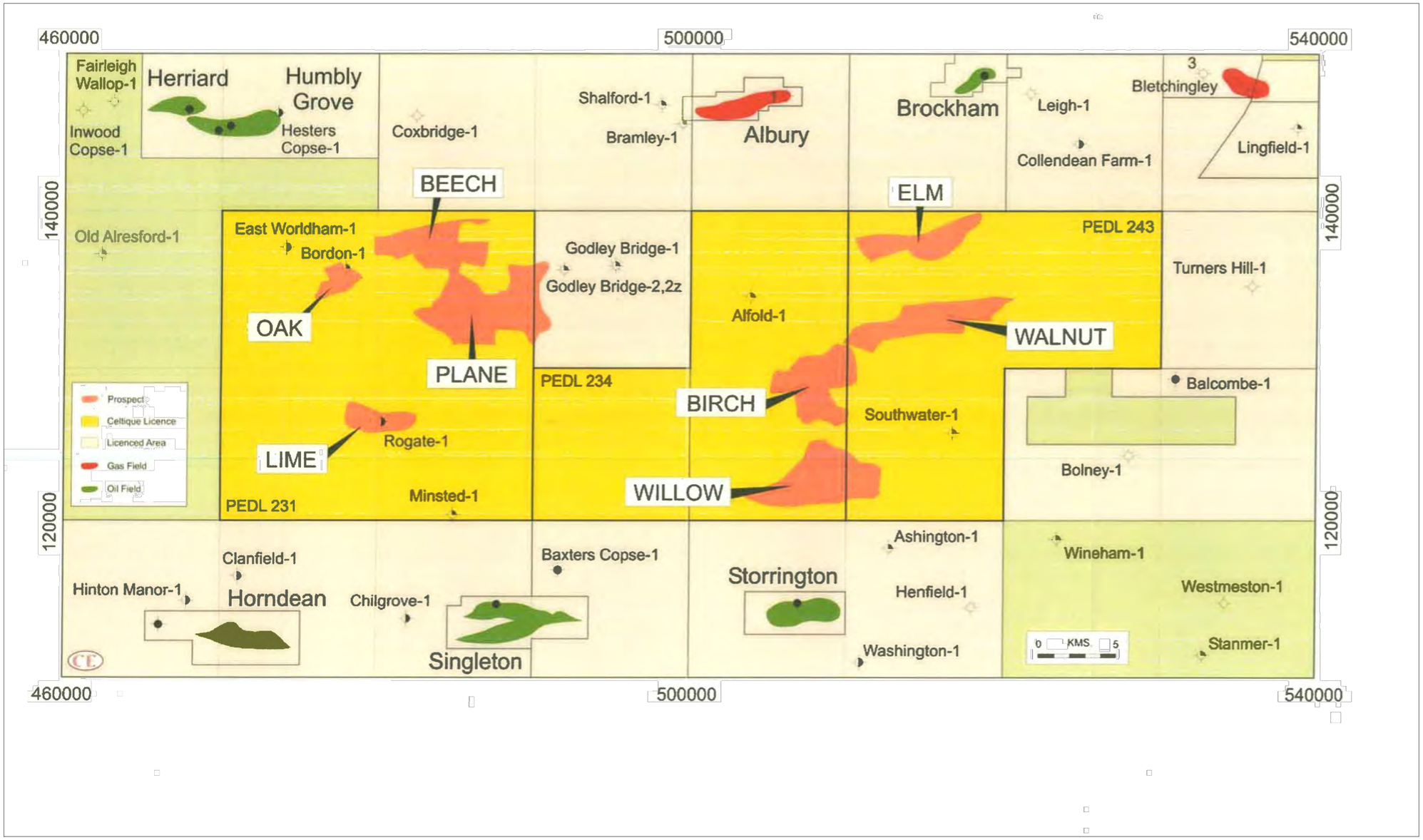
http://www.jncc.gov.uk/ProtectedSites/SACselection/sac.asp?EUCode=UK0012793 Joint Nature Conservation Committee website.

http://maps.environment-agency.gov.uk/wiyby/wiybyController Environment Agency “What’s in your backyard” website.

http://www.english-nature.org.uk/Special/sssi/unitlist.cfm?sssi_id=1000009 Natural England SSSI website.

Appendix A

DRAWINGS



Rev	Date	Description	Ckd	By

Hydrock

4th Floor, Churchill House
Regent Road
Hanley
Stoke on Trent ST1 3JJ
TEL: 01782 261 919
FAX: 01782 262 020
E-Mail: stoke@hydrock.com
or visit www.hydrock.com

Client
CELTIQUE ENERGIE

Project
WILLOW #1

Title
Licence Areas

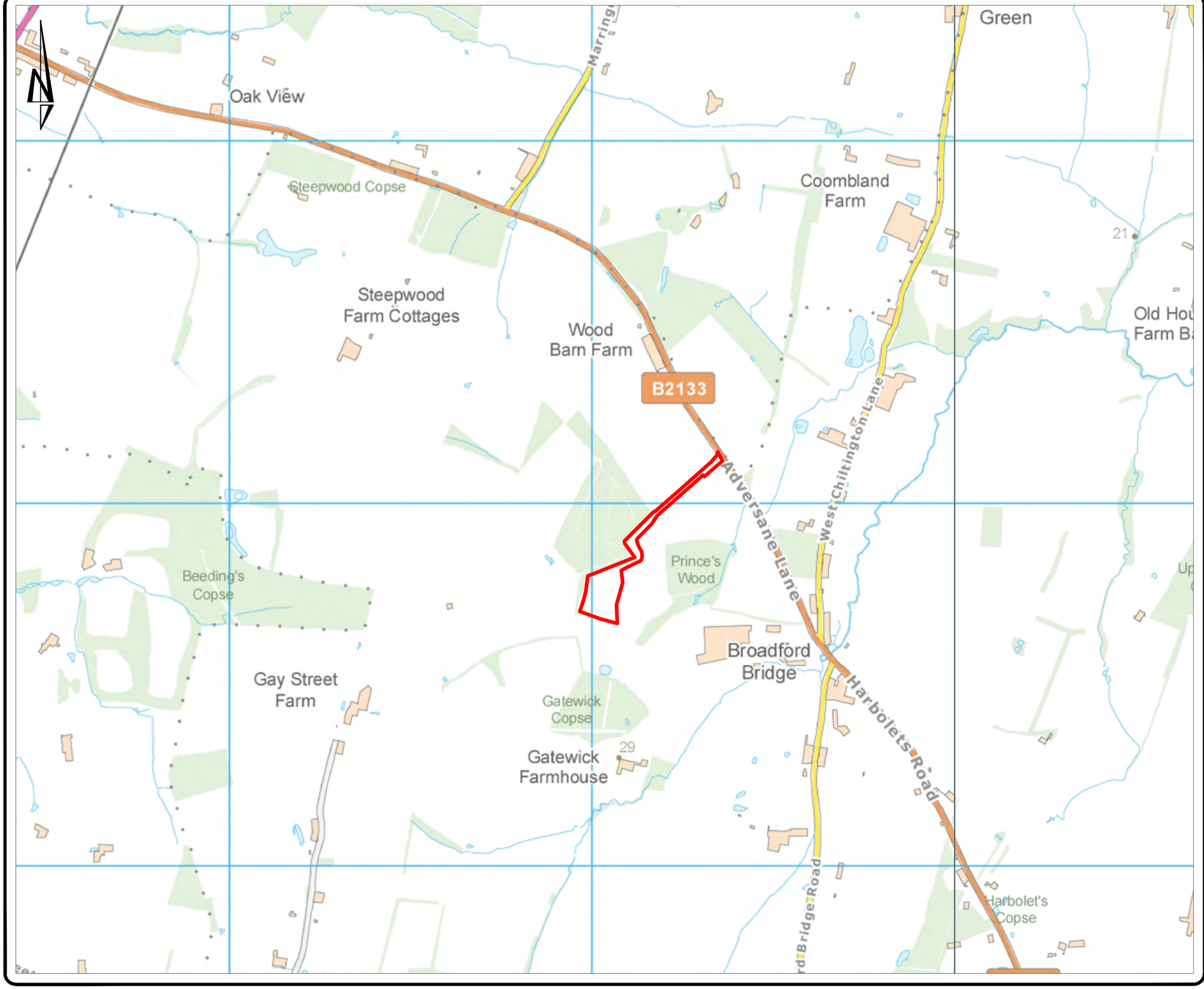
Drawing Status
FINAL

Job No.
C/12049

Drawn	Checked	Scale at A3	Date	Issue Date
LW	EC	As shown	23/05/12	23/05/12

Drawing No.
C12049/001

Revision
-



Notes:

Site Area

Rev	Date	Description	Ckd	By

Hydrock

4th Floor, Churchill House
Regent Road
Hanley
Stoke on Trent ST1 3JJ
TEL: 01782 261 919
FAX: 01782 262 020
E-Mail: stoke@hydrock.com
or visit www.hydrock.com

Client
CELTIQUE ENERGIE

Project
WILLOW #1

Title
Site Location

Drawing Status
FINAL

Job No.
C/12049

Drawn	Checked	Scale at A3	Date	Issue Date
LW	EC	1:10,000	23/05/12	23/05/12

Drawing No.
C12049/002

Revision
-

Notes:

Rev	Date	Description	Ckd	By

Hydrock

4th Floor, Churchill House
Regent Road
Hanley
Stoke on Trent ST1 3JJ
TEL: 01782 261 919
FAX: 01782 262 020
E-Mail: stoke@hydrock.com
or visit www.hydrock.com

Client
CELTIQUE ENERGIE

Project
WILLOW #1

Title
Aerial Photo

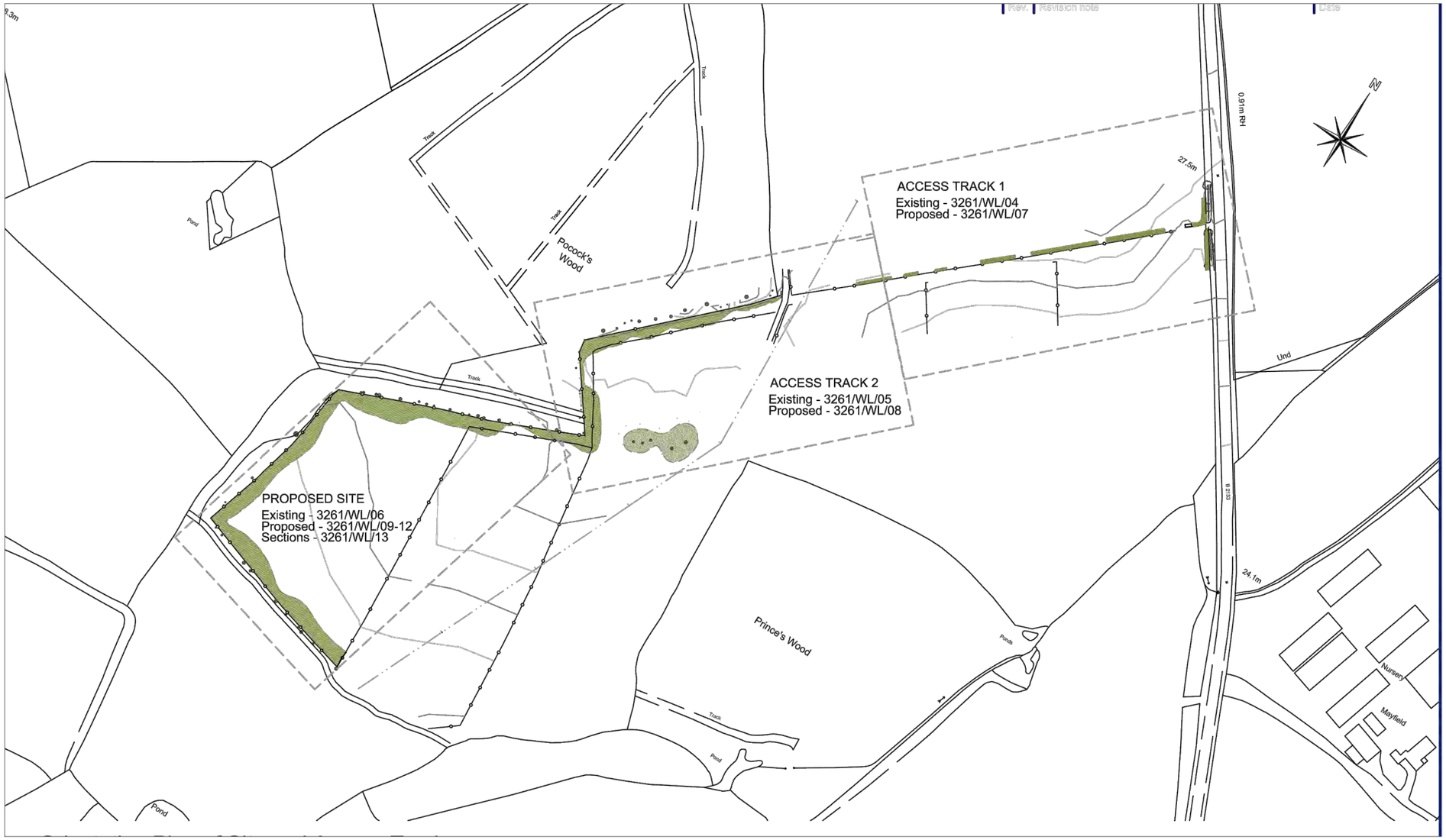
Drawing Status
FINAL

Job No.
C/12049

Drawn	Checked	Scale at A3	Date	Issue Date
LW	EC	1:5,000	23/05/12	23/05/12

Drawing No.
C12049/003

Revision
-



Based on Drawing 3261/WL/03 by R Elliot Associates Ltd.

Notes:

Rev	Date	Description	Ckd	By

Hydrock

4th Floor, Churchill House
Regent Road
Hanley
Stoke on Trent ST1 3JJ
TEL: 01782 261 919
FAX: 01782 262 020
E-Mail: stoke@hydrock.com
or visit www.hydrock.com

Client
CELTIQUE ENERGIE

Project
WILLOW #1

Title
Drill Site Area

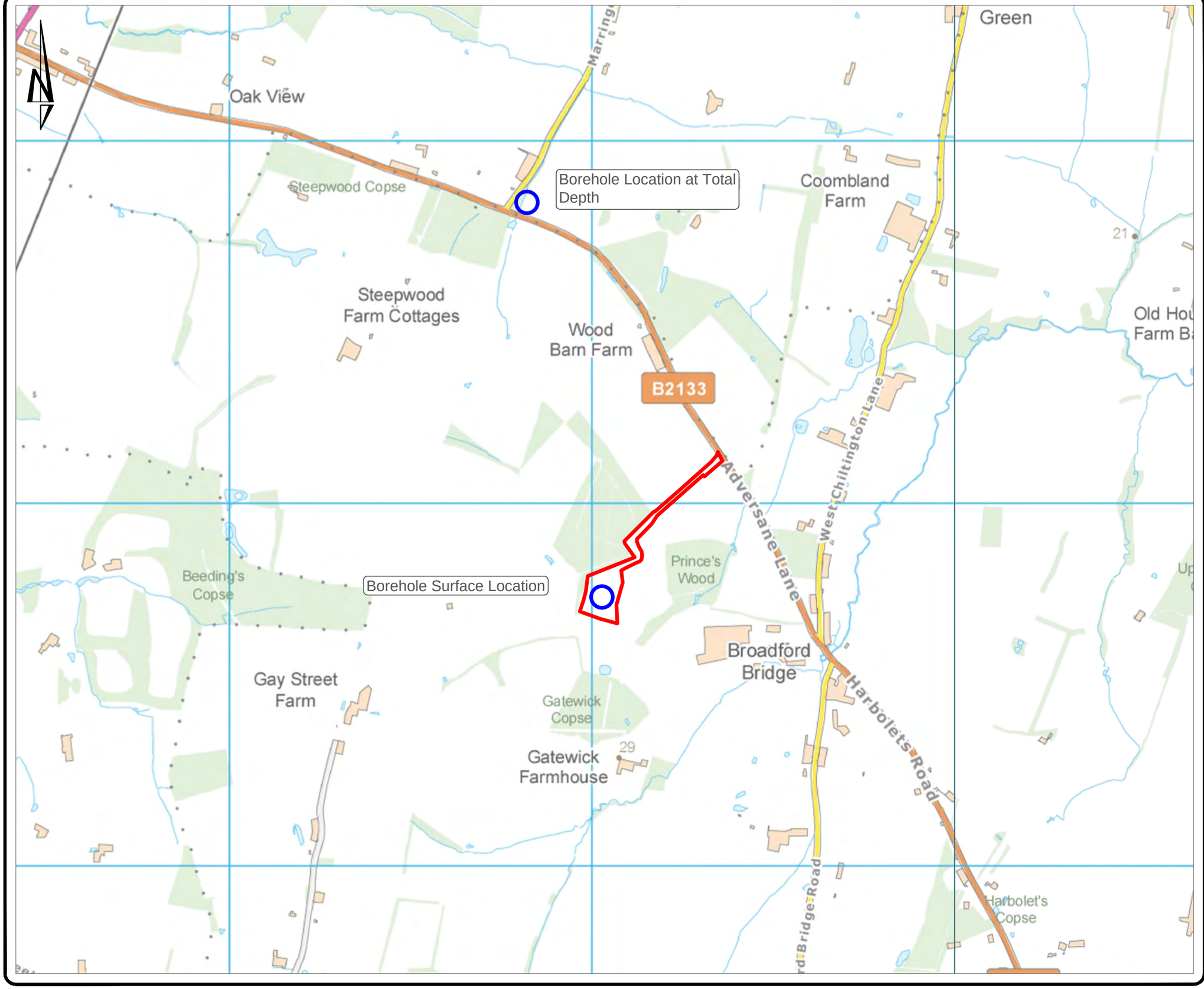
Drawing Status
FINAL

Job No.
C/12049

Drawn	Checked	Scale at A3	Date	Issue Date
LW	EC	NTS	23/05/12	23/05/12

Drawing No.
C12049/004

Revision
-



Notes:

Site Area

Rev	Date	Description	Ckd	By

Hydrock

4th Floor, Churchill House
Regent Road
Hanley
Stoke on Trent ST1 3JJ
TEL: 01782 261 919
FAX: 01782 262 020
E-Mail: stoke@hydrock.com
or visit www.hydrock.com

Client
CELTIQUE ENERGIE

Project
WILLOW #1

Title
Borehole Trajectory

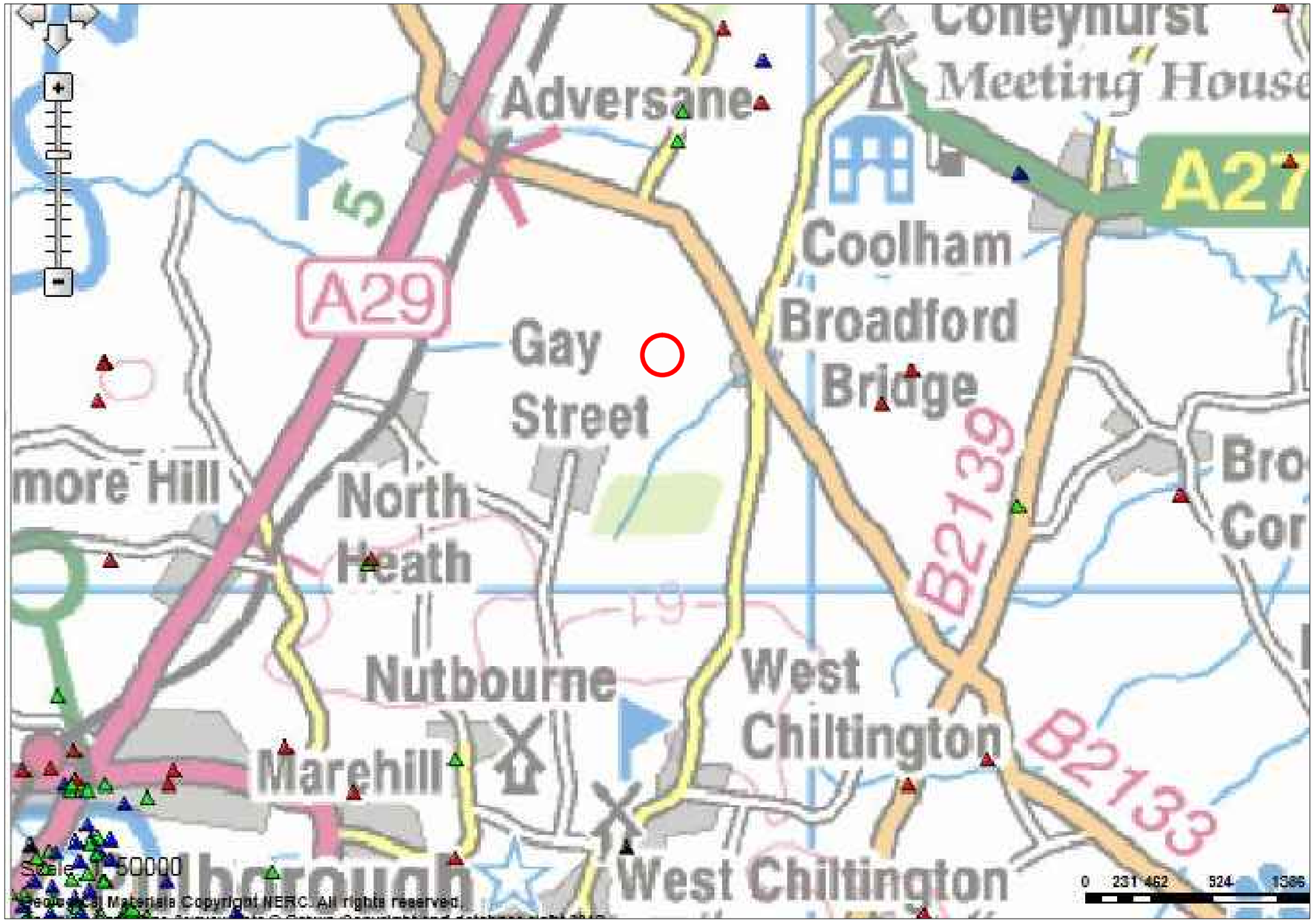
Drawing Status
FINAL

Job No.
C/12049

Drawn	Checked	Scale at A3	Date	Issue Date
LW	EC	1:10,000	23/05/12	23/05/12

Drawing No.
C12049/005

Revision
-



Notes:

Site Location

Water wells
- Not Available
- 0 - 10m
- 10 - 30m
- 30m+

Rev	Date	Description	Ckd	By

Hydrock

4th Floor, Churchill House
Regent Road
Hanley
Stoke on Trent ST1 3JJ
TEL: 01782 261 919
FAX: 01782 262 020
E-Mail: stoke@hydrock.com
or visit www.hydrock.com

Client: CELTIQUE ENERGIE

Project: WILLOW #1

Title: Location of Nearest Water Wells

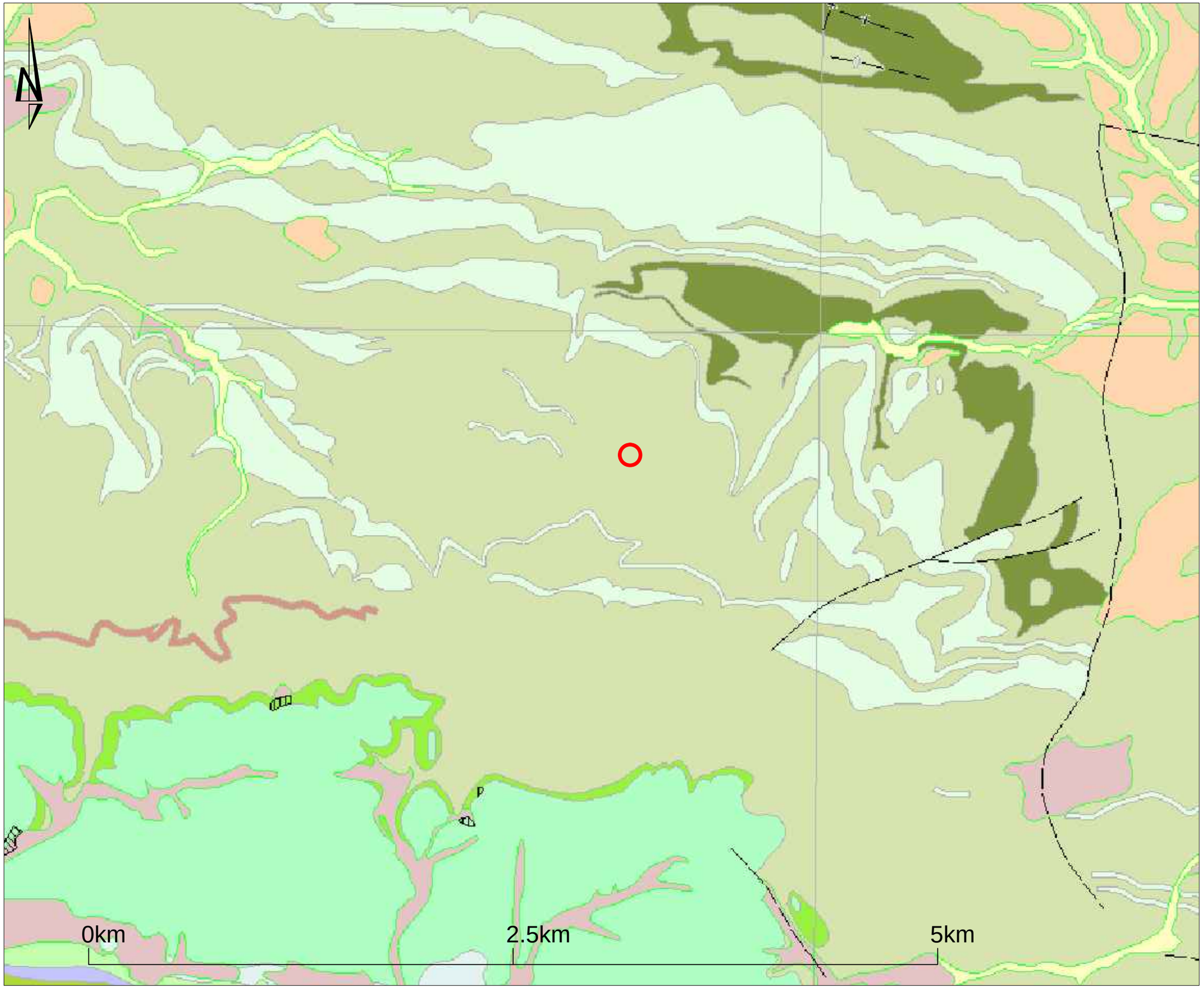
Drawing Status: FINAL

Job No.: C/12049

Drawn	Checked	Scale at A3	Date	Issue Date
LW	EC	As shown	23/05/12	23/05/12

Drawing No.: C12049/006

Revision: -



Notes:

Superficial deposits
- ALLUVIUM - CLAY, SILT, SAND AND GRAVEL
- ARUN TERRACE DEPOSITS, 2 MEMBER - SAND AND GRAVEL
- RIVER TERRACE DEPOSITS, 2 (ADUR) - SAND AND GRAVEL
- HEAD - CLAY, SILT, SAND AND GRAVEL

Bedrock geology
- ATHERFIELD CLAY FORMATION - MUDSTONE
- HYTHE FORMATION - SANDSTONE
- WEALD CLAY FORMATION - CLAY-IRONSTONE
- WEALD CLAY FORMATION - LIMESTONE
- WEALD CLAY FORMATION - MUDSTONE
- WEALD CLAY FORMATION - SANDSTONE

Site Area

Rev	Date	Description	Ckd	By

Hydrock

4th Floor, Churchill House
Regent Road
Hanley
Stoke on Trent ST1 3JJ
TEL: 01782 261 919
FAX: 01782 262 020
E-Mail: stoke@hydrock.com
or visit www.hydrock.com

Client: CELTIQUE ENERGIE

Project: WILLOW #1

Title: Geology

Drawing Status: FINAL

Job No.: C/12049

Drawn	Checked	Scale at A3	Date	Issue Date
LW	EC	As Shown	23/05/12	23/05/12

Drawing No.: C12049/007

Revision: -

Appendix B

TERMS OF REFERENCE

Hydrock Consultants Ltd
4th Floor
Churchill House
Regent Road
Hanley
Stoke-on-Trent
Staffordshire ST1 3JJ
United Kingdom

T +44 (0)1782 261919
F +44 (0)1782 262020
E stoke@hydrock.com

Hydrock
www.hydrock.com

Document ref: E7928/001

23 January 2012

Celtique Energie Petroleum Ltd
76-78 Charlotte Street
London
W1T 4QS

For the attention of Martin Berry

Dear Martin

PROPOSED HYDROCARBON EXPORATORY BOREHOLES
Groundwater Risk Assessment

It was a pleasure meeting you and your team in London last Thursday. In response to our discussions and your subsequent email I present the following proposal for your consideration.

1.0 Groundwater Risk Assessment for Exploration in the Weald Basin

1.1 Context

I note that you have a number of licensed prospects in the Weald Basin and wish to drill a number of hydrocarbon exploratory boreholes. All such activities will require planning permission and the delivery of an Environmental Impact Assessment (EIA). Part of the EIA will be a requirement to consider impact on groundwater, that is, aquifers that the well may be sited on or will penetrate. It will be a requirement to show that:

- the presence of aquifers have been recognised;
- that this risks to such aquifers has been professionally assessed (i.e. by professionals with a demonstrable expertise in hydrogeology); and
- that reasonable steps have been taken to mitigate any significant risks so identified.

A key consultee in this process will be the Environment Agency, who may seek to impose a separate condition regarding protection of Controlled Waters. Also, other consultees such as the local water company may also seek to have any of their concerns addressed.

It is should be noted that the extent of any concern will vary depending upon the hydrogeological conditions. For example, because of the aquifer system penetrated, a well site located on the Upper Chalk will be more of a groundwater protection issue than one founded on the Weald Clay. In this regard the first prospect, Willow 1, looks to be at the low end of the risk spectrum.

You may wish to note that Hydrock's appointment as remediation contractor on the Environment Agency's largest self-funded groundwater remediation scheme is a measure of our standing with the Agency in terms of technical competence.

1.2 Objectives

The objective of the Hydrock services will be to provide authoritative groundwater risk assessments, the deliverable being a comprehensive report on findings. In addition, Hydrock will be required to contribute to the EIA reports prepared by Barton Willmore. The services will also involve liaison with other members of the Celtique team and its advisers. Contact and meetings with the regulatory authorities and consultees will be undertaken as necessary to deliver the assessments to the required standard.

1.3 Components of Work

A typical sequence of work will be:

- collate data from in-house and other sources on the geological, hydrological and hydrogeological conditions that characterise the project area;
- review information to gain an understanding of your test well construction proposals;
- formulate a conceptual hydrogeological model to identify key risks;
- consider mitigation/protection requirements and to what extent your drilling proposals satisfy those requirements;
- meet with the Agency (and the LPA if required) to gain an understanding of their concerns;
- negotiate and derive suitable mitigation proposals (this in close consultation with Celtique to ensure that the outcome is acceptable);
- prepare an deliver Groundwater Risk Assessment report;
- contribute to EIA as required.

1.4 Costs

1.4.1 Willow 1

Hydrock fees for the services required will vary according to the complexity of the hydrogeological conditions that characterise the site. As noted above, from initial review of geological and hydrogeological maps, it appears that Willow 1 is a low risk site and our proposed costs for this site are as Table 1.1 below:

Table 1.1: Willow 1 Groundwater Risk Assessment

Item	Description	Cost (£ exc. VAT)	Comment
1	Hydrogeological data collation and interpretation, including formulation of conceptual site model.	£1600.00	Fixed price inclusive of all expenses.
2	Familiarisation with Celtique drilling works proposals, qualitative assessment of risk to groundwater and identification of mitigation measures as appropriate.	£1200.00	Fixed price but no allowance made for drilling works, testing, or Detailed Quantitative Risk Assessment.
3	Single project review meeting in	£1060.00	Inclusive of expenses.

	London and liaison with Environment Agency consultees etc (telephone contact only).		
4	Preparation and issue of report to Agency after Celtique approval. Discussion with Agency followed by amendment and final issue.	£2880.00	Fixed price inclusive of all expenses but excludes face to face meeting with Agency.
5	Contribution to EIA.	£1040.00	Estimate based on likely requirements.
Total		**£7780.00**	**Excludes VAT**

1.4.2 Groundwater Risk Assessment for Other Sites

You may regard the above cost as indicative for any Weald Basin wells founded on the Wealden Beds.

Based on our experience will wells sited on the Chalk, an indicative cost would be £10,000 - £12000 plus VAT including some allowance for face to face meetings with the Agency.

We suggest that we provide additional quotations on a site by site basis.

1.5 Willow 1 Programme

We note a requirement to complete our work on Willow 1 by end of February 2012 and will commit to that reporting deadline, with written contribution to the EIA by mid-February 2012.

2.0 Pre-Development Land Quality Assessment (UK Sites)

At the meeting we mentioned the possibility of surveys to benchmark land quality conditions prior to establishment. This is so that when the same is done after demobilisation, you will be able to show no adverse effect.

Should this service be required at Willow 1, the costs will be as Table 2.2 below. Costs are all inclusive assuming no access restriction or special plant requirements.

Table 2.2 Land Quality Assessments

Item	Description	Cost (£ excluding VAT)
1	Acquisition of *Envirocheck* data report and 'Phase I' Desk Study	£215.00
2	One day's fully supervised shallow soils window sampling (6-8 locations, no standpipe installations)	£1450.00
3	MCERTS Laboratory chemical testing of 8 soils samples; tests to include standard metals and other inorganics, speciated PAH, and level 2 (speciated TPH)	£920.00
4	Assessment of data and reporting (including report sign-off by a SiLC-accredited professional).	£1400.00
Total		**£3985.00**

This price applies to Willow 1 but it is unlikely that prices for other UK sites will vary significantly.

3.0 Weald Basin Water Resources Study

We mentioned this as an issue without going into much detail. My understanding is that on some/all sites you will benefit from access to a groundwater supply source with use of the water for 'fracking'.

Hydrock is able to undertake all aspects of the assessment and the following sequence is likely to apply:

- receive information on:
    - site location;
    - amount of water required;
    - rate of delivery of water required;
    - any water quality constraints;
- undertake hydrogeological assessment to determine likelihood or otherwise of groundwater resources being available;
- make comment on surface storage required (i.e. if rate of delivery required exceeds water well production capacity);
- advise on licensing issues, procedures etc;
- provide outline costs for development; and
- report on findings.

The above schedule takes the process to the point where Celtique is able to make a go/no go decision on the establishment of a water supply borehole for fracking.

I will provide cost for this exercise on a site by site basis. If we have already undertaken hydrogeological assessment of the site as part of groundwater risk assessment, the cost will take the availability of that information into account.

4.0 Sites in France and Switzerland

We discussed the site in Switzerland where you require someone to review reports produced by Hydro-Geos. I will be pleased to undertake this work subject to further confirmation of objectives, scope, and deliverable. You may also want me to become involved in prospects in France. In each case I understand the issue to be groundwater risk assessment.

My appointment to such a task accords with the 'expert witness'- type of senior level review work that I currently undertake.

We noted also the desirability of me working alongside Swiss and French consultants with specialist expertise and good local knowledge. I am looking into who might be suitable and will report back to you.

5.0 Generic Charge Rates

For your information for the above and all other works, the following charge rates apply from now until the end of 2012:

Eric Cooper SiLC, Technical Director Contaminated Land and Groundwater: £80 per hour;

Senior Consultant: £55 per hour;

Consultant: £45 per hour;

Technician: £30 per hour;

Mileage charged at £0.45 per mile. Third party costs (including other travel) charged at cost plus 12.5%. All costs exclude VAT.

These are the rates that have been used to build up the cost schedules presented in Tables 1.1 and 1.2 above.

6.0 Flood Risk Assessments and Site Drainage Strategy

As noted at the meeting Hydrock has carried out these assessments on other hydrocarbon exploratory borehole sites in the UK. The work was undertaken by a specialist Hydrock team led by my colleague Dr David Lloyd.

Whilst I have no wish to interfere with existing arrangements, I note that these services are currently supplied to you by Barton Willmore under subcontract from a third party. Therefore I attach, for your information, at Annex A, the typical scope and cost of these services at a drill site should Hydrock ever be called upon to provide them.

7.0 Terms and Conditions

We propose that Hydrock Standard Terms and Conditions as attached apply to the services provided.

8.0 Closing Remarks

I trust that I have interpreted your instructions correctly and will be pleased to clarify any aspects of this proposal

Yours sincerely
for **Hydrock Consultants Ltd**

Eric Cooper
Technical Director

ericcooper@hydrock.com

Encl: Terms and Conditions.

ANNEX A

Flood Risk Assessment and Drainage Strategy
(Indicative Proposal)

1.0 Flood Risk and Drainage

1.1 Review of Requirements

The FRA will include a desk study of available data and will involve a request to the Environment Agency for flood level data for (local stream, as applicable). Such flood levels will be compared to the detailed ground topography (sourced from LiDAR if required/available) to confirm site specific flood levels and extents if required. If the EA do not hold reliable flood level data then hydrological and hydraulic modelling may be needed to assess flood levels in respect to the watercourse; however, this is unlikely to be required.

The completion of the FRA will be dependent upon the receipt of the finalised site layout and the provision of soakaway test results to BS365 which would need to be provided as part of this assessment. This information will be required to deal with the Agency concerns about infiltration.

The objective of the work will be to provide sufficient information to the Agency such that any objection to the proposals in respect of flood risk and drainage issues will be withdrawn.

1.2 Proposed Actions

The Flood Risk Assessment will cover:

a) Site visit;

b) Enquiries with the Environment Agency to seek pre application comments to the proposed storm water disposal strategy and identify any historical flooding data that may be available

c) Obtaining the wide area topographic data (LiDAR) if required,

d) Completion of watercourse modelling using HEC-RAS software to confirm possible development limits and minimum site levels (if required)

e) Discussions with Thames Water on storm water disposal adoption and flooding history;

f) Discussions with the Environment Agency on storm water disposal;

g) Identification of possible disposal options and outfalls and identification of issues that may need to be resolved;

h) Comments on planning layout from a storm drainage disposal aspect in case there are any amendments needed to facilitate the drainage strategy;

i) Completion of an outline storm drainage strategy with plans and preliminary storm water runoff calculations confirming storage volumes (if soakaways or permeable paving not applicable);

j) Completion of drainage strategy report; and

k) Completion of the Flood Risk Assessment Report to support submission of a planning application

It is assumed that a topographical survey, based on OS datum, will be provided for the site.

1.3 Costs

Flood Risk and Drainage Issues			
1	Flood Risk Assessment	2380.00	Inclusive of purchase of Environment Agency data and sewer records data and purchase of LiDAR data (estimate at £500) NB If watercourse hydrological modelling and hydraulic modelling is required then a budget fee for such works would be an additional **£2800**. However this is considered highly unlikely to be required
2	Soakaway Testing	1060.00	Fixed price for one day's soakaway testing, inclusive of all plant and equipment
3	Drainage Strategy: development of a Storm Water and Foul Drainage strategy for the site	1280.00	
4	Attendance at meetings etc assume 1 at Celtique HQ, 1 with Agency, one site visit	1980.00	
4	Reporting	300.00	
Total		**6,700.00**	**Excludes VAT**

ANNEX B

STANDARD TERMS AND CONDITIONS

Definitions

“Fee”	The fee payable for the Services as set out in the Quotation as may be adjusted in accordance with these Standard Terms and Conditions.
"Consultant"	Hydrock Consultants Limited.
"Customer"	The individual, firm, company or other party for which the Consultant is carrying out the Services.
"Quotation"	The Consultant's letter to the Customer (to which these Standard Terms and Conditions are attached) specifying the Services which the Consultant proposes to carry out and the proposed fee for providing those Services.
“Revised Quotation”	Any Quotation revised in accordance with these Standard Terms and Conditions.
"Services"	The services set out in the Quotation which the Consultant agrees to carry out for the Customer, as may be adjusted in accordance with these Standard Terms and Conditions.

1 Services

The Consultant will exercise reasonable skill and care in carrying out the Services and will carry out the Services within a reasonable time subject to these Standard Terms and Conditions.

2 Fee

The Fee and the fees quoted in any Revised Quotation are in pounds sterling and are exclusive of VAT unless stated otherwise.

3 Acceptance of the Quotation

The Quotation shall be open for acceptance by the Customer for a period of 60 days from the date stated thereon. The Consultant shall not be bound by the Quotation if accepted by the Customer outside the 60 day acceptance period but shall after such period be entitled to amend the Quotation at its discretion. The Consultant shall not be obliged to commence the Services until such time as the Quotation is accepted by the Customer.

4 Invoicing

The Consultant may submit invoices monthly being a proportion of the Fee which shall be based on Services completed up to the time of submission of the invoice (and if applicable, any additions to the Fee pursuant to Condition 24).

5 Payment

The due date for payment shall be 14 days from the date of the invoice and the final date for payment shall be 28 days from the date of the invoice. Payment shall be made in pounds sterling by cheque or BACS payable to "Hydrock Consultants Limited". If payment is not received by the final date for payment the Consultant shall be entitled to compound interest of 4% above Bank of England base rate.

6 Client Variations

If the Customer requests variations to the Services, the Consultant will submit a Revised Quotation incorporating such variations and clearly indicating the effect on the Fee. The Consultant shall not be obliged to carry out any requested variations to the Services until such time as the Revised Quotation is accepted by the Customer. Upon acceptance by the Customer the Revised Quotation shall replace (or, where it is so stated, have effect in addition to) any previous Quotation or Revised Quotation.

7 Security Passes and Work Permits

Where necessary, the Customer shall prepare security passes, working permits, and official entry or exit documents in advance of the date that the Consultant is due to commence the Services. If the Consultant is delayed in carrying out the Services as a result of failure to provide such passes and/ or other documents, the Consultant shall be entitled to payment in accordance with Condition 4.

8 Access

The Customer shall ensure the Consultant has the necessary access in order to carry out the Services.

9 Necessary Data

The Customer shall collate and provide all necessary, current data prior to the start of the Services.

10 Health & Safety

The Consultant's personnel shall not be obliged to work in unsafe conditions. If site conditions become unsafe during the progress of the Services then the Consultant may recall personnel at the Customer's cost.

11 Suspension

The Consultant reserves the right to suspend the Services on giving 7 days notice to the Customer if full information enabling it to proceed is not received by the Consultant. Any costs or losses incurred as a result of such suspension shall be recoverable from the Customer as a debt. This Condition shall not affect any statutory right of suspension that may be available to the Consultant.

12 Termination

The Consultant may terminate this agreement on giving 7 days notice to the Customer in the event of non-payment by or the insolvency of the Customer. Any costs or losses incurred as a result of such termination shall be recoverable from the Customer as a debt.

13 Cancellation

In the event of cancellation of the Services through no fault of the Consultant, the Customer shall pay the Consultant a proportion of the Fee based on the Services carried out, any outstanding expenses and any losses to the Consultant which are incurred as a result of the cancellation, including but not limited to costs to which the Consultant is committed in respect of planned future work on the Services.

14 Assignment

The Customer shall not assign this agreement between the Consultant and the Customer nor any of its rights and benefits under the agreement without the consent of the Consultant.

15 Confidentiality

Information of any kind whatsoever relating to the Services shall only be used in respect of the Services and the specific project..

16 Events beyond the Consultant's Control

In the event that the Consultant shall be affected by any circumstances whatsoever beyond the control of the Consultant which prevent, hinder or delay the Consultant's performance of its obligations, it shall give prompt notice thereof to the Customer. Non-performance or delay in performance of the Services caused by, or resulting from or owing to those circumstances shall be deemed not to breach the agreement between the Consultant and the Customer, and the Consultant shall carry out the Services within a reasonable time taking account of any such non-performance or delay and shall be entitled to payment in accordance with Condition 4.

17 Copyright

The Consultant grants to the Customer a non-exclusive licence to use and reproduce all drawings, details, plans, specifications, schedules, reports, calculations and other work ("the Documents") and the designs contained in the Documents which have been or are hereafter written, originated or made by the Consultant for the completion, use, letting, management and sale of the property to which the Services relate. The Consultant shall not be liable for any use of the Documents for any purpose other than that for which the same were prepared and provided by the Consultant.

18 Language

All communications between the Consultant and the Customer shall be in the English Language.

19 Entire Agreement

The Services are carried out on these Standard Terms and Conditions which supersede all previous agreements between the Consultant and the Customer. These Standard Terms and Conditions, the Quotation or any Revised Quotations form the entire agreement between the Consultant and the Customer.

20 Customer's Standard Terms and Conditions

Only a duly authorised representative of the Consultant has the authority to bind the Consultant or agree to vary or supplement these Standard Terms and Conditions.

21 Severability

In the event that any Condition or any part of any Condition contained in these Standard Terms and Conditions is declared invalid or unenforceable by the judgement or decree by consent or otherwise of a court or body of competent jurisdiction from whose decision no appeal is or can be taken, all other Conditions or parts of Conditions contained in these Standard Terms and Conditions shall remain in full force and effect and shall not be affected thereby.

22 Limit of Liability

The Consultant's aggregate liability shall be limited to ten times the Fee, save in respect of personal injury and death. The Consultant shall not be liable for any consequential loss, howsoever caused.

23 Law

The agreement between the Consultant and the Customer shall be construed in accordance with English Law and shall be deemed to have been made in England and both parties agree to submit to the exclusive jurisdiction of the English Courts.

24 Additions to the Fee in the event of delay

The Consultant shall be entitled to payment for any days or part days during which it is unable to carry out the Services through no fault of its own, including but not limited to any one or more of the reasons stated in Conditions 8, 9, 10, 11 or 17 hereof, at the rate specified in the Quotation and shall be entitled to any additional expenses or other consequential costs incurred as a result of the delay.

25 Disputes

Any dispute arising under or in connection with the agreement between the Consultant and the Customer may be referred to adjudication under the Housing Grants, Construction and Regeneration Act 1996. The Scheme for Construction Contracts referred to in the Act shall apply.

26 Interpretation

All headings used herein are for guidance and reference purposes only and shall not in any way affect the interpretation of these Standard Terms and Conditions or any part thereof. Words importing the singular include the plural and vice versa. Words importing a gender include every gender and references to persons include corporations, partnerships and other unincorporated associations or bodies of persons. References to Conditions are, unless the context otherwise requires, references to Conditions in these Standard Terms and Conditions.