INEOS Shale

# 4.
# The Proposal

## Land adjacent to Dinnington Road, Woodsetts

Construction of a well site and creation of a new access track, mobilisation of drilling, ancillary equipment and contractor welfare facilities to drill and pressure transient test a vertical hydrocarbon exploratory core well and mobilisation of workover rig, listening well operations, and retention of the site and wellhead assembly gear for a temporary period of 5 years on land adjacent to Dinnington Road, Woodsetts, Rotherham.

June 2018

# Contents

# 1.0 Introduction

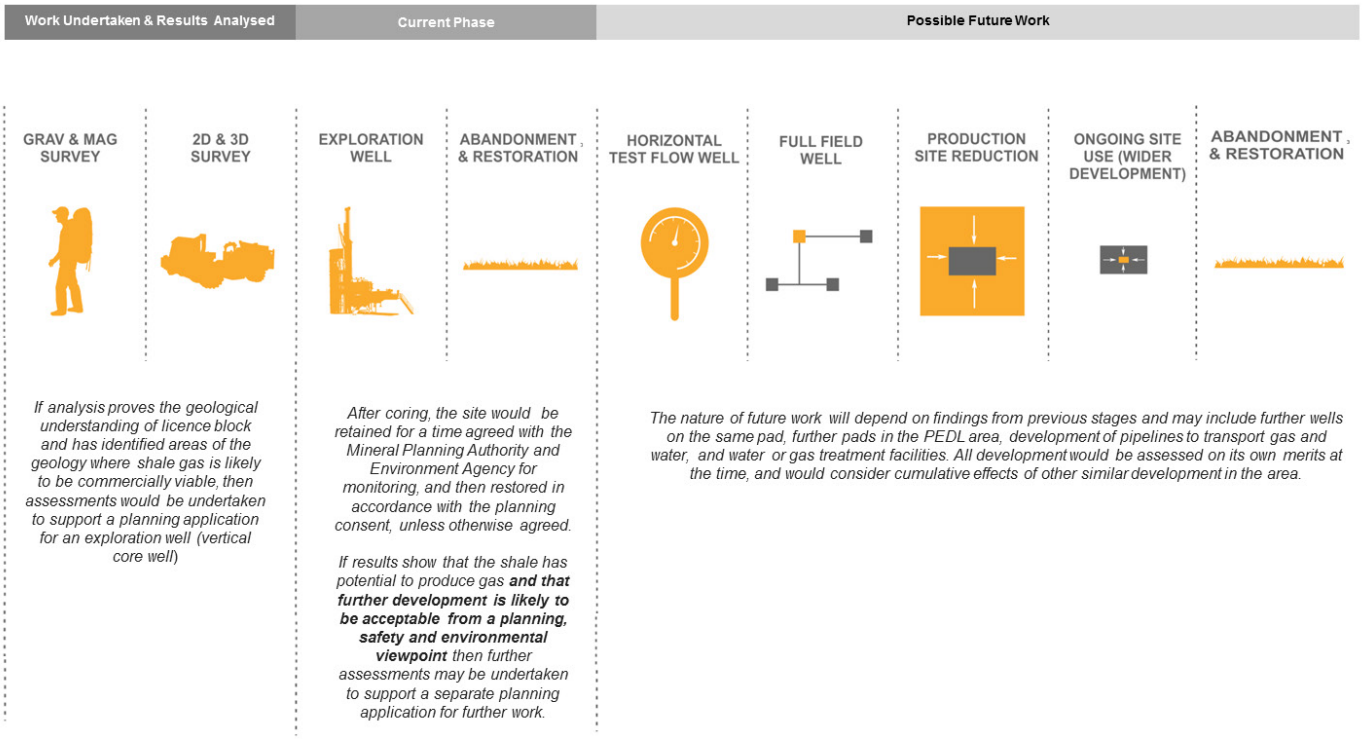
## 1.0 Introduction

This document outlines INEOS Upstream Limited's Proposal (hereafter INEOS) to develop a site and drill, core and test a vertical well, and then suspend the well for use as a monitoring site. It describes what is proposed, methods that would be followed during operations and ways in which the environment would be protected. All measures within this report, including the identified management techniques, comprise the proposed development.

Regulation covering the oil and gas industry, and which would apply to this proposed development, is outlined in Chapter 4 of this document and in Section 5.3 of the accompanying Planning Statement. This includes regulation relating to well design and construction, well integrity, operation of the surface equipment on the well pad, management of mining waste, and well decommissioning and abandonment. The Proposal would be undertaken in accordance with the Environment Agency's Standard Rules[1] reflecting the minimal environmental permitting requirements due to the nature and management of the proposed development. In addition, civil engineering design standards and regulations for site construction (such as the Construction (Design and Management) Regulations 2015) and Health and Safety regulation and best practice would be followed.

This Proposal is part of INEOS's phased approach to evaluate the hydrocarbon prospectivity of its Petroleum Exploration and Development Licences (PEDLs) in England. The aim of the well would be to test geological properties of the underlying strata (in particular the Bowland Shale formation equivalent within the East Midlands basins) and to assess their potential to produce gas. On completion, the well would be temporarily suspended with the potential to use as a "listening well" to monitor subsurface impacts arising from other operations in the region, should such operations receive the relevant planning consent and environmental permits. This Proposal is not to flow test or produce gas by hydraulic fracturing or other means and it does not depend on other developments receiving consent. A separate planning application would be required to undertake such additional works.

The graphic below shows INEOS's progress and intentions in assessing and exploring the potential for shale gas across the East Midlands. The current phase of the proposed vertical core well is shown. If results from this and other similar wells are favourable, further planning applications for "possible future work" may be submitted to the relevant Minerals Planning Authorities (MPAs).




1. The site would require an environmental permit from the Environment Agency, under the Environmental Permitting Regulations 2016. This is a separate process to the planning application. Certain low-risk operations can apply for a "standard rules" permit where operations follow a standard set of rules relating to waste management. The Environment Agency accepts that such operations following these standard rules will result in minimal risk of harm to the environment, and therefore minimal permitting effort. The Standard Rules INEOS would follow (SR 2015 No 1) relate to "management of extractive waste, not including a waste facility, generated from onshore oil and gas prospecting activities including drilling, coring, leak off testing, acid wash and decommissioning but excluding hydraulic fracturing for the production of oil or gas (using oil and water based drilling mud)" – https://www.gov.uk/government/publications/sr2015-no-1-onshore-oil-exploration.

## 1.1 Summary of the Proposal

The Proposal is to drill a vertical core well to approximately 2,800 m (9,200 ft.), and to recover cores of the target geological formations. Subsurface data would be collected during and following the drilling process and the core samples would be removed from site for testing of the potential for the target horizons to contain hydrocarbons. A post-drilling "Pressure Transient Test" (PTT)[2] would be undertaken to determine the pressure of the potential reservoir and not to establish rates of gas flow. The well would be suspended in line with Oil & Gas UK Guidelines for a period of time for later use as a "listening well" during development of other sites in the area.

The duration of the planning permission requested is five years, which accords with the length of INEOS's initial PEDL term, as awarded by the Oil and Gas Authority.

After five years the site would be restored to its existing use and returned to the landowner unless a further planning application is made for additional work.

There would be several Stages over the proposed five year life of the site, each with different activities and potential impacts:

+ Stage 1: Site Development and Establishment – approximately three months
+ Stage 2: Drilling, Coring, PTT and Suspension – approximately five months
+ Stage 3: Maintenance of the Suspended Well Site – retained until restoration, up to the five-year extent of the application
+ Stage 3a: Possible Workover of the Suspended Well – up to one month as required. This stage is included as a contingency and would only be required if the well required to be re-entered for maintenance or similar. However, planning permission is requested for the potential to undertake these operations to allow a rapid deployment of the rig if required
+ Stage 4: Use of the Well as a Listening Well – up to five weeks as required
+ Stage 5: Abandonment (Decommissioning) and Restoration – approximately two months

Chapter 2 describes activities involved at each Stage, operational information including hours of working and staff numbers, and outlines measures in place to protect the environment at each Stage. The timescale for each Stage is approximate, and may take a shorter or slightly longer time than indicated herein, though a reasonable longest case is proposed. Delays beyond INEOS's control would extend the timescales indicated. Stages may not be immediately sequential though the overall five-year timescale is proposed as a maximum.

Plans of the site at each Stage are shown in Figure P1 at the end of this document. These show how the site would change in appearance over the lifetime of the planning permission.

The plans do not show the Proposal site in detail: these detailed plans form the application drawings for the planning application. These include plans showing drainage, fencing, site surfacing details and lighting and security arrangements.

Certain features would be consistent over the lifetime of the site; for example the bunds, fencing, infrastructure and access. They have been designed to minimise the environmental impact and ensure the site could be safely and efficiently operated. This is termed "embedded mitigation" – in that it comprises part of the site design and standard operational practice (albeit it incidentally or intentionally reduces environmental impacts arising from the proposals), rather than being introduced as a result of site-specific environmental assessments as a measure to prevent, reduce or offset any remaining significant adverse effects. Ways in which the site would be designed to provide this protection are shown in Figure P2. The photograph shown in Figure P2 is indicative of a site during Stage 2 operations only (when a drilling rig is present). However, only the planning application drawings represent the exact appearance and details of the proposed vertical core well site.

Chapter 3 indicates equipment on site and vehicle numbers at each Stage, and how this would change over the life of the site. Equipment listed and pictured in Chapter 3 is indicative, and flexibility around exact dimensions and appearance is required. However, height of the tallest features on site at each Stage would not be exceeded. Sources of photographs used in Chapter 3 are provided in a Confidential Appendix (CA) as some potential suppliers have requested not to be named in the application. The split between potential suppliers and indicative plant is not made in the CA.

Chapter 4 contains information on relevant regulation and internal management that would be followed over the life of the site.

Each Chapter contains a series of Information Boxes providing general information about the Proposal. In this Chapter BOX 1 outlines INEOS's commitment to health and safety throughout the Proposal, and BOX 2 outlines the objectives behind the core well.

Photographs throughout this document are presented to illustrate what is proposed and should not be assumed to exactly represent the activity as carried out by INEOS.

## 1.2 Site Location and Access

The site is located in an agricultural field adjacent to Dinnington Road, west of Woodsetts in Rotherham Metropolitan Borough Council area. The site covers approximately 1.86 ha, including the proposed access track.

The site and its surroundings are described in the Planning Statement (Section 4), alongside information relating to environmental sensitivities, and access.

Site selection was undertaken according to the criteria outlined in Section 3 of the Planning Statement.

2. This test is also referred to in industry as a Diagnostic Formation Injection Test (DFIT), leak-off test, formation propagation test, formation injectability test and pressure test.

## **BOX 1**: Health and Safety

Safety, Health and Environmental (SHE) performance excellence is a core value of INEOS as part of their commitment to protect the health and safety of employees, sub-contractors, the communities in which they operate and the users of their products. They aim to meet or where practicable exceed all relevant legislative requirements, and strict safety, health and environmental performance targets, to ensure their sites have as low an impact as possible on local people and the environment. Relevant legislation and standards followed, including ISO (International Organization for Standardization) and Occupational Health and Safety accreditation are outlined in Chapter 4 of this document.

INEOS works in close partnership with community groups and other stakeholders to ensure that they are a responsible neighbour. All companies contracting to and/or supplying INEOS Shale will be expected to demonstrate a robust record of SHE performance and improvement. SHE audits will form a critical part of the tender process and successful companies and their employees will be expected to participate fully in achieving the objectives.

INEOS's ultimate goal is zero injuries, and to achieve this they are committed to continuous improvement in all aspects of their operations and are open and honest about their SHE performance. They publish SHE records locally and nationally and liaise regularly with the Health and Safety Executive (HSE) to ensure all their sites meet current standards and best practice guidance.

INEOS fosters a positive safety culture, as outlined in the company's 20 Principles for Process and Behavioural Safety (below) and a number of self-imposed internal standards, referred to as INEOS Group Guidance Notes. These collate best practice (internal and external) on specific topics that have caused Safety, Health or Environmental concerns.

### PROCESS SAFETY

The basis of process safety is asset integrity and avoiding loss of containment

1. The asset operating manager is responsible for its overall integrity
2. The asset engineers are responsible for maintaining the asset and protective systems integrity
3. The responsibilities in the organisation for defining and maintaining the correct operating envelopes must be clear
4. Operating procedures and envelopes must be observed. Deviations must be reported and investigated
5. Any changes must be properly risk assessed and subjected to MOC procedures
6. Process hazards are systematically identified, risk assessed, reviewed and managed
7. All assets must be subject to periodic inspection designed to ensure their integrity and the reliability of their protective systems
8. Operations must always place the safe operation or shutdown of the asset ahead of production
9. When in doubt the asset must always be taken to its safest state
10. We have emergency plans based on assessed risks which are regularly tested

### BEHAVIOURAL SAFETY

1. INEOS believes all incidents and injuries can be prevented
2. Everyone's first responsibility is to ensure they work safely
3. Everyone has the duty to stop work if they feel the situation is unsafe
4. The expectations and standards are the same for everyone on the site
5. Rules and procedures must be observed and respected
6. All staff should look out for each others safety and unsafe situations
7. All injuries and incidents /near misses must be reported and investigated
8. Risk assessment must be carried out prior to, during and on completion of work
9. All team leaders have a special responsibility for promoting and upholding these principles
10. All staff must always work within the limit of our competency and training

INEOS requires each operation to appoint a Responsible Person who is required to compile, own, periodically review and update the following safety documentation:

+ Project specific risk assessments, for both the whole life cycle of the project and each individual stage
+ Emergency Response and Spill Response Plans
+ Audit schedule, Corrective Action and Improvement Plan

The Responsible Person must also ensure adequate processes and/or procedures are in place to control all risks and implement good practices such as Toolbox Talks, Safety Observations and Safe Systems of Work.

In relation to the proposed vertical core well, specific safety measures include:

+ Appropriate and ongoing training of all staff.
+ No naked flames allowed on site at any time.
+ Gas detection equipment would be used on an ongoing basis to expose the presence of gas and allow for appropriate steps to be taken if necessary. Gas production is not proposed, but as the vertical core would pass through gas-bearing formations release of gas could occur so gas protection measures (e.g. blow out preventers) would be provided.
+ All potentially dangerous equipment would be fitted with recommended protective devices.
+ All personnel and visitors on site would be required to wear suitable personal protective clothing (hard hats, etc.).
+ Spill kits would be available at all times, and an emergency shower during drilling and listening operations.
+ During drilling, a muster point would be allocated and appropriately signed at the site boundary.

Continuous improvements would be made to the SHE Strategy, informed by ongoing activities.

## **BOX 2**: Aims of the Core Well

### GEOLOGICAL OBJECTIVES

+ Gather information on depth, sedimentology and thickness of prospective section
+ Gather information to correlate with 2D and 3D seismic data
+ Identify potential target zones
+ Gather geochemical information (Total Organic Content, mineralogy, gas composition, matrix composition, maturity)
+ Allow geomechanical analysis on core (stress, brittleness, fracture analysis, fracture barriers)
+ Gather information on gas content (desorption, free gas) and storage capacity
+ Assess target zone pressure and temperature

### SAFETY, HEALTH AND ENVIRONMENT OBJECTIVES

+ Demonstrate the ability of INEOS Shale to conduct all operations with due regard to the highest possible SHE standards
+ Achieve a target of zero lost time incidents and zero reportable incidents
+ Perform all operations with proper regard to the environment with no pollution caused
+ Ensure full compliance with governmental reporting and traceability in respect to chemical usage
+ Work in close partnership with community groups and other stakeholders to ensure that the company is a responsible neighbour
+ Ensure compliance with INEOS's 20 Principles of Process and Behavioural Safety and INEOS Group Guidance Notes

# 2.0 Summary of the Proposal

## 2.1 Stage 1: Site Development and Establishment

### 2.1.1 Stage 1 Activities

Activities proposed in Stage 1 are listed below. A simplified plan showing the site at the end of Stage 1 is shown in Figure P1. A more detailed plan is provided as planning application drawing P304-S21-PA-06.

Measures embedded into the site design to minimise the environmental impacts of these activities are listed in Table 1 and illustrated in Figures P2 and P3. Figure P2 shows features that would remain constant throughout the lifetime of the site. Figure P3 shows features of the site at Stage 1 which would not remain constant throughout the lifetime of the site. Site construction activities would comprise standard civil engineering techniques and would be controlled by the Construction (Design and Management) Regulations 2015.

Equipment and plant on site, and vehicle numbers during Stage 1 are shown in Chapter 3.

#### Stage 1: Key Points

DURATION – APPROXIMATELY 3 MONTHS

+ Surveys and fencing – 2 weeks
+ Development of bellmouth, access track and parking – 2-3 weeks
+ Site clearance and development – 4-5 weeks
+ Installation of Conductor/Surface Casing - 3 weeks
+ Completion of site works and demobilisation – 1-2 weeks

HOURS OF WORKING

+ Monday - Friday - 0700-1900
+ Saturday - 0700-1300
+ Sunday or Bank/ Public holiday - No working unless in an emergency or agreed otherwise with the MPA
+ 24 hour working would be required during the installation of the conductor and surface casing

STAFF NUMBERS

+ Staff on site at one time during Stage 1 – Approximately 10 (plus approx. 2 security)

#### Surveys and Fencing

Any necessary pre-commencement surveys would be undertaken, including geotechnical surveys, site investigation surveys, road condition surveys and environmental surveys. Environmental surveys will include baseline monitoring, subject to an environmental monitoring plan agreed with the Environment Agency as a requirement of the Environmental Permit. Prior to the commencement of any operations INEOS would be required to undertake a programme of monitoring and sampling to establish the existing environmental conditions of the site. This would include surface water, soil and ground gas sampling and would provide a baseline against which the site closure report (at Stage 5) would be assessed. Site personnel would be inducted.

The construction compound would be fenced with 2 m Heras fencing for security and to delineate the site, excluding areas where works would not take place, such as within the 30 m buffer from Dewidales Wood to the south. In addition, <1 m post and wire fencing would be placed around the entire site, outside the application boundary, to provide separation from the footpath running along the eastern boundary of the field in which the site is located. This would be installed under permitted development rights. Necessary plant and site accommodation for preliminary construction works to establish the site access and bellmouth would be brought to site.

#### Development of Bellmouth, Access Track and Parking

The junction to the adopted road (Dinnington Road) would be created ensuring that visibility splays provided safe access and egress from the site; for example, by ensuring that hedges adjacent to the site entrance were trimmed to 1 m to provide sight lines as shown in planning application drawing P304-S21-PA-05. Hedges adjacent to the access track, running along the existing footpath east and south of the access track would also be trimmed as necesssary. This would be done with regard to ecological considerations relating to timing and method of working. Any necessary passing places on the surrounding road network would be developed in discussion with the Highways Authority.

A bellmouth to the road network would be created in accordance with standard procedures. This would be tarmacked for the first 20 m approximately. The access track would be lined with a geotextile membrane and covered with aggregate to ensure the integrity of the underlying soil was maintained during site construction and subsequent site works. A dry wheel wash would be installed. An area for parking on the site would also be developed to ensure all necessary vehicles were within the site boundary. This would also be lined with a geotextile membrane and covered with aggregate. The membrane on the access track and parking area would be permeable and would ensure all material forming the site surface could be removed at restoration.

## Site Clearance and Site Development

Once access to the site is established, the construction plant, including generators, site offices, self-contained welfare cabins and stores would be brought to site.

Vegetation would be carefully removed from the site.

The topsoil and any subsoil necessary would be removed (approximately top 300 mm) to create a level site surface.

Screening bunds would be created within the perimeter of the site (up to 3 m high) from topsoil and any subsoil. These would ensure appropriate storage of this soil for restoration of the site and act as visual screening.

The site hardstanding area (approximately 25 m x 17 m x 1 m deep) would be excavated within the centre of the site, providing a flat, level surface for the concrete pad for the rig. Drainage pipe trenching (approximately 1.5 m deep) and a liner anchor trench would be excavated at the foot of the soil bunds.

### Cellar Installation

A well cellar with a "stove pipe" (up to 91 cm (36"), approximately 6 m deep) would be excavated into the centre of the site hardstanding area. The cellar would be constructed from a reinforced concrete ring approximately 2.5 m diameter and up to 4.5 m deep, laid on concrete within the excavation (surrounding the stove pipe). This would be heat sealed to the liner laid subsequently, to provide a watertight join to the rest of the impermeable site surface (see planning application drawing P304-S21-PA-16). The cellar would provide a level, impermeable surface from which the rest of the vertical core well would be drilled.

### Lining

A geotextile and high-density polyethylene (HDPE) liner would be laid over the site area by licensed contractors (650 GSM geotextile above and below 2 mm HDPE liner, forming a triple-layered membrane – see planning application drawing P304-S21-PA-16).

Liner joints would be welded together, and integrity tested, and the liner would be heat sealed to the cellar to ensure an impermeable joint. The liner would ensure an impermeable site lining preventing any potential spills or surface water from percolating through the site floor into the underlying soil.

The liner would be anchored in place by backfilling the trench and integrated into the inner face of the bund to ensure no spills could seep under the liners. Once lined, no vehicles would drive on the site until surfacing was complete.

Any subsequent perforations of the liner would be heat sealed to the surrounding material, ensuring their integrity and preventing leaks.

### Drainage

A perimeter water storage pipe (approximately 900 mm) would be laid within the drainage pipe trench ditch at the foot of the soil bunds, fed from a catch pit. The storage pipe and catch pit would be corrugated HDPE in a concrete surround, underlain by site liner. Runoff from the site into the catch pit and perimeter pipe would be pumped into a double skinned surface water storage tank for removal from site by a licensed contractor. The water tank would be bunded to contain 110% of the tank volume in accordance with Environment Agency Standard Rules and good industry practice[3].

Water within the hardstanding area would drain to the centre of the site and into the impermeable cellar. Therefore, it would be kept separately from runoff into the perimeter pipe for removal and treatment as appropriate.

All surface runoff from the site would therefore be retained on the site and removed by a licensed waste contractor.

### Site Surfacing

The liner would be covered by compacted sub-base and aggregate to at least 450 mm below the finished site surface. The surfacing would be completed from the site entrance first so no vehicles would be required to drive on the site. Sub-base and aggregate would be stored outside the main site while the preliminary site construction works were completed, to ensure sufficient aggregate would be in place for rapidly surfacing the site. This area would be stripped of top soil (stored at the edge of the area in a temporary bund) and surfaced with bog mats. It would form part of the site only for this Stage 1, and at Stage 5 when the aggregate would be removed at restoration. On completion of Stage 1 (and again after removal of aggregate at Stage 5) the bog mats would be removed, topsoil replaced, and the area would be returned for use by the landowner.

A concrete pad for the rig would be formed in the hardstanding area, surrounding the sealed cellar.

### Site Accommodation

Cabins would be placed on the perimeter of the site, over the top of the perimeter water storage pipe trench. These would be stacked up to 2 cabins high to provide further screening as appropriate. Barriers to separate the accommodation from the main site working area would be installed.

3. Oil Storage Regulations for Business (https://www.gov.uk/guidance/storing-oil-at-a-home-or-business) and CIRIA C736 (Containment systems for the prevention of pollution. Secondary, tertiary and other measures for industrial and commercial premises) referred to in the Environment Agency Standard Rules SR2015 No1, notes that where a single bulk liquid tank is bunded, the recommended minimum bund capacity is 110% of the capacity of the tank. Where two or more tanks are installed within the same bund, the recommended capacity of the bund is the greater of:
   + 110% of the capacity of the largest tank within the bund.
   + 25% of the total capacity of all of the tanks within the bund, except where tanks are hydraulically linked in which case they should be treated as if they were a single tank

### Installation of monitoring boreholes

Groundwater monitoring boreholes would be installed towards the edge of the site, in locations and to depths to be agreed with the Environment Agency. These would be installed under permitted development rights and do not form part of this planning application. They would be installed outside of the bund, with foot access for sampling, and would not perforate the lining of the main site.

### Installation of Conductor/ Surface Casing

A Conductor rig of up to 32 m, plus associated casing and drill fluids (water and additives) may be mobilised to site if required. This would drill the upper section of the well, and install the upper strings of casing to approximately 610 m (2,000 ft.) (see BOX 4). This would isolate mine workings in the Westphalian coal measures and aquifers. It would drill with water based fluids, approved by the Environment Agency for use in the well (See BOX 5). The rig would be operational for 24 hours a day, for approximately three weeks and would then be demobilised.

### Demobilisation

The soil bunds would be covered with a grass seeded geotextile blanket for stability and to minimise the visual impact of the bunds.

Security measures and lighting would be established around the site, including site operational fencing on the bund (up to 1.3 m high post and rope fencing), and CCTV. Permanent lighting would be angled to light the site floor, entrance, car park and cabins only and would be shielded and low intensity to reduce light spill (see planning application drawing P304-S21-PA-10).

Construction equipment would then be demobilised in preparation for mobilising the Stage 2 drilling rigs and equipment.

## 2.1.2 Stage 1 Environmental Considerations and Protection Measures

Table 1 overleaf summarises how the site would be developed in Stage 1 having regard for environmental protection. These measures would be incorporated into the site design and follow good site construction guidance for similar development[4] and Environment Agency Sector Guidance (to be updated as Guidance for Pollution Prevention[5]).

4. For example ICE (2014) Environmental good practice on site - 3rd edition, SNH (2015) Good Practice during Wind Farm Construction v3
5. Environment Agency (2016) Onshore Oil & Gas Sector Guidance v1, PPG6: Working at Construction and Demolition Sites (http://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/)

Table 1: Stage 1 Environmental Protection Measures

| Environmental Aspect | Aim | Measures built into Proposal |
|---|---|---|
| Water and Soil | Prevent soil damage during soil strip prior to laying of membrane/ development of access tracks | Site vehicles tracking on bare ground would have appropriate tyres to prevent damage. |
| | | If large numbers of vehicle movements are needed on bare ground, temporary tracks or peat-boards would be used. |
| | | Works would be undertaken in suitable weather conditions to prevent soil damage (especially avoiding periods of high rainfall). |
| | | Bunding would ensure soils were stored appropriately, and kept separate from other construction activities. |
| | | Vegetation removal would be minimised and carried out according to good practice. Works would be undertaken to minimise the area of soils exposed at any one time. |
| | | Barriers and/or netting would be used to prevent vehicle movements in sensitive areas. |
| | Prevent pollution of soil, groundwater or surface water from leaks from construction vehicles or onsite tanks | A triple-layered geotextile/ HDPE membrane would be laid between the site surface and soil by a qualified groundwork contractor under a Construction Quality Assurance Plan to make an impermeable site surface. |
| | | All fuels, oils, lubricants and other chemicals would be stored in double skinned tanks, or in bunded, impermeable areas to provide appropriate secondary containment and in accordance with recommended guidance and regulation (e.g. Control of Substances Hazardous to Health Regulations 2002 (COSHH) and Guidance for Pollution Prevention[6]). |
| | | All vehicles would be maintained regularly and would be subject to daily inspection at the start of the working day by plant operatives. |
| | | Any equipment maintenance would take place in a designated area within the lined construction compound where reasonably practicable. |
| | | Fuel and oil deliveries, and any refuelling on site would only be undertaken in appropriate impermeable areas, by competent persons. Double-skinned fuel tanks (or a bunded impermeable area) would be used for refuelling trucks and pumps as well as fuel storage. |
| | | Standing machinery and refuelling points would have drip trays placed underneath to prevent oil and fuel leaks causing pollution. |
| | | Spill kits would be present on site, and staff trained in spill response via contingency plans. |
| | | On-site welfare facilities would be adequately designed and maintained, and all sanitary waste water and sewage would be removed from site by licensed waste contractors. |
| | Prevent pollution of soil, groundwater or surface water from runoff from site surface | No water would be discharged from the site to the surrounding environment once the drainage system was in place. All water would be removed from site by a licensed waste contractor. |
| | | Works would be undertaken in suitable weather conditions to prevent silting of watercourses (especially avoiding periods of high rainfall). |
| | | Runoff from access tracks would be to the surrounding road / field drainage. Aggregate used on these would ensure sediment laden runoff was not produced. |
| | Prevention of pollution of soil, groundwater or surface water from installing cellar, conductor/ surface casing and monitoring boreholes | Borehole and well design and operation (for example, fluids to be used) would be approved by Environment Agency (via Environmental Permit), Oil and Gas Authority, HSE, Coal Authority and an accredited Independent Well Examiner prior to drilling. |
| | | Only air and water based fluids would be used as drilling fluids to install the conductor/ surface casing and monitoring boreholes. All fluids proposed would be approved by the Environment Agency. |
| | | Drilling would not take place within source protection zones (SPZ) 1 or 2, as defined in the Environment Agency's Groundwater protection: principles and practice (pp. 23-24). |
| | | Once installed the cellar and conductor would be checked to ensure no leaks to the environment. |
| | | Drilling of groundwater monitoring boreholes would comply with good practice for drilling water wells, as described in the Environment Agency's Guidance on the design and installation of groundwater quality monitoring points (Science Report SC020093). |

6. https://www.gov.uk/guidance/storing-oil-at-a-home-or-business

Table 1: Stage 1 Environmental Protection Measures (cont.)

| Environmental Aspect | Aim | Measures built into Proposal |
|---|---|---|
| Water and Soil | Prevent pollution from other construction activities | Concrete mixing for the rig pad would be undertaken by a mixer unit, with the components of the concrete enclosed in the unit prior to and during mixing. The mixer would be used on the lined site only. |
| | | Shutters would be used when concrete is poured, and no concrete would be used where there was standing water. |
| | | Pumps would be used to keep excavations dry if needed. |
| | | Method statements would be produced for all activities that could pose a risk to the water environment and would clearly state what mitigation measures and monitoring requirements should be in place prior to and while the activity is underway. |
| | Prevent pollution of watercourses through engineering works | The Environment Agency permits engineering works in the water environment where required, through Flood Risk Activity permits. The site is located over 100 m from the nearest watercourse, and good practice to prevent silting and dust would prevent harm to the watercourse as a result of engineering works. A Flood Risk Activity permit is not required at this site. |
| Air | Reduce dust arising from construction works and groundworks | Site and access tracks would be damped down using clean water in dry, windy weather. |
| | | Cutting equipment would be damped down using clean water as necessary. |
| | | Vehicles and wheels would be cleaned as appropriate (a wheel wash would be installed), and vehicles carrying potentially dusty loads would be covered when entering and leaving the site. |
| | | Skips would be covered to prevent wind blow. |
| | | Mud and debris would be removed from roads as required. |
| | Reduce local air pollution (particulates, NOx) and greenhouse gases arising from HGVs and generators | Vehicles would turn off their engines on site and would not idle on the site. |
| | | On-road vehicles would comply with set emission standards. |
| | | Off- road mobile machinery would use ultra-low sulphur diesel where available and be fitted with appropriate exhaust after-treatment. |
| | | Efficient diesel generators would be used, to minimise pollution. |
| Noise | Control noise from site works | The site (excluding access track) is located approximately 425 m from the nearest residential receptor though the access track is closer. Noise during construction would be reduced at this receptor by good practice, and work on the access track close to the receptor would be temporary. In addition, bunds and double stacked cabins would act as a further noise reduction measure. |
| | | No night working except during conductor installation – all deliveries and the majority of site works would take place 0700-1900 only Monday – Friday, 0700-1300 on Saturdays and not on Sundays or Bank or Public holidays. |
| | | Construction plant noise from static plant would be minimised by plant choice (including acoustic enclosure and silencers on exhausts where applicable – See Environmental Report – Noise). |
| | | Vehicles on site would follow good practice methods to minimise noise (no audible reversing alarms, if working takes place outside normal working hours following agreement with MPA or in an emergency, no idling on site, use of effective silencers). |
| | | Local residents would have contact details for the company's operations team to raise noise issues. |
| | | A Noise Management Plan would be developed to include provisions for monitoring, complaints and review. |
| | Control noise from HGVs accessing site along access route | Routeing to site would be developed sensitively to avoid settlements where possible. |
| | | A Transport Management Plan (TMP) relating to speed, traffic movements and hours to access the site would be followed. |

Table 1: Stage 1 Environmental Protection Measures (cont.)

| Environmental Aspect | Aim | Measures built into Proposal |
|---|---|---|
| Traffic | Ensure safety along local roads, including pedestrians, horseriders and cyclists | TMP would be followed relating to speed, traffic movements and controls on timing to access site. |
| | | Any issues would be dealt with through INEOS' complaints management procedure, including dismissing non-compliant contractors through a "yellow/ red card" system. |
| | | Vehicles would only enter the site when they have permission to do so, to ensure all site vehicles can access the site safely. |
| | | All manoeuvring would take place within the site, and not on the public road. |
| | Reduce delay caused by site traffic | Timing of HGV access would be controlled by TMP, following discussion with local communities and the Highways Authority. |
| | Minimise damage to roads | A pre-operation road survey would be undertaken by INEOS, and any damage caused by site vehicles would be repaired. |
| | | Mud or debris would be removed from roads as required. A dry wheel wash on site would minimise potential for mud to be tracked onto the public highway. |
| Ecology | Minimise damage to habitats through direct loss or pollution | Site clearance works including the creation of the new site access and any necessary trimming of hedges to create necessary visibility splays would normally take place outside the bird breeding season. If works were necessary between March and August, the site would be assessed by an ecologist for presence of nesting birds and appropriate action taken, including a delay of works if necessary. |
| | | A buffer of 30 m from the hardstanding area would be retained from Dewidales Wood on the southern side of the site. This would be kept as a "dark zone" and would also ensure no damage to adjacent trees or requirement to remove or trim hedges apart from adjacent to the bridleway and at the visibility splay at the northern field boundary hedge (which would widen the existing field entrance). |
| | | No badger setts were identified within the site boundary or in nearby hedgerows, and any setts within the woodland to the east would be at least 30 m from the site. |
| | | The site would be located on agricultural land with minimal ecological interest. |
| | | Much equipment used in site preparation would be similar in size to agricultural equipment (delivery vehicles, low loaders etc.). |
| | | Measures to prevent pollution during construction works as detailed above under "Water and Soil" would prevent pollution of habitats or changes to the drainage patterns or water quality. |
| | Control of nuisance caused by noise, light and presence of workers and vehicles | Except during conductor installation, working would take place on a 12-hour day Monday – Friday and 6 hours on Saturday (0700-1300) with no working on Sundays, Bank or Public Holidays (unless in an emergency or otherwise agreed with MPA). |
| | | Standard good practice to ensure protection of wildlife would be used: for example, covering excavations at night and ramping all ditches (until site is securely fenced). |
| | | Vehicle speeds would be controlled to avoid collision. |
| | | Lighting would be low intensity, angled in towards the site, and only security lighting (motion sensitive) at night. |
| | | A "dark zone" adjacent to Dewidales Wood would be maintained. |
| | | Impact would be temporary for duration of Stage 1 (and Stage 2). |
| Visual Impact | Reduce impact on landscape character | The site would be small scale and screened by soil bunding and fencing. |
| | Reduce impact on key viewpoints, including settlements, individual properties, roads and tracks | Bunds, cabins and fencing (in a recessive colour) would screen views into the site. |
| | | Works in Stage 1 would be low level (generally <9 m if a conductor/ surface rig is used and temporary cranes up to 32 m) and screened by double-stacked cabins and bunding. |

Table 1: Stage 1 Environmental Protection Measures (cont.)

| Environmental Aspect | Aim | Measures built into Proposal |
|---|---|---|
| Flood | Control risk of site flooding | Site and access track would be located out of the flood risk zone. |
| | | The site drainage system would be sized to withstand 1 in 100-year flood event. |
| | | Site would be located to minimise risk of groundwater or surface water flooding. |
| | Control risk of site increasing flood risk elsewhere | Field drainage system around the site would be maintained. |
| | | Any water falling onto site would feed into the site perimeter water storage pipe and be removed by a licensed waste contractor for treatment and disposal as applicable. |
| Cultural Heritage and Archaeology | Prevent damage to recorded and unrecorded archaeological features | Site would not be located on designated cultural heritage sites, or known sites of archaeological importance (see Environmental Report – Archaeology and Cultural Heritage). The site is located in an area of heritage potential and artefacts associated with this may be present. A geophysical survey has been undertaken as discussed with the county archaeologist to understand local archaeological potential (see Environmental Report – Archaeology and Cultural Heritage). |
| | | A process for recording archaeological features within the site would be developed (see Environmental Report – Archaeology and Cultural Heritage). |
| | Control impact on setting of sites of cultural heritage importance | The site would be low level in Stage 1, with minimal visibility. |
| | | Any impact would be temporary for the duration of Stage 1(and Stage 2). |
| Waste | Management of waste on site to avoid pollution | All waste would be stored appropriately on site prior to collection by a registered waste carrier and removal to an appropriately permitted treatment/disposal facility. |
| | | A dedicated waste area would be provided on site. |
| | | Skips and other waste stores would be covered if there was a risk of wind-blow, and lorries transporting waste would be sheeted where applicable. |
| | | Waste from staff welfare facilities and office/ mess waste would be routinely removed from site (cabins would be self-contained). |
| | | Waste oil/ coolant fluids from servicing of construction plant (including generators) would be disposed to licenced waste facilities following separation for recycling where possible. |
| | Reducing waste sent for disposal | Where possible, waste would be segregated for re-use (for example soils would be used for screening bunds in Stage 1) or recycling to minimise disposal requirement. |
| | | Water from the site perimeter drainage system gathered during Stage 1 could be used for drill fluid at Stage 2, subject to testing of quality. |
| Monitoring | | Monitoring boreholes would be installed under permitted development rights to allow monitoring of groundwater throughout the duration of the planning consent, subject to an Environmental Monitoring Plan to be agreed with the Environment Agency. |
| | | The area around the site (soils, field drains etc.) would be checked daily for visual signs of pollution (e.g. fuel oil, noticeable silting). |
| | | An Environmental Clerk of Works would be present during Stage 1 to oversee the enabling works and construction and ensure operations proceed in accordance with management plans and planning conditions. |
| | | Mitigation measures put in place (e.g. impermeable membrane, drainage system etc.), would be inspected regularly and suitably maintained to ensure they remain fully operational and effective. All inspections would be recorded. Where failures or shortfalls within mitigation measures were noted, these would be recorded and action identified and undertaken within a suitable timeframe. |

## 2.2 Stage 2: Drilling, Coring and Suspension

### 2.2.1 Stage 2 Activities

Activities in Stage 2 are listed below. The site at the commencement of drilling during Stage 2 is shown in Figure P1.

Measures embedded into the site design to minimise the environmental impacts of these activities are listed in Table 2 and illustrated in Figure P4. Figure P4 shows features of the site at Stage 2 which would not remain constant throughout the lifetime of the site. Features that would remain constant are shown in Figure P2.

There would be four key aspects in Stage 2:

+ Mobilisation and assembly of drilling rigs
+ Drilling and coring (followed by demobilisation of the main rig)
+ PTT and suspension of the well
+ Demobilisation (of the PTT rig and associated equipment)

In addition to the rig (BOX 3), other equipment on site and vehicle movements during Stage 2 are shown in Chapter 3.

#### Mobilisation and Assembly of Drilling Rigs

The drill rigs and associated equipment including drill pipe, drill water and additives, bottom hole assembly components, logging equipment and mud pumps would be brought to site. In addition, casing and cementing equipment would be delivered.

The two proposed rigs to be used during this Stage (the main rig (60 m) and a workover rig (32 m) used to perform the PTT and suspend the well after the main rig) would be brought onto site sequentially as required.

A crane (up to 60 m) would be used to assemble the drill rigs and place other equipment on site. Temporary mobile lighting would be installed (<9 m mobile towers) to provide additional lighting to the drill floor as needed, in addition to standard site security lighting.

#### Drilling and Coring

The well would be drilled to approximately 2,800 m (9,200 ft.). Details of the largest drill rig that could be used on site are held in BOX 3. Details of the Well Design and how that has been informed by the geological understanding of the site are held in BOX 4. Drilling fluids (muds) that would be used are described in BOX 5. All muds would be chosen to be appropriate for the anticipated geology and would be compliant with the Environment Agency's Standard Rules (Waste Management Plan WMP3) and permitted by the Environment Agency in advance of use.

It is anticipated that the well would contain three strings of casing and a liner in addition to the conductor (as shown in BOX 4):

+ surface casing installed through the Westphalian coal measures to approximately 610 m (2,000 ft) to isolate old mine workings (this section of the well could be drilled, and casing installed at the end of Stage 1, or at the beginning of Stage 2, within the identified 12 weeks for drilling and coring activities);
+ intermediate casing installed to the top of the Namurian formation (approximately 1,183 m (3,880 ft)), to isolate the Westphalian formations before entering the target Namurian formations;
+ reservoir casing installed through the primary and additional formations of interest - the Namurian age Millstone Grit Formation and Pendleian Shale. This would be to the base of the formation (with an additional logging sump) anticipated to be at approximately 1,680 m (5,510 ft);

### Stage 2: Key Points

**DURATION – APPROXIMATELY 5 MONTHS**

+ Rig Assembly – 2 weeks
+ Drilling and Coring – <12 weeks
+ Pressure Transient Testing (PTT) – <7 weeks
+ Suspension and Demobilisation – 2 weeks

**HOURS OF WORKING**

+ Assembly, drilling, coring, PTT and suspension
  - Monday-Sunday – 24 hours per day; 12 hour shifts
+ Site deliveries
  - Monday – Friday 0700-1900
  - Saturday – 0700-1300
  - Sunday or Bank/ Public holiday – no working unless in an emergency or as agreed with the MPA

**STAFF NUMBERS**

+ Staff on site at one time during Stage 2 – up to approximately 25 (plus approx. 3 security)
+ Approximate total staff – 45

As the drilling operations would take place over 24 hours, the site would be continually manned.

**SAFETY**

+ Standard well safety equipment would be present on the site during drilling, including a blow-out preventer, vent for emergency venting of gas encountered and methane (and radon) monitoring as outlined in the Borehole Regulations.
+ Safety measures for any construction site would also be followed, including an emergency plan, maintenance of all safety equipment and routine monitoring of plant to ensure safe operation.
+ Pollution prevention measures would be used including bunding, spill kits and training of staff.

+ A liner, installed through the potential additional target shales – the Dinantian age Holkerian and Arundian shales.

Casing would be certified and visually inspected prior to running. Once at setting depth and when cemented, it would be tested to ensure its integrity. The depths, diameters, specifications and types of threaded connection of each casing string would be dependent on the depth at which the different geological formations were encountered. For this reason all of the values described above (and illustrated in BOX 4) are indicative.

Drilling operations would be required to take place 24 hours per day to enable full management of the well and drilling depth to be maintained, ensuring it is monitored and safely managed throughout the drilling. The rig and ancillary equipment including pumps would be selected to be appropriate for the site and proposed well, and to ensure that environmental impacts associated with drilling (including noise levels generated) would be acceptable at the nearest receptors to the site.

Cores of the target formations and sidewall cores would be removed using standard wireline coring equipment. The openhole section of the well would also be logged after drilling. Details of the coring and logging proposed are in BOX 6. The cores would be sent from the site for tests in a laboratory to identify the geological characteristics of the core and its gas-producing properties.

Waste from drilling and coring (drilling cuttings, muds, site waste etc.) would be removed from the site by a licensed contractor.

## **BOX 3**: Rig Parameters

INEOS would use an appropriate rig for the site. At present the exact make or model is not known as this will be dependent on availability at the time. This application therefore uses worst case parameters (on site) for a variety of rigs currently available on the market. Values used in this application are given below:

+ Max Height – 60 m
+ Max Length – 32 m
+ Max Width – 12 m
+ Max height of substructure and ancillary equipment – 15 m
+ Max Weight – 350 tonne
+ Number of vehicles needed to mobilise – approx. 76 including 6 abnormal (152 movements)
+ Will abnormal loads be required? – yes
+ Will rig lighting be required? – yes
+ Overall Sound Power Level – 113 dBA
  - Top drive without enclosure – 102 dBA
  - Shakers – 97 dBA
  - Centrifuge- 100 dBA
  - Mud pump – 99 dBA
  - Hydraulic Power Unit – 102 dBA

Where appropriate, mitigation for these values is described in the Environmental Report (for example, mitigation for noise levels).

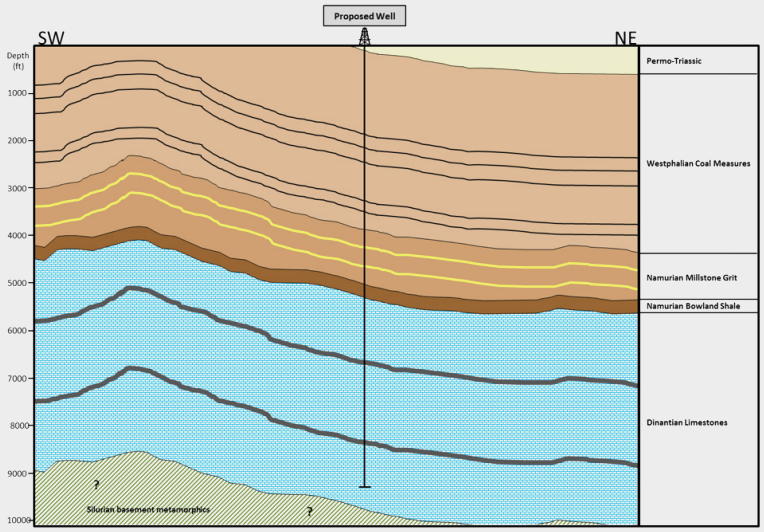
An example rig with similar parameters is shown in the above photograph (details provided in Confidential Appendix CA22). It should not be assumed this rig would be used from this supplier.

As indicated in the text, more than one rig may be used sequentially, to provide the most appropriate drilling for the geology. The rig parameters here are for the largest rig that could be used. Traffic movements and timescales provided allow for the potential to mobilise and demobilise all necessary rigs.

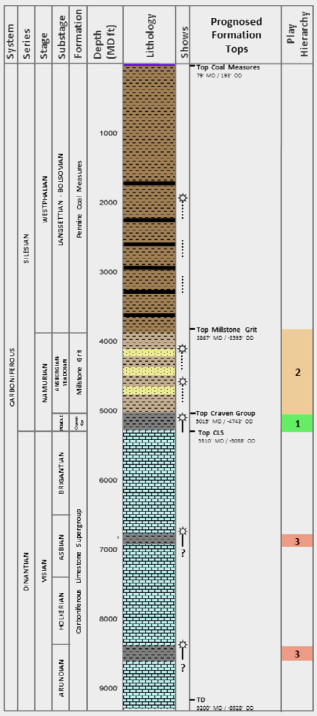
# **BOX 4**: Well Design and Geological Understanding of Site

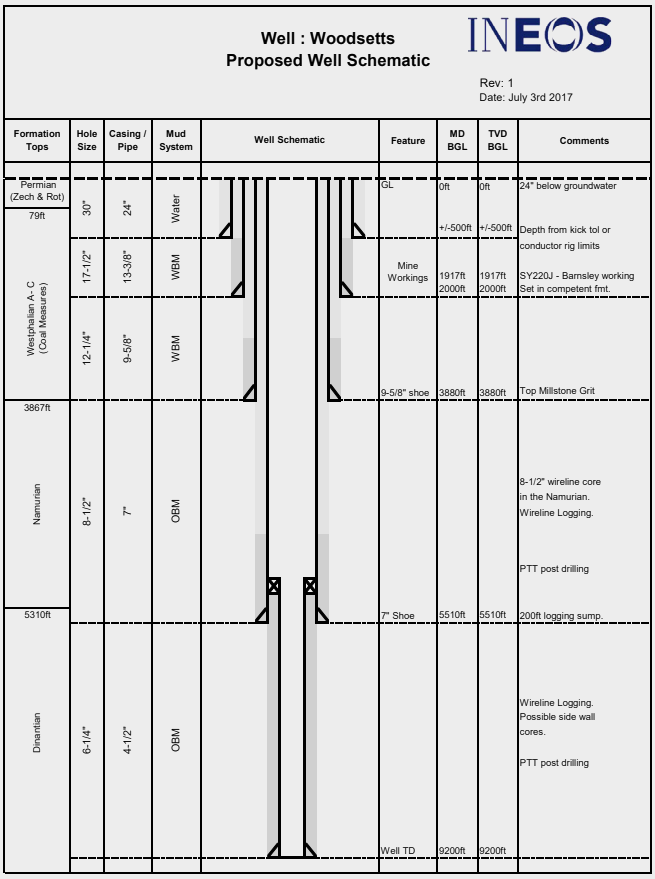
The well design is informed by INEOS' understanding of the geology and objectives of the vertical core well. The figure below shows a schematic geological cross section through the local area. A more detailed illustration of the anticipated geology is also shown. There are abandoned coal mine workings in the Westphalian Coal Measures beneath the site and the well has been designed taking these into account. The Coal Authority regulates INEOS' interaction with coal seams and abandoned workings

### Schematic Geological Cross Section




### Anticipated Stratigraphic Succession




## Well Design

The well would be designed in accordance with the Borehole Sites and Operations Regulations 1995 and Offshore Installations and Wells (Design and Construction) Regulations 1996. Oil and Gas UK Guidelines will be followed in designing and drilling the well. The well design would be approved by an independent well examiner, and subject to Health and Safety Executive (HSE) notification and Oil and Gas Authority (OGA) approval prior to the commencement of operations. A Coal Authority Deep Energy Access Agreement would also be required where a well passes through coal seams.

The vertical core well would be drilled at various diameters which progressively decrease with depth. Each diameter would be lined with steel casing with each casing string secured in place with cement. The casing would also be tested to ensure well integrity following cementing.

The casing would protect the surrounding geology, including groundwater, isolate different pressure regimes within the well and ensure well integrity.

There are old mine workings underlying the site (at approximately 584 m (1,917 ft)) and the well design has allowed for these. Mine abandonment plans have been used to chart their extent, depth and thickness and the well location reduces the number of potential mine workings this well could encounter. Should the well drill through old mine workings and losses of drill fluids occur, casing would be run and cemented to permanently isolate the mine working. If necessary, a "stage collar" can be run in the casing string above the loss zone to ensure good quality cement above and below. The well is designed to accommodate such additional contingency casing strings if required.

Sizes and setting depths shown in the adjacent figure are indicative and are subject to modification during detailed design according to final geological data and due to operational conditions as well construction progresses. In particular, the pore pressure and fracture pressure will determine the mud densities needed to control fluid ingress whilst allowing efficient drilling.

## **BOX 5**: Drilling Fluids

The purpose of drilling fluid (mud) is to:

+ Provide the primary source of well control by using a mud weight sufficiently over hydrostatic pressure to prevent any unwanted influx of formation fluids;
+ Remove drill cuttings (i.e. the fragments of rock created by the drill);
+ Stabilise the borehole;
+ Lubricate the drill string;
+ Cool the drill bit;
+ Allow use of bridging agents in the drilling fluid to minimise any loss of drill cuttings or fluids to permeable formations, where these exist;
+ Allow for the measurement of gas in the mud as it is circulated to surface.

INEOS would use drilling muds appropriate for the geology. All drill muds would be subject to engineering assessment prior to and during the drilling of the well. Denser muds would be required to maintain a sufficient weight of fluid to ensure primary well control over the expected subsurface conditions.

At present, INEOS proposes the following muds for the Vertical Core Well:

+ Fresh water with minimal additives – when drilling through upper strata;
+ Water Based Muds (polymer drilling) – when drilling through the shallow formations to the base of the Westphalian Formation (coal measures). This section would be cased and cemented before any other drill muds are used;
+ Low Toxicity Oil Based Mud (LTOBM) – when drilling through deeper strata. The Namurian Formations are particularly water sensitive, leading to problems with borehole stability when using Water Based Muds, so to drill the Namurian and Dinantian Formations in the well, LTOBMs offer improved performance over water-based fluids to improve wellbore stability. In addition, LTOBM can be reconditioned for use at other locations, thus minimizing waste generation. The base oil fluid would conform to the requirements of the EA Standard Rules SR 2015 No1 i.e. "highly refined mineral oils which contain levels of total aromatics below 0.5 per cent and polycyclic aromatic hydrocarbon (PAH) levels below 0.001 per cent, according to the OGP definition" – likely to contain base oil, calcium chloride brine, emulsifier, viscosifier, lime for alkalinity control and a baroid weighting agent.

All drilling muds would be Standard Rules compliant and authorised by the Environment Agency under the Environmental Permitting (England and Wales) Regulations 2016 for use in well construction.

## **BOX 6**: Coring and Logging Proposed

Geological objectives of the well (BOX 2) would be achieved by a combination of mud logging, coring, and wireline logging.

Detailed formation evaluation requirements (wireline logs to be run, the depth which they would cover, the amount of core to be cut, mud logging parameters etc.) would be confirmed during detailed design of the well. They would require to be confirmed by the Independent Well Examiner and OGA. However, it is anticipated that a full size core and a full suite of wireline logs would be required over the primary target. A full suite of wireline logs and if necessary, rotary sidewall coring would be required over any additional targets.

A sliced one-third of this core would be deposited with the British Geological Survey (BGS) to inform the national geological record, after a period of commercial protection.

Wireline retrievable coring systems would be used. It is planned to run the coring system into the 8-1/2" hole.

The primary target sections of the geology that would be cored are between approximately 1,179 - 1,628 m (3,867 - 5,340 ft). The total depth of the vertical core well would be approximately 2,800 m (9,200 ft.).

The PTT would measure formation pressure within the shale over a 2-week period. The pressure used would squeeze a small amount of potassium chloride (KCl) into the formation (at a minimum depth of 1,179 m (3,867 ft)), which would largely be returned to surface at the end of the test. Minimal amounts of methane would be released from the formation during this process, which would be returned to surface with returning KCl for management and disposal. This is not a flow test of gas, as the methane is not produced or measured to establish potential extraction rates. This kind of "leak-off test" is permitted under the Environment Agency's Standard Rules.

## Pressure Transient Testing

The purpose of the PTT would be to establish reservoir properties, such as whether the target zone is overpressured (which is encouraging for shale gas extraction).

Following the drilling and coring, the main rig (BOX 3) would be demobilised and a smaller workover rig (up to 32 m height) or wireline truck would be mobilised to site to undertake the PTT. The PTT would first take place at the depth of the primary shale target at approximately 1,529 m (5,015 ft). The cased well would be perforated at the target depth and a packer[7] lowered into the well from the workover rig. A maximum of 10 $m^3$ potassium chloride (KCl) solution (2-4 %) would be squeezed into the formation at the target zone, over a period of approximately two hours. The KCl would be anticipated to extend a maximum of 25 cm into the formation.

The test zone would be closed off using valves and pressure within the isolated area monitored for a period of up to two weeks. Although the site would be manned, there would be no noise associated with the rig during this period. At the end of two weeks, the packer would be removed. A small quantity of the KCl solution within the wellbore could return to surface, and any that does return would be stored for removal by a licensed waste contractor. This process could be repeated for up to two additional target zones in the Namurian Millstone Grit and Dinantian shales, if penetrated, making up a total testing period of up to two months.

There would be no flow testing of the well (i.e. no gas would be flowed to surface for metering).

It is anticipated that the PTT would follow immediately after the core well drilling was completed. However, there is the potential that there could be a short period after the drilling rig was removed from site, and prior to the workover rig being mobilised for the PTT to start, allowing for rig availability. A temporary suspension of the well would be undertaken with a mechanical plug (in accordance with Oil and Gas UK Guidelines) between the two rigs, if required.

## Suspension of the Well

Following completion of the PTT, the well would be suspended using the rig. Suspension would take approximately 2-3 days and be undertaken according to Oil and Gas UK Guidelines.

This would involve at least two mechanical plugs set into the 18 cm (7") casing, above the levels of the PTT (see BOX 7). The plugs would be weight and pressure tested to ensure the integrity of the suspended well. A blind flange, well monitoring pressure gauge and valves will be fitted to the wellhead.

The suspended well would be protected by a steel wellhead protection cage (approximately 2m x 2m x 2m) over the wellhead.

## Demobilisation

The workover rig (or wireline truck) and ancillary equipment would be removed from site, and waste removed from site by a licensed contractor for treatment and disposal or reuse. Cabins, including screening cabins would be removed from the site, with the exception of the gatehouse and an office/ welfare unit which would be retained for staff during subsequent Stages.

## **2.2.2** Stage 2 Environmental Considerations and Protection Measures

A number of environmental protection measures present for Stage 2 would be established during site construction (Stage 1). In addition, the following protection measures are included in the Proposal (table 2, Stage 2).

7. A packer is a device that can be run into a wellbore with a smaller initial outside diameter that then expands externally to seal the wellbore.

Table 2: Stage 2 Environmental Protection Measures

| Environmental Aspect | Aim | Measures built into Proposal |
|---|---|---|
| Water and Soil | Preventing pollution of aquifer during drilling | Appropriate well design would be used, including design calculations and engineered cement design and use of closed-loop mud system to allow gains and losses to be monitored. |
| | | Drilling activities would be designed to ensure that there would be no inputs of pollutants to groundwater. |
| | | Drilling fluids would be used in accordance with good practice as described in the Health and Safety Executive (HSE)'s guidance on 'The Offshore Installations and Wells (Design and Construction etc) Regulations 1996' (DCR)) (in particular that they would be designed to prevent exchange of fluids between the borehole and any groundwater-bearing formation) and Borehole Sites Operations Regulations 1995. |
| | | In the case of principal and secondary aquifers (for which 'groundwater bodies' are defined for the purposes of the Water Framework Directive), air flush, water only or water-based fluids would be used. |
| | | Drilling fluids would exclude hazardous substances as defined in paragraph 4 of Schedule 22 to the EPR 2016 and guidance published by the Joint Agencies Groundwater Directive Advisory Group (JAGDAG). Acceptable additives are listed in Annex 1 of WMP3. INEOS would gain the Environment Agency's prior agreement before any other additives were used. |
| | | If karstic or highly fissured conditions were anticipated, INEOS would gain the Environment Agency's agreement to use any additives other than inert materials. In the event that there was a loss of circulation during drilling the operator would use only those materials listed in Annex 2 of WMP3 to manage the loss of circulation and would inform the Environment Agency as soon as practicable. |
| | | Borehole design and operation (for example, fluids to be used) would be approved by Environment Agency (via Environmental Permit), OGA, HSE, and an accredited Independent Well Examiner prior to drilling. |
| | | Casing would be installed and cemented into a competent formation beneath the groundwater body, in accordance with good drilling and casing installation practice, as described in HSE's The Offshore Installations and Wells (Design and Construction etc) Regulations 1996' guidance. The maximum depth defined for a groundwater body is taken to be 400 m. Should any formation that contains a groundwater body extend below this, the criteria described above for protecting groundwater would apply to the use of drilling fluids, until a low permeability formation was reached into which casing could be set. |
| | | Details of where the casing would be installed into the competent formation beneath a groundwater body once that formation is reached would be set out in the Water Resources Act 1999 section 199 WR11 notification for this borehole. Indicative depths are shown in BOX 4. |
| | | Each layer of casing would be tested as appropriate to the geological conditions and technical requirements, to confirm integrity. |
| | | Drilling would not take place within source protection zones (SPZ) 1 or 2, as defined in the Environment Agency's Groundwater protection: principles and practice (pp. 23-24). |
| | Preventing pollution of aquifer during PTT | During testing (PTT) all fluids would be contained in a closed-loop system. |
| | | During testing, only KCl at 2-4% (dependant on the salinity within the formation) would be used. |
| | Preventing pollution of soil, groundwater or surface water from leaks from construction vehicles or onsite tanks | The geomembrane and "closed-loop" drainage system would be maintained to ensure all liquids remained on the site for removal by a licensed waste contractor, and treatment prior to disposal if required. |
| | | Frequent checking of integrity of site surface and drainage system. |
| | | Cement mixing for well cement would take place in truck-mounted silos on the hardstanding area. |
| | | Rigs would be refuelled from dedicated tanks, which would be filled directly from fuel tankers that deliver to the site. This would be undertaken in the hardstanding area to ensure any spillage would drain to the impermeable cellar rather than the perimeter drainage pipe. |
| | | Drilling fluids (muds) would be stored in a mud tank with a closed-loop system to prevent leakage. |
| | | Water for the drilling process would be contained within a closed-loop system with any potential excess water from the drilling process being transported off site in suitable tankers by a licensed contractor. |

Table 2: Stage 2 Environmental Protection Measures (cont.)

| Environmental Aspect | Aim | Measures built into Proposal |
|---|---|---|
| Air | Control of local air pollution (particulates, NOx) and greenhouse gases arising from drilling operations (rig) | Equipment including the rig would be chosen to ensure emissions were as low as possible while maintaining efficiency of the plant. |
| | | With appropriate mud system design, methane would not be anticipated to be encountered in quantity. The mud weight would be maintained at a sufficient weight to prevent the ingress of gas. |
| | | Well control equipment would be utilised during the drilling of this well. A diverter would be installed onto the conductor as a safety precaution in the unlikely event gas was encountered within the shallower formations. A Blow Out Preventer (BOP) would be installed onto the 13-3/8" casing. Gains in mud volume indicating the ingress of hydrocarbon fluids would trigger use of the BOP to shut in the well to stop more gas from entering the wellbore. Any gas that was within the well would be circulated out under controlled conditions and vented to the atmosphere. |
| Noise | Controlling noise from drilling operations | The rig would be oriented to help mitigate drilling noise. |
| | | The site (excluding access track) is located approximately 425 m from the nearest residential receptor and noise during Stage 2 would be within acceptable limits at this receptor due to the distance. |
| | | Use of silencers or other noise attenuation equipment or enclosures on mud pumps and other noise generating equipment associated with drilling. |
| | | Night-time vehicle movements would not be permitted except in case of emergency, and audible vehicle reversing alarms would not be used at night. |
| | | Local residents would have contact details for the company's operations team to raise noise issues. |
| | | Regular maintenance of equipment would be undertaken to minimise noise generation. |
| Traffic | Safely mobilising rig to site | INEOS would liaise with the local police force and local Highways Authority to address abnormal load delivery. |
| | | A TMP would be followed relating to speed, traffic movements and controls on timing to access site. |
| | Reducing traffic disturbance to other road users and local residents during drilling | Any issues would be dealt with thorough INEOS' complaints management procedure, including dismissing non-compliant contractors. |
| | | Night-time vehicle movements would not be permitted except in case of emergency, or with the agreement of the MPA. |
| Ecology | Reducing disturbance caused by noise, light and presence of workers and vehicles over 24 hour working | Additional lighting for Stage 2 would be low intensity, shielded (when located above the site perimeter) and angled away from sensitive receptors. This would include maintaining the "dark zone" for bats and other protected mammals. |
| | | Night working would be minimised, with only operations to run the drilling operations undertaken at night (no deliveries etc.). |
| | | Impact of Stage 2 would be temporary, lasting up to five months. |
| Visual Impact | Reducing impact on landscape character | The rigs would be a temporary feature in the landscape, but mitigated by site choice, including screening by the existing landscape including blocks of trees, hedges, topography and agricultural infrastructure. Low-level operations would be screened by grassed bunding and fencing as well as full height screening by double stacked cabins.<br><br>The largest drilling rig would be removed from site after the drilling/ coring, and a smaller rig or wireline truck introduced for the PTT, to minimise visual impact. |
| | Reducing impact on key viewpoints, including settlements, individual properties, roads and tracks | The temporary nature of the Proposal would ensure no significant, long term effects on visual impact. |
| | | Site design would include fencing and bunding to screen operations from viewpoints close to the site. |
| | | Additional lighting for Stage 2 would be low intensity, shielded (when it is located above the site perimeter) and angled away from sensitive receptors. |
| Cultural Heritage and Archaeology | Reducing impact on setting of sites of cultural heritage importance | As described above for visual impact. |

Table 2: Stage 2 Environmental Protection Measures (cont.)

| Environmental Aspect | Aim | Measures built into Proposal |
|---|---|---|
| Seismic Impact or Subsidence | Avoiding risk of subsidence of abandoned mine workings | There are abandoned mine workings underlying the site. The site and well design has allowed for these. The site location, and location of the proposed well on the site was selected to reduce the number of potential mine workings this well could encounter. Mine abandonment plans, geological data and offset drilling records have been used to assess the extent and nature of abandoned workings and mine entries. |
| | | Should mine workings be encountered (identified by loss of drilling fluid, which at this point would be water-based fluids compliant with WMP3 of Standard Rules Permit SR2015 No1 ) the mine working would be isolated by running an additional casing string and cementing it in place above and below the mine. A stage collar can be run in the casing string above the mine to ensure there is good quality cement above and below, to isolate it. |
| | | The well has been designed with an additional casing string to be installed just below the mine workings. This method has been successfully used to deal with the issue of mine workings in a number of oil and gas wells in the area. |
| | | There is no risk of subsidence associated with wall/panel workings, as the collapse of the roof of the mine was an integral part of the process. |
| | | A Coal Authority Deep Energy Access Agreement would be required to ensure well design has taken old mine workings into account. |
| | Minimising risk of seismic activity | No activities that could cause seismic activity will be undertaken. |
| Waste | Effective management of drilling waste on site to prevent pollution or exceedance of local treatment capacity | Waste would be minimised through appropriate well design. |
| | | Drilling muds would form a closed-loop system, with recycling where possible (subject to solids control equipment). |
| | | Surface water from the perimeter drain would be tested and could be used in drilling muds if of appropriate quality. |
| | | Used low-toxicity oil-based mud would be returned to the supplier for recycling and re-use. |
| | | Drill cuttings and waste water-based drilling fluid would be removed from site for treatment by licensed waste contractor. |
| | | Well components would be retained for use in future wells where possible (see Stage 5). |
| Monitoring | INEOS SHE representative will ensure operations proceed in accordance with management plans and planning conditions | The area surrounding the site would be checked daily for visual signs of pollution (e.g. fuel oil, leakage from perimeter, noticeable silting). |
| | | Gas detection equipment would be used to continuously monitor gases in drilling mud returns and on the drill floor. |
| | | Management plans for waste, noise and traffic would continue to be followed, which would include provisions for monitoring, review and addressing complaints. |

## 2.3 Stage 3: Maintenance of the Suspended Well Site

### 2.3.1 Stage 3 Activities

During Stage 3, the following activities would be undertaken:

+ Daily visits (if required)
  - Security Patrol (checking security arrangements, fencing, CCTV if maintained)
+ Weekly visits
  - Operational maintenance (checks on surface water storage tank integrity, site membrane, pipe integrity, valves and well pressure)
  - Environmental Monitoring (check on environmental condition surrounding site, evidence of breaches to membrane etc.)
+ Monthly visits
  - Site drainage contractor (removal of water from drainage system and any foul water)
  - Environmental Monitoring (groundwater monitoring)
+ Quarterly visits
  - Facilities maintenance (checking fencing, welfare cabins etc.)
+ Annual visits
  - Wellhead inspection and routine maintenance if required.

Visits would be undertaken by staff accessing the site using their own transport, rather than in a minibus, as in Stage 1 and 2, given the small numbers involved. Only one or two staff would generally access the site at a time, and the site would not be constantly manned. The gatehouse and welfare facilities would remain on the site to provide accommodation for these staff when carrying out their maintenance and monitoring visits. The site during Stage 3 is shown in Figure P1.

Equipment and plant on site, and vehicle movements during the suspension stage are outlined in Chapter 3.

Measures embedded into the Proposal to minimise the environmental impacts of these activities at Stage 3 are illustrated in BOX 7.

### Stage 3: Key Points

**DURATION – UP TO THE 5-YEAR EXTENT OF THE APPLICATION**

**HOURS OF WORKING**

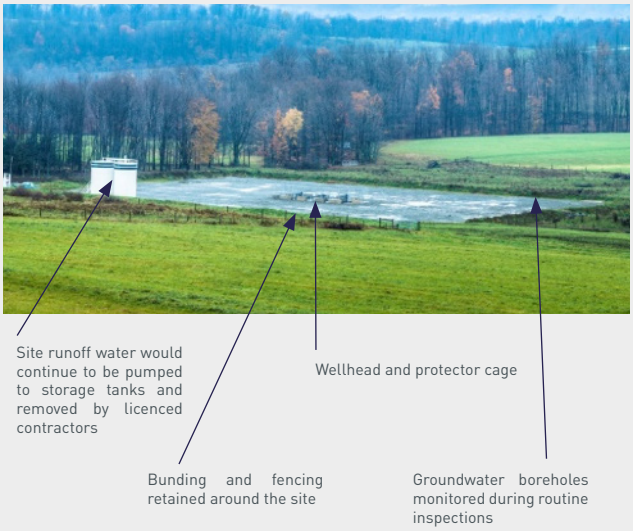
+ Monday-Friday – 0700-1900
+ Saturday, Sunday and Bank / Public Holiday – no working unless otherwise agreed with MPA or in an emergency

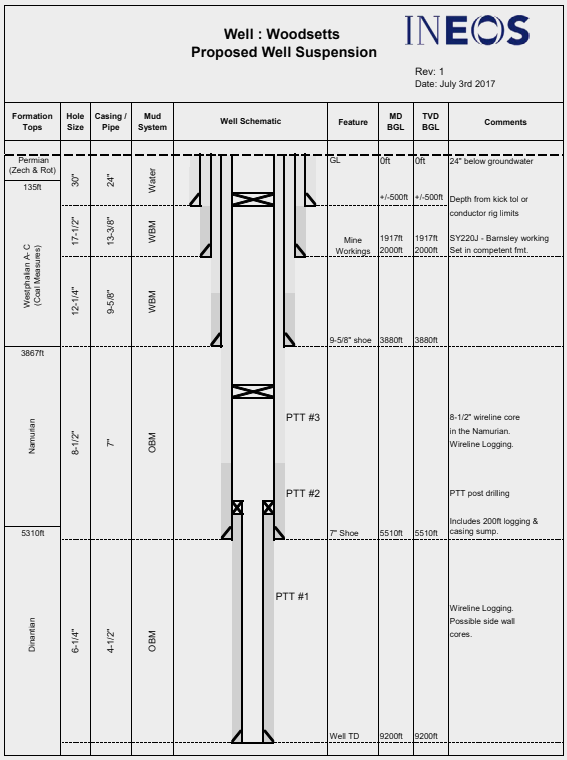
**STAFF NUMBERS**

+ Staff on site during Stage 3 – up to 5

## BOX 7: Features of the Vertical Core Well Site at Stage 3

This graphic shows features of the site at Stage 3 (where it would differ from the generic site shown in Figure P2), and the proposed suspension schematic.



### 2.3.2 Stage 3 Environmental Considerations and Protection Measures

A number of environmental protection measures would have been established during site construction (Stage 1) and drilling, coring and suspension (Stage 2) as outlined in Figure P2 and Tables 1 and 2.

Stage 3 works would result in a much lesser potential for environmental impact with minimal risk of air pollution, noise, disturbance and transport impacts due to the nature and duration of each proposed activity. The Stage 3 site would be low impact, with all plant generally below the level of the retained fencing and bunding. The impermeable site membrane and perimeter drainage system would be retained and frequently checked, to ensure their integrity.

Monitoring would be undertaken in accordance with the environmental monitoring plan as outlined in Stage 1. Monitoring would include surface water, soil and ground gas sampling.

## 2.4 Stage 3a: Possible Workover of the Suspended Well

### 2.4.1 Stage 3a Activities

There may be a requirement to bring a workover rig back onto site for well maintenance; though not to modify the well for any other purpose. If required, this would be a maximum of 32 m tall and could be on site for up to a month, including mobilisation / demobilisation. It is not intended for there to be any night-time or weekend working during workovers, unless agreed with the MPA separately, or in an emergency.

Appropriate screening would be provided as necessary, as in Stage 2, and there would be a requirement for lighting, generators and other low-level site equipment. Traffic movements for this aspect are provided as a contingency in Chapter 3, as in practice a workover is unlikely to be required on a suspended well, and the full timing is not known. The MPA would be informed in advance of any workover taking place.

### 2.4.2 Stage 3a Environmental Considerations and Protection Measures

The environmental protection measures outlined for Stage 2 (Table 2) would be followed during any workover.

#### Stage 3a: Key Points

DURATION – UP TO 1 MONTH

HOURS OF WORKING

+ Monday-Friday – 0700-1900
+ Saturday, Sunday and Bank / Public Holiday – no working unless otherwise agreed with MPA or in an emergency

STAFF NUMBERS

+ Staff on site during Stage 3a – up to approximately 10 plus approximately 3 security.
+ Although night working is not proposed, staff would be on site for 24 hours, with reduced staff numbers at night and at weekends, to maintain the rig safely.

## 2.5 Stage 4: Use of the Well as a Listening Well

### 2.5.1 Stage 4 Activities

There would be three key aspects in Stage 4.

+ Mobilisation of workover rig (up to 32 m), crane (up to 50 m) and other required plant and facilities (listening truck, welfare, generators, storage etc.). Alternatively, instead of a workover rig, a wireline truck, crane and elevated work platform could be mobilised
+ Placement of a string of geophones (small seismic receivers) run on wireline inside the reservoir casing for the duration of the listening operations
+ Demobilisation

Operations during Stage 4 would only take place to undertake baseline monitoring, or when a well elsewhere is hydraulically fractured, subject to such a consent for that separate activity being granted within the period of planning consent for this well. As this would only take place during the daytime, there would be no night-time working. There would be no introduction of any chemicals into the well during Stage 4. Further details are shown in BOX 8.

### 2.5.2 Stage 4 Environmental Considerations and Protection Measures

The environmental protection measures outlined for Stage 2 (Table 2) would be followed during listening well operations, where appropriate.

The listening well activities would result in minimal noise and very few traffic movements (See Chapter 3).

#### Stage 4: Key Points

DURATION – APPROXIMATELY 5 WEEKS

+ Mobilisation / demobilisation – 2-3 day each
+ Listening operations – up to 30 days

HOURS OF WORKING

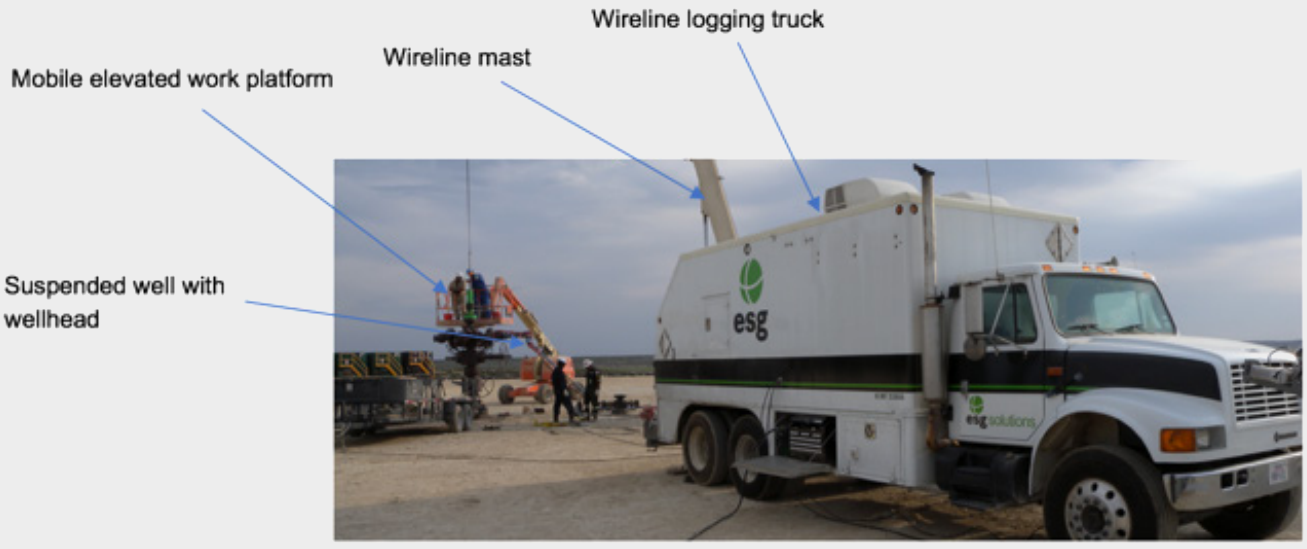
+ Monday-Friday – 0700-1900
+ Saturday, Sunday or Bank / Public holiday – no working

STAFF NUMBERS

+ Staff on site during Stage 4 – 5-10 plus approximately 3 security.
+ If a workover rig is used, staff would be on site for 24 hours, with reduced staff numbers at night and at weekends, although night working is not proposed, to maintain the rig safely.

### BOX 8: Features of the Vertical Core Well Site at Stage 4

This photograph shows features of the site at Stage 4 during a listening operation (photo from CA16).



## **2.6** Stage 5: Abandonment (Decommissioning) and Restoration

### **2.6.1** Stage 5 Activities

There would be three key aspects in Stage 5:

+ Plugging and abandoning (decommissioning) the well
+ Removal of residual wellsite equipment and surfacing
+ Restoration of ground (and aftercare)

Activities in Stage 5 are listed below, and the site at the end of Stage 5 is shown in Figure P1.

Equipment and plant on site and vehicle movements during the decommissioning and restoration stage are listed in Chapter 3. Plant required at each aspect of Stage 5 would differ, although would all be brought onto the site at the beginning of Stage 5.

### Stage 5: Key Points

DURATION – APPROXIMATELY 2 MONTHS

+ Plugging and abandoning (decommissioning) well – approx. 2 weeks
+ Removal of site equipment – approx. 2 weeks
+ Restoration – approx. 3 weeks
+ Aftercare – up to 5 years

HOURS OF WORKING

+ Decommissioning well – 24 hours per day, 12 hour shift
+ Restoration
  - Monday-Friday – 0700-1900
  - Saturday – 0700-1300
  - Sunday or Bank / Public holiday – no working unless agreed by MPA or in an emergency

STAFF NUMBERS

+ Staff on site during Stage 5 – approx. 20 during decommissioning (plus approx. 3 security), approx. 5 for restoration.

#### Decommissioning the Well

Decommissioning of the well would be undertaken in accordance with Oil and Gas UK Guidelines on Well Abandonment and according to an abandonment plan to be agreed with the Environment Agency, Health and Safety Executive (HSE) and an independent Well Examiner. The decommissioning process would also follow OGA, Coal Authority and HSE requirements, and proceed in accordance with good industry practice of the time.

Decommissioning and restoration plant would be mobilised onto site. The suspended well would be decommissioned by ensuring there were two permanent barriers, each of at least 30 m of good cement, in place within the well. The barriers would be verified and tested in accordance with the Oil and Gas UK Guidelines. The wellhead would be removed and casing and cement cut to 2 m below ground level in accordance with regulatory and permit requirements, to allow restoration of the site to agriculture.

The 32 m (max) workover rig would be required during well decommissioning for a short period.

#### Removal of Residual Site Equipment and Site Surfacing

Removal of residual equipment would take place within the existing site Heras fencing. The concrete pad and cellar would be broken for removal by a licensed waste contractor, and aggregate, drainage pipework and other infrastructure would be removed from the surface (following ensuring it was emptied of residual water, which would be removed by a licensed contractor as usual) and reused where permitted. Aggregate would be stored outside the main site fencing on bog mats for removal, in the same location as Stage 1. Any potentially contaminated equipment would be removed from the site prior to removal of the impermeable geotextile/ HDPE lining.

All site equipment and infrastructure would be reused or recycled where possible, or alternatively removed from site by licensed waste contractors as appropriate.

Any groundwater monitoring boreholes would be maintained until the environmental permit was surrendered.

#### Restoration

All restoration would be undertaken in appropriate weather conditions. The soils stored in bunds would be used to level and restore the site surface, with any necessary physical or nutrient treatment applied as appropriate. Field drainage would be re-developed if required. The site would be reseeded and prepared for aftercare as agricultural land.

Access tracks and road amendments (junction amendments or passing place improvements) would also be restored as agreed with the landowner and Highways Authority, or retained for continued use, subject to any necessary further planning consent. Any fences or gates removed to facilitate the development would be replaced In addition, gaps in the existing hedgerows parallel to the access track and linking the two sections of Dewidales Wood will be planted with native species of local provenance, to benefit the local environment.

### Aftercare

An aftercare plan would be put in place as a condition of planning consent, to ensure appropriate aftercare of the site as agricultural land. Aftercare would take place within the landowner's existing management schedule.

A monitoring plan as agreed with the Environment Agency would be followed as a condition of the Environmental Permit for the site. This would include post-plugging and abandonment monitoring, and the permit surrender could not be accepted by the Environment Agency unless they were content that no long-term environmental issues remained.

## 2.6.2 Stage 5 Environmental Considerations and Protection Measures

Operations during Stage 5 would be similar to the construction operations at Stage 1 and the same protective measures would apply for appropriate activities. Measures to minimise effects from the workover rig during decommissioning would be similar to those outlined under Stage 2. In addition, the following additional protective measures in Table 3 would be followed.

Table 3: Stage 5 Environmental Protection Measures

| Environmental Aspect | Aim | Measures built into Proposal |
|---|---|---|
| Water and Soil | Minimising soil damage during ground restoration works | The methods in the restoration and aftercare plan would be followed to prevent soil damage. |
| | | Once the site surface membrane was removed, care would be taken to avoid pollution of soil, groundwater or surface water from fuel leaks or routine activities during ground restoration (as outlined for Stage 1 prior to laying the membrane). |
| | | Aggregate and concrete (pad and cellar) would be fully removed from site before the impermeable liner was removed so any residual contamination would not be washed into soil. |
| | Avoid pollution of aquifer during decommissioning | Measures would be taken when decommissioning the vertical core well to ensure there would be no inputs of pollutants to groundwater and that there was no subsequent leakage of groundwater into the well or to other geological horizons. |
| | Prevention of leaks of gas or suspension fluid from vertical core well once abandoned | The well has been designed in accordance with the Borehole Regulations reviewed by the HSE and by an independent third party well examiner to ensure wellbore integrity. During drilling each string of casing would have been cemented to surface and pressure tested to confirm integrity. |
| | | At decommissioning, two permanent barriers would be set within the wellbore to seal the well. These would be pressure tested and tagged to ensure integrity. |
| | | The well would be decommissioned in accordance with all current borehole regulations and guidance to ensure integrity and seal the wellbore. |
| | | Suspension / decommissioning fluid would be brine. |
| Subsidence | Ensuring well is properly abandoned and restored and will not collapse over time should surrounding minerals be excavated | The casing of the vertical core well would remain in the ground apart from the upper 2 m (which would be cut, to allow for surface restoration), and the well would be sealed, so there would be no risk of the borehole itself collapsing. |
| Ecology | Restoring site to be appropriate for surrounding environment | Restoration would be to a condition allowing pre-existing management to be undertaken, in accordance with the restoration and aftercare plan. This would include improving surrounding "gappy" hedgerows with native species of local provenance. |
| | | Restoration would be carried out to best agricultural practice taking account of existing site specific considerations at the time. |
| | | Well decommissioning would include cutting casing and covering with topsoil, so subsurface environment would be unaffected. |
| Visual Impact | Minimising impact on landscape character and key viewpoints, including settlements, individual properties, roads and tracks | No surface features of the well site would remain once site restored. |
| Flood | Preventing risk of site flooding or site increasing flood risk elsewhere | Restoration and soil management would ensure field drainage would be efficient so site would not be subject to ponding. |
| Monitoring | | An Environmental Clerk of Works would be present during Stage 5 to ensure restoration operations proceeded in accordance with management plans and planning conditions. |
| | | The area around the site would be checked daily for visual signs of pollution (e.g. fuel oil, noticeable silting). |

# 3.0 Equipment & Vehicle Movements Proposed

Equipment and plant on site during each Stage are shown in Table 4. Figures in brackets refer to a less likely option (though potentially worst case) for the Stage identified. For example, Stage 4 (Listening Well Operations) could be undertaken using a workover rig, though more likely a wireline truck would be used.

Locations of fixed plant are shown in Figure P1 and the planning application drawings (P304-S21-PA-06 to 09). Exact models chosen will depend on availability and specific site requirements (for example, to minimise noise) but indicative dimensions are given in Table 4. Sources of the photographs shown in Table 4 are provided in a Confidential Appendix (CA). Although some photographs are of indicative equipment from generic plant supply websites (and are acknowledged as a courtesy), some potential suppliers have requested not to be named in the application. It must therefore be noted that photographs shown in Table 4 do not imply suppliers to be used. This separation is not made in the CA.

Traffic movements associated with each Stage are shown in Table 5. It should be noted that a "movement" refers to a one-way journey of a single vehicle. Therefore 10 movements per day equates to 5 vehicles arriving at and leaving the site. A reasonable worst case is assumed in terms of vehicle movements required, and the time over which they would occur (i.e. the shortest possible length of a Stage is used, which would maximise daily movements).

An abnormal load is one greater than 44 tonnes, an axle load of more than 10 tonnes for a single non-driving axle and 11.5 tonnes for a single driving axle, a width of more than 2.9 metres or a rigid length of more than 18.65 metres.

Table 6 shows a breakdown of these movements by activity within each Stage, and Table 7 a maximum number of vehicle movements per day, separated into vehicle types (noting that the maximum for all vehicle types would not apply to a single day).

A maximum of 60 movements per day of vehicles over 7.5 tonnes would apply to the site at all Stages. This size relates to Heavy Goods Vehicles (HGVs) excluding the smaller Large Goods Vehicles (LGVs) between 3.5 tonnes and 7.5 tonnes. This corresponds to a maximum of 30 trucks entering and leaving the site each day – or 3 trucks an hour over a 10 hour day. This level would occur only over short periods during site construction and restoration when aggregate is brought onto site to surface the site, and during the mobilisation and demobilisation of the drilling rigs.

### Table 4: Plant and Equipment on Site

| Plant | Max height (m) | Max width (m) | Max length (m) | Plant/Comment/Photo | Approximate Number | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Stage 1 | Stage 2 | Stage 3 | Stage 3a | Stage 4 | Stage 5 |
| Fencing | 2.0 | n/a | variable | Heras Fencing for site boundary (photo from CA1)  | yes | yes | yes | yes | yes | yes |
| | 1.3 | n/a | variable | Operational site fencing on top of bunding (post and rope) | yes | yes | yes | yes | yes | yes |
| | 2.0 | n/a | variable | Security gates (one set at road and one set at entrance to compound) | 2 | 2 | 2 | 2 | 2 | 2 |
| | 2.0 | n/a | variable | Rear gates (pedestrian) | 1 | 1 | 1 | 1 | 1 | 1 |
| Cabins | Up to 3.0 | 4.5 | Up to 18m | Cabins would be stacked around the site perimeter to a maximum height of 2 cabins – staff offices on top of storage (photo from CA2).<br><br>In Stage 1 and 2, cabins include welfare (160 $m^2$ in all) Offices (100 $m^2$ in all) Gatehouse and Stores including Chemical Store (320 $m^2$ in all). In stage 3, only welfare, site office and gatehouse would remain, with additional stores in Stage 5 (it is likely that a combined office/welfare facility would be used). Stage 3a and 4 would use empty cabins as acoustic screening for the workover rig.  | 34 | 34 | 2-3 | 34 | (34) | 34 |

Table 4: Plant and Equipment on Site (cont.)

| Plant | Max height (m) | Max width (m) | Max length (m) | Plant/Comment/Photo | Approximate Number | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Stage 1 | Stage 2 | Stage 3 | Stage 3a | Stage 4 | Stage 5 |
| Lighting/ security cameras | 5.5 | n/a | n/a | Camera security for site (likely 3 mobile and ground mounted, 1 fixed at site entrance). | 4 | 4 | 4 | 4 | 4 | 4 |
| | 9.0 | 1.0 | 1.0 |  Lighting for cabins and site floor – mobile for use on site where necessary. Diesel powered. Photo from CA3. | 7 | 7 | 1 | 4 | 2 | 4 |
| Site power | 2.9 | 1.7 | 5.1 | 500kva generator: To power site offices, electrical construction devices, electrical top drive on workover rigs etc (separate generators associated with main rig). Photo from CA4.  | 1 | 1 | - | 1 | (1) | 1 |
| | 2.0 | 1.2 | 2.9 | 100 kva generator (to power lighting for site office and minor electrical needs at restoration etc). Photo from CA5.  | - | - | 1 | 1 | 1 | 1 |
| | 3.9 | 2.5 | 12 | 500 kva generator associated with main rig | - | 3 | - | - | - | - |
| Site infrastructure | 2.5 | 2.5 | 3.5 | Water tank for site perimeter drain – approx. 15 $m^3$. Photo from CA6.  | 1 | 1 | 1 | 1 | 1 | 1 |

Table 4: Plant and Equipment on Site (cont.)

| Plant | Max height (m) | Max width (m) | Max length (m) | Plant/Comment/Photo | Approximate Number | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Stage 1 | Stage 2 | Stage 3 | Stage 3a | Stage 4 | Stage 5 |
| Site infrastructure | 3.0 | 5.5 | 4.5 | Water tanks for construction water/drilling water and waste water (up to 55 $m^3$). Likely 15 $m^3$ for Stage 1, 3a, 4 and 5. Photo from CA7.  | 1 | 2 | - | 1 | 1 | 2 |
| | n/a | n/a | n/a | Foul water tanks: 4 x tanks attached to welfare cabins – 20 $m^3$ in all | 4 | 4 | 1 | 1 | 1 | 1 |
| | 2.0 | 8.0 | 5.0 | Waste area (including segregated skip for general site waste (not drilling waste) – approx. 40 $m^2$ | yes | yes | yes | yes | yes | yes |
| | 1.5 | 2.0 | 1.7 | Diesel tank for general site use (lighting, generators, site vehicles etc) – likely 4-5 $m^3$. Photo from CA8.   | 1 | 1 | 1 | 1 | 1 | 1 |
| | 2.0 | 2.0 | 2.0 | Wellhead with safety cage. Photo from CA9.  | – | – | 1 | 1 | 1 | – |
| Construction & Operational Plant | 3.0 | 2.3 | 5.0 | Concrete mixer: Brought onto site with water, sand and cement. Batched on site from within vehicle to prevent concrete hardening in case of delay. Photo shows 12 $m^3$ vehicle. Photo from CA10.  | 2 | - | - | - | - | - |

Table 4: Plant and Equipment on Site (cont.)

| Plant | Max height (m) | Max width (m) | Max length (m) | Plant/Comment/Photo | Approximate Number | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Stage 1 | Stage 2 | Stage 3 | Stage 3a | Stage 4 | Stage 5 |
| Construction & Operational Plant | 6.7 | 2.8 | 2.8 |  Cement silo : Brought onto site on a truck. Photo from CA11. | 1 | 3 | - | - | - | 1 |
| | 2.5 | 2.5 | 3.0 | Cement pump. Photo from CA12.  | 1 | 1 | - | 1 | - | 1 |
| | 35 | 7.0 | 12.5 | Up to 50T crane: For Installation of rigs. Photos from CA13.   | - | 1 | - | 1 | (1) | 1 |
| | 60 | 7.0 | 12.5 | Up to 350T crane: For installation of main rig and lifting kit into place as necessary(alternative). Photo from CA14.  | - | (1) | - | - | - | - |
| Construction & Operational Plant | 3.0 | 5 | 5 | Wireline truck: For listening well operations (as in BOX 8) and logging unit for wireline coring. Photo from CA15.  | - | 1 | - | - | 1 | - |
| | 10 | 5 | 5 | Wireline mast: For listening well operations (as in BOX 8). Referenced in CA16. | - | - | - | - | 1 | - |
| | 3.0 | 5 | 5 | Elevated work platform: For listening well operations (as in BOX 8). Referenced in CA16. | - | - | - | - | 1 | - |

Table 4: Plant and Equipment on Site (cont.)

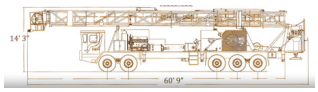
| Plant | Max height (m) | Max width (m) | Max length (m) | Plant/Comment/Photo | Approximate Number | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Stage 1 | Stage 2 | Stage 3 | Stage 3a | Stage 4 | Stage 5 |
| Construction & Operational Plant | 2.6 | 1.2 | 2.5 | Rollers: Levelling surface of site. Photo from CA17.  | 2 | - | - | - | - | - |
| | 3.2 | 3.9 | 5.5 | Dozers: Stripping soils and forming soil bunds. Photo from CA18.  | 2 | - | - | - | - | 2 |
| | 9.0 | 3.2 | 8.5 | Excavator: Stripping soils and forming soil bunds. Photo from CA19.  | 1 | - | - | - | - | 1 |
| | 3.3 | 2.5 | 4.5 |  Dumper truck: Stripping soils and forming soil bunds. Photo from CA20. | 2 | - | - | - | - | 2 |
| Drilling rigs | 32 | 5 | 10 | Workover rig. Photos from CA21 example workover showing rigs.   | - | 1 | - | 1 | (1) | 1 |
| | 32 | 5 | 10 |  Conductor/ surface rig. Photo from CA23 showing 25 m rig | 1 | - | - | - | - | - |
| | 8.0 | 2.0 | 5.0 |  Monitoring Borehole Rig – photograph shows rig approximately 3 m height | 1 | - | - | - | - | - |

Table 4: Plant and Equipment on Site (cont.)

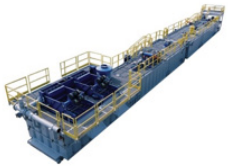
| Plant | Max height (m) | Max width (m) | Max length (m) | Plant/Comment/Photo | Approximate Number | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Stage 1 | Stage 2 | Stage 3 | Stage 3a | Stage 4 | Stage 5 |
| | 60 | 32 | 12 |  Main rig: As outlined in BOX 3 – referenced in CA22 | - | 1 | - | - | - | - |
| Kit associated with drilling rigs | 3.5 | 2.7 | 7.7 | Fuel tank plus bund: 20,000 litre diesel tank (20 $m^3$) (double skinned). Photo from CA24.  | - | 2 | - | 1 | (1) | 1 |
| | 2.6 | 3.6 | 16.8 | Mud tank (3 tanks combined – approx. 143 $m^3$ in total). Photos from CA25.  | - | 1 | - | 1 | - | 1 |
| | 3.3 | 3.3 | 9.2 |  Mud pump. Photo from CA26. | - | 2 | - | 1-2 | - | 1-2 |
| | 3.0 | 2.5 | 6.0 |  Mud mixer. Photo from CA27. | - | 1 | - | 1 | - | 1 |
| | 2.3 | 2.7 | 12 | Settling tank | - | 1 | - | 1 | - | 1 |
| | 2.3 | 2.6 | 11.4 |  Shaker tank/skid (3 shakers on a skid) Photos from CA28.  Mud tank and shaker combined. | - | 1 | - | 1 | - | - |

Table 4: Plant and Equipment on Site (cont.)

| Plant | Max height (m) | Max width (m) | Max length (m) | Plant/Comment/Photo | Approximate Number | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Stage 1 | Stage 2 | Stage 3 | Stage 3a | Stage 4 | Stage 5 |
| Kit associated with drilling rigs | 2.5 | 2.5 | 5.8 | Surge tank | - | 1 | - | 1 | - | - |
| | 3.5 | 2.9 | 6.5 | Cement tank & Well kill tank | - | 2 | - | 2 | - | 2 |
| | 3.5 | 2.5 | 12 | Cuttings handling (skip following treatment in shaker tank/settling tank) | - | 1 | - | 1 | - | 1 |
| | 2.6 | 12 | 12 | Mud storage (segregated tanks) | - | 1 | - | - | - | 1 |
| | 10.0 | 2.5 | 2.5 | Emergency vent | - | 1 | - | 1 | - | - |
| | 3.2 | 3.5 | 15.2 |  Silicon Controlled Rectifier (SCR) (rig power control). Photo from CA29. | - | 1 | - | - | - | - |
| | 4.5 | 2.5 | 6.5 |  Koomey (Pressure control). Photo from CA30. | - | 1 | - | 1 | - | 1 |
| | 4.0 | 3.0 | 8.9 |  Blow out preventor and skid and choke manifold. Photo from CA31. | - | 1 | - | 1 | (1) | 1 |
| | 2.5 | 2.5 | 6.0 | Compressor and housing for power for top drive. Photo from CA32.  | - | 2 | - | - | - | - |
| | | | | Drill pipe rack (to be stored in dedicated area adjacent to bunding in corner of site). Photo from CA33.  | - | yes | - | - | - | - |

Table 5: Summary of traffic movements by vehicle type (indicative)

| | Stage 1 Site construction | Stage 2 Drilling, Coring , PTT & Suspension | Stage 3 Routine maintenance (annual) | Stage 3a Well intervention/ workover (if required) | Stage 4 Listening well operations | Stage 5 Decommissioning and restoration | Total over 5 years (excluding Stage 3a & 4) | Total over 5 years (including Stage 3a & 4) |
|---|---|---|---|---|---|---|---|---|
| Number of days | 77 | 140 | 365 | 16 | 35 | 42 | | |
| Total small vehicle movements (<3.5t)  | 36 | 40 | 986 | 6 | 8 | 38 | 4,334 | 4,221 |
| Total Large Goods Vehicles (LGV) movements (3.5t-7.5t)  | 446 | 1,622 | 12 | 144 | 306 | 224 | 2,343 | 2,792 |
| Total Heavy Goods Vehicles (HGV) movements (7.5t-32t)  | 1,220 | 224 | 0 | 22 | 86 | 1,134 | 5,013 | 5,811 |
| Total HGV movements (>32t)  | 454 | 1,554 | 28 | 224 | 456 | 206 | | |
| Total abnormal load movements  | 42 | 43 | 0 | 2 | 12 | 16 | | |
| Total LGV, HGV and abnormal movements (>3.5 t) | 2,162 | 3,443 | 40 | 392 | 860 | 1,580 | 7,357 | 8,603 |
| **Total movements (all vehicles)** | **2,198** | **3,483** | **1,026** | **398** | **868** | **1,618** | **11,701** | **12,824** |
| **Daily average movements (all vehicles)** | **29** | **25** | **3** | **25** | **25** | **39** | | |

Table 6: Breakdown of total traffic movements into activities at each Stage (indicative)

| | Stage 1 Site construction | Stage 2 Drilling, Coring & Suspension | Stage 3 Routine maintenance (annual) | Stage 3a Well intervention/ workover (if required) | Stage 4 Listening well operations | Stage 5 Decommissioning and restoration |
|---|---|---|---|---|---|---|
| Staff and stakeholder visits | 476 | 1,652 | 730 | 150 | 316 | 252 |
| Regular site requirements (potable water, skip change, road sweeper, fuel, drainage removal etc) | 360 | 486 | | 54 | 136 | 168 |
| Site construction | 1,192 | | | | | |
| Site set up (delivery of screening cabins etc) | 70 | | | | | 60 |
| Installation of cellar and monitoring boreholes | 100 | | | | | |
| Drilling of preliminary section (including mobilisation and demobilisation) | | 228 | | | | |
| Mobilisation of main rig | | 232 | | | | |
| Drilling of main core | | 484 | | | | |
| Demobilisation of main rig | | 250 | | | | |
| Mobilisation for PTT | | 42 | | | | |
| PTT | | 56 | | | | |
| Suspension of well and demobilisation | | 53 | | | | |
| Weekly maintenance (technical and environmental monitoring) | | | 208 | | | |
| Monthly maintenance (drainage removal and environmental monitoring) | | | 48 | | | |
| Quarterly maintenance (facilities maintenance) | | | 24 | | | |
| Annual maintenance (wellhead inspection) | | | 16 | | | |
| Well intervention | | | | 194 | | |
| Listening well operations | | | | | 416 | |
| Plugging and abandonment (decommissioning) | | | | | | 72 |
| Restoration | | | | | | 1,066 |
| TOTAL | **2,198** | **3,483** | **1,026** | **398** | **868** | **1,618** |

Table 7: Maximum daily traffic movements by vehicle type at each Stage (indicative)[8]

| | Stage 1 Site construction | Stage 2 Drilling, Coring & Suspension | Stage 3 Routine maintenance (annual) | Stage 3a Well intervention/ workover (if required) | Stage 4 Listening well operations | Stage 5 Decommissioning and restoration |
|---|---|---|---|---|---|---|
| Max small vehicle movements (<3.5t) per day | 4 | 2 | 20 | 2 | 2 | 5 |
| Max LGV movements (3.5t-7.5t) per day | 10 | 14 | 6 | 12 | 12 | 8 |
| Max HGV movements (>7.5t) per day | 60 | 60 | 6 | 60 | 60 | 60 |
| Max abnormal loads per day | 14 | 6 | 0 | 1 | 6 | 10 |
| Max movements per day (all vehicles) | 70 | 70 | 32 | 60 | 60 | 61 |

8. This table provides maximum daily vehicle movements (approximately twice the maximum number of vehicles per day) at any point in each Stage. The bottom row of Table 5 (Daily average movements (all vehicles)) averages out traffic movements over the entirety of the Stage. The difference between these figures highlights the variation in daily vehicle movements – i.e. on some days there will be less traffic at the site than on other days. This Table showing the Maximum values puts an upper limit on this variability. It should not be assumed that there could be up to the Maximum number on every day of the Stage. Also, the maximum of each vehicle type would not occur on the same day.

# 4.0 Regulation and Internal Management

In addition to planning consent, the Proposal would be regulated by other agencies as follows. These requirements have been taken account of in the design of the Proposal;

+ Well design and construction – Health and Safety Executive (HSE) and Coal Authority (interaction with coal seams)
+ Well integrity during operation – independent qualified experts, HSE and Environment Agency
+ Operation of the surface equipment on the well pad – Environment Agency and HSE
+ Extractive (mining) waste – Environment Agency
+ Flaring or venting of gas (as a mining waste for the proposed vertical core well) – Environment Agency[9]
+ Well decommissioning and abandonment – HSE and Environment Agency

INEOS would also follow its own internal procedures and safety and environmental management processes as indicated in BOX 1 including the 20 Principles for Process and Behavioural Safety and INEOS Group Guidance Notes.

INEOS Shale achieved certification to ISO 9001, ISO 14001 and OHSAS 18001 (Occupational Health and Safety Assessment Series) by DNV in 2017, requiring certain standards of Quality Management, Environmental Management and Occupational Health and Safety to be followed. INEOS contractors would also be expected to participate in safety teams, contribute to investigations and incident learning, and suggest ongoing improvements in safety standards and procedures.

Onshore oil and gas development in the UK is subject to the same level of HSE regulation that other business sectors are including:

+ Health and Safety at Work etc. Act 1974
+ The Management of Health & Safety at Work Regulations 1999
+ Workplace (Health, Safety and Welfare) Regulations 1992
+ Provision and Use of Work Equipment Regulations 1998
+ Lifting Operations and Lifting Equipment Regulations 1998
+ Manual Handling Operations Regulations 1992
+ Control of Substances Hazardous to Health Regulations 1999
+ Personal Protective Equipment at Work Regulations 1992
+ Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 2013 (RIDDOR)
+ Work at Height Regulations 2005
+ Health and Safety (Consultation with Employees) Regulations 1996
+ Pressure Systems Safety Regulations 2000

There are established industry specific regulations, which place specific duties on Operators in addition to those required under the general HSE regulation noted above, such as the Borehole Sites and Operations Regulations 1995 and Offshore Installations and Wells (Design and Construction) Regulations 1996 (DCR 1996). These require the integrity of wells to be maintained over the lifecycle of the well (design, construction, use, plugging and abandonment). These regulations ensure appropriate well controls are in place during all phases of the well's life.

DCR 1996 imposes a general duty on the well operator to ensure that a well is so designed, modified, commissioned, constructed, equipped, operated, maintained, suspended and abandoned so as to ensure, so far as is reasonably practicable that there can be no unplanned escape of fluids from the well and that the risks to the health and safety of persons from it or anything in it or in the strata to which it is connected are as low as is reasonably practicable. DCR 1996 also stipulates that before the design of a well is commenced or adopted the well operator is obliged to put into effect arrangements for examinations by independent persons to ensure that the well is designed, constructed and maintained properly.

In all, there are over 100 pieces of regulation governing the conduct of onshore operators in the UK. INEOS also adopts industry best practice, such as International Association of Oil & Gas Producers standards, for relevant operations such as seismic acquisition. Other relevant best practice that would be followed includes UKOOG Onshore Shale Gas Well Guidelines and Oil & Gas UK Well Life Cycle Integrity Guidelines.

All site works would be undertaken in accordance with Environment Agency guidance as well as regulations. The proposed activities would require an environmental permit under the Environmental Permitting (England and Wales) Regulations 2016 to manage extractive (mining) waste. The site would be operated in accordance with Standard Rules SR2015 No 1 relating to the "management of extractive waste, not including a waste facility, generated from onshore oil and gas prospecting activities including drilling, coring, leak off testing, acid wash and decommissioning but excluding hydraulic fracturing for the production of oil or gas (using oil and water based drilling mud)". It is not proposed to carry out acid wash as part of this Proposal. The proposed PTT is a type of leak-off test, so covered by these Standard Rules. Management according to Standard Rules indicates that the Environment Agency does not consider a properly managed site undertaking the relevant activity to generate significant environmental risk meriting management under a bespoke permit.

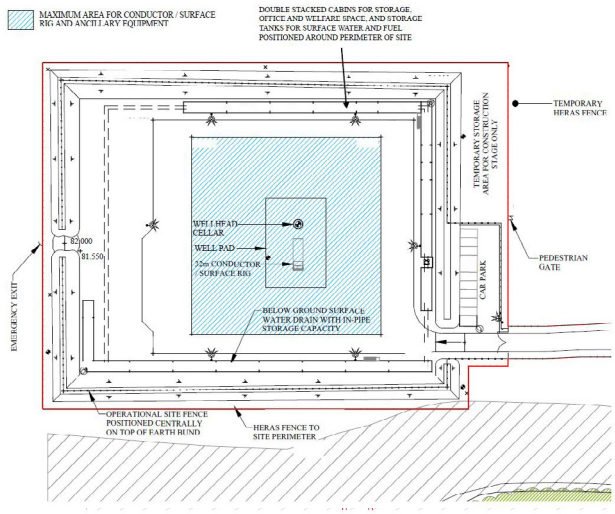
Abandonment (decommissioning) of the well would also be carried out according to best practice at the time of decommissioning (such as in the Oil and Gas UK Suspension and Abandonment Guidelines), and abandonment plans would be agreed with the MPA, OGA and Environment Agency prior to commencing abandonment.

9. SR2015 No1 requires that there will be no point source emissions to air, land or water. Target formations for the vertical core well are expected to be normally pressurised with no over pressure. Well control would be maintained by the weight of the drilling mud used. In the unlikely event formations are found to be over pressurised, anywhere gas is produced this must be managed at the surface. A blow out preventer would be in place to ensure the wellbore is sealed and any oil or gas circulated out is safely managed. The mud weight would then be adjusted to prevent any further release of gas or oil. The Environment Agency would be notified of any release

# Figures

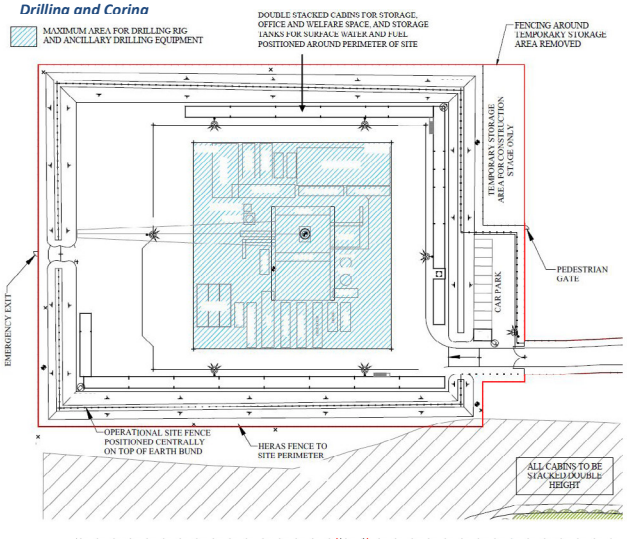
## Figure P1

**STAGE 1**
***Site Development and Establishment***



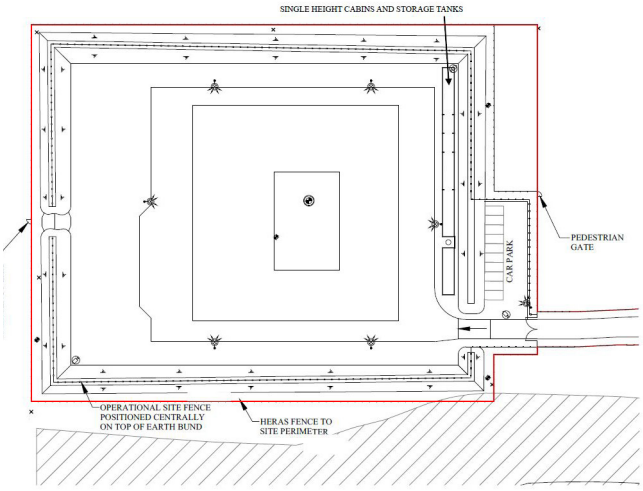

Plan shows end of Stage 1, just before the rig is brought to site.

**STAGE 2**
***Drilling and Coring***

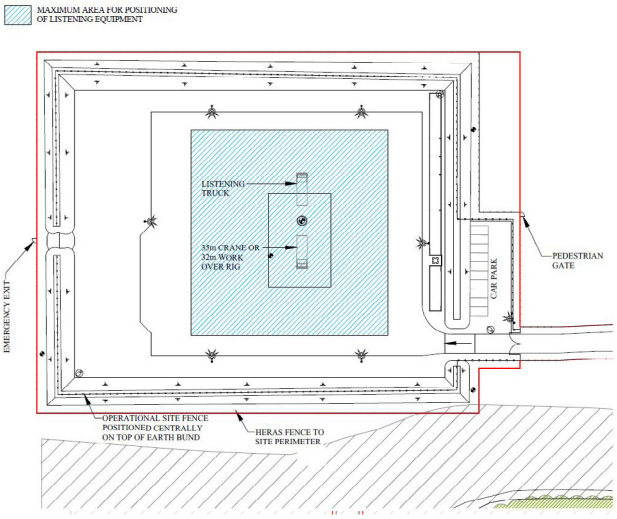



Plan shows site at the "peak" of activity, with the rig and all necessary drilling and coring equipment on site.

**STAGE 3**
***Maintenance of the Suspended Well Site Listening Well***

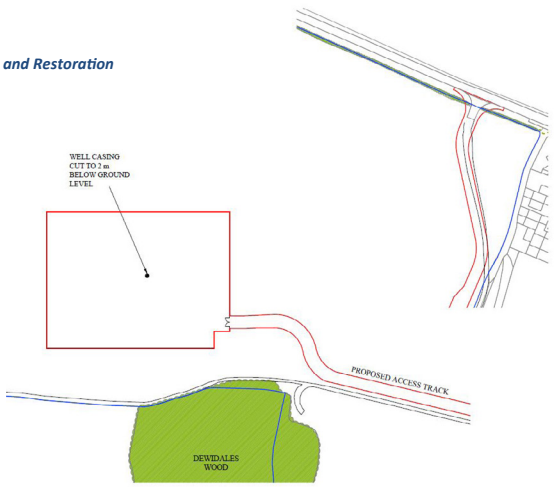



**STAGE 4**
***Use of the Well as Listening Well***




Plan shows site during listening operations with a listening truck and either a crane or a workover rig on site.

**STAGE 5**
***Decommissioning and Restoration***





Plan shows site after completion of decommissioning and restoration. Decommissioning of the Stage 3 well would require a workover rig (<32 m) and associated equipment as shown in Stage 2. This would be temporary for a period of approximately 2 weeks, with removal of site equipment taking an additional 2 weeks, followed by a 3 week restoration period.

**KEY:**

APPLICATION BOUNDARY AND EXTENT OF SURFACE WORKS

LAND WITHIN APPLICANT CONTROL

MONITORING BOREHOLE LOCATIONS ARE INDICATIVE AND WILL BE AGREED WITH THE ENVIRONMENT AGENCY

CCTV CAMERA LOCATIONS ARE INDICATIVE

MOVEABLE LIGHTING COLUMNS

WELLHEAD CELLAR

CATCH PIT WITH COVER

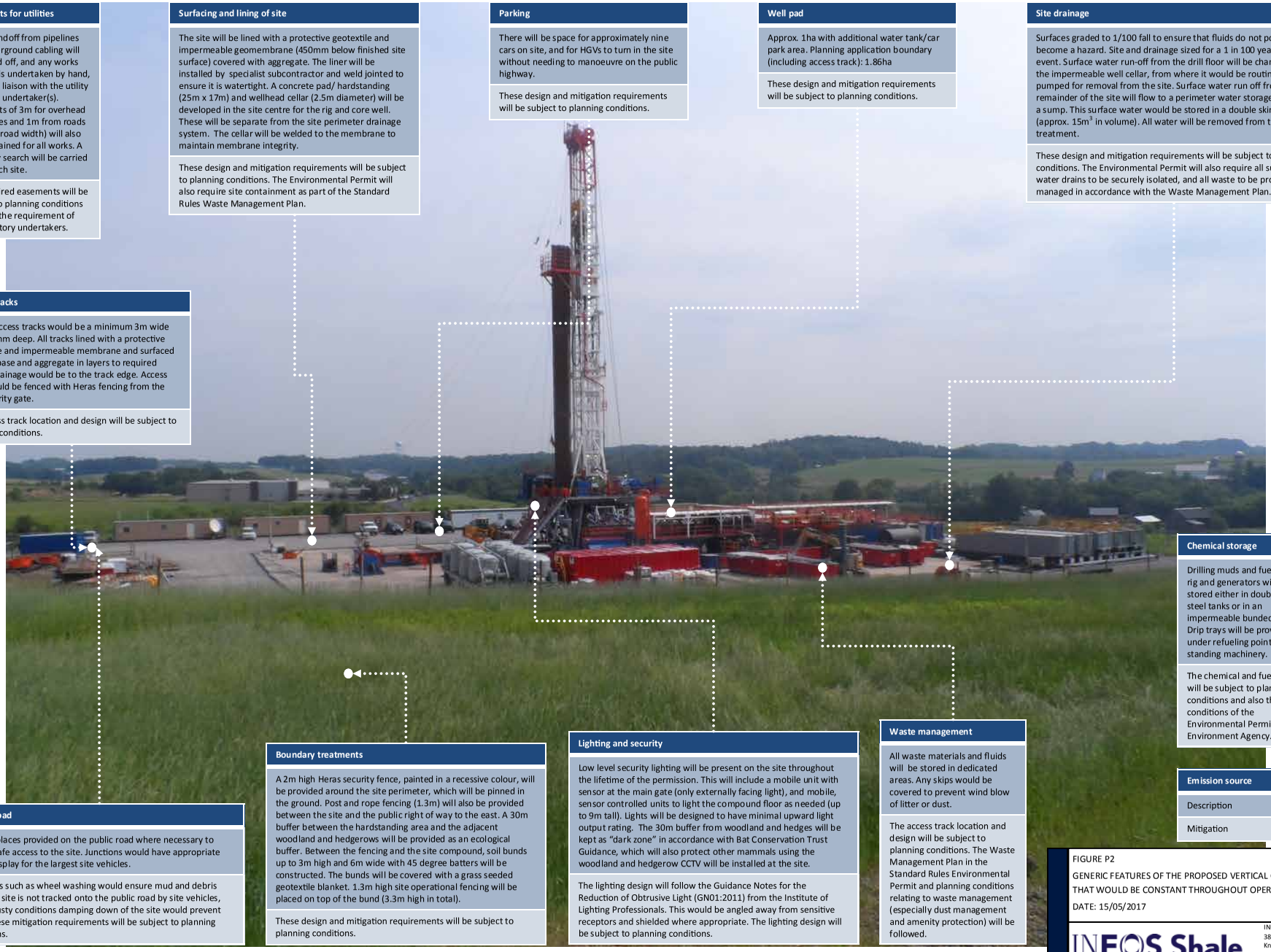
30m WIDE ECOLOGICAL BUFFER

FIGURE P1
STAGES OF THE PROPOSAL
DATE: 25/04/2017

INEOS Shale
INEOS Shale
3B Hans Crescent,
Knightsbridge,
London, SW1X 0LZ
www.ineosshale.com

Figure P2

N.B. Photograph shows features that would not be present throughout operations, but illustrate a standard, similar site at one stage (drilling –Stage 2)



**Easements for utilities**

A 3m standoff from pipelines and underground cabling will be fenced off, and any works within this undertaken by hand, following liaison with the utility statutory undertaker(s). Easements of 3m for overhead powerlines and 1m from roads (plus the road width) will also be maintained for all works. A full utility search will be carried out at each site.

The required easements will be subject to planning conditions and also the requirement of the statutory undertakers.

**Surfacing and lining of site**

The site will be lined with a protective geotextile and impermeable geomembrane (450mm below finished site surface) covered with aggregate. The liner will be installed by specialist subcontractor and weld jointed to ensure it is watertight. A concrete pad/ hardstanding (25m x 17m) and wellhead cellar (2.5m diameter) will be developed in the site centre for the rig and core well. These will be separate from the site perimeter drainage system. The cellar will be welded to the membrane to maintain membrane integrity.

These design and mitigation requirements will be subject to planning conditions. The Environmental Permit will also require site containment as part of the Standard Rules Waste Management Plan.

**Parking**

There will be space for approximately nine cars on site, and for HGVs to turn in the site without needing to manoeuvre on the public highway.

These design and mitigation requirements will be subject to planning conditions.

**Well pad**

Approx. 1ha with additional water tank/car park area. Planning application boundary (including access track): 1.86ha

These design and mitigation requirements will be subject to planning conditions.

**Site drainage**

Surfaces graded to 1/100 fall to ensure that fluids do not pool and become a hazard. Site and drainage sized for a 1 in 100 year flood event. Surface water run-off from the drill floor will be channelled to the impermeable well cellar, from where it would be routinely pumped for removal from the site. Surface water run off from the remainder of the site will flow to a perimeter water storage pipe via a sump. This surface water would be stored in a double skinned tank (approx. $15m^3$ in volume). All water will be removed from the site for treatment.

These design and mitigation requirements will be subject to planning conditions. The Environmental Permit will also require all surface water drains to be securely isolated, and all waste to be properly managed in accordance with the Waste Management Plan.

**Access Tracks**

All new access tracks would be a minimum 3m wide and 450mm deep. All tracks lined with a protective geotextile and impermeable membrane and surfaced with subbase and aggregate in layers to required depth. Drainage would be to the track edge. Access track would be fenced with Heras fencing from the first security gate.

The access track location and design will be subject to planning conditions.

**Chemical storage**

Drilling muds and fuel for the rig and generators will be stored either in double skinned steel tanks or in an impermeable bunded area. Drip trays will be provided under refueling points and standing machinery.

The chemical and fuel storage will be subject to planning conditions and also the conditions of the Environmental Permit from the Environment Agency.

**Emission source**

Description

Mitigation

**Public Road**

Passing places provided on the public road where necessary to ensure safe access to the site. Junctions would have appropriate visibility splay for the largest site vehicles.

Measures such as wheel washing would ensure mud and debris from the site is not tracked onto the public road by site vehicles, and in dusty conditions damping down of the site would prevent dust. These mitigation requirements will be subject to planning conditions.

**Boundary treatments**

A 2m high Heras security fence, painted in a recessive colour, will be provided around the site perimeter, which will be pinned in the ground. Post and rope fencing (1.3m) will also be provided between the site and the public right of way to the east. A 30m buffer between the hardstanding area and the adjacent woodland and hedgerows will be provided as an ecological buffer. Between the fencing and the site compound, soil bunds up to 3m high and 6m wide with 45 degree batters will be constructed. The bunds will be covered with a grass seeded geotextile blanket. 1.3m high site operational fencing will be placed on top of the bund (3.3m high in total).

These design and mitigation requirements will be subject to planning conditions.

**Lighting and security**

Low level security lighting will be present on the site throughout the lifetime of the permission. This will include a mobile unit with sensor at the main gate (only externally facing light), and mobile, sensor controlled units to light the compound floor as needed (up to 9m tall). Lights will be designed to have minimal upward light output rating. The 30m buffer from woodland and hedges will be kept as "dark zone" in accordance with Bat Conservation Trust Guidance, which will also protect other mammals using the woodland and hedgerow CCTV will be installed at the site.

The lighting design will follow the Guidance Notes for the Reduction of Obtrusive Light (GN01:2011) from the Institute of Lighting Professionals. This would be angled away from sensitive receptors and shielded where appropriate. The lighting design will be subject to planning conditions.

**Waste management**

All waste materials and fluids will be stored in dedicated areas. Any skips would be covered to prevent wind blow of litter or dust.

The access track location and design will be subject to planning conditions. The Waste Management Plan in the Standard Rules Environmental Permit and planning conditions relating to waste management (especially dust management and amenity protection) will be followed.

FIGURE P2

GENERIC FEATURES OF THE PROPOSED VERTICAL CORE WELL SITE THAT WOULD BE CONSTANT THROUGHOUT OPERATIONS

DATE: 15/05/2017

INEOS Shale

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## VEGETATION REMOVAL AND STRIPPING TOPSOIL:

All soil will be kept separate from other construction activities for restoration. Top 300mm of topsoil and subsoil, where necessary, will be removed for bunding.

The layout and arrangements for topsoil removal and storage will be subject to planning conditions.

## FORMATION OF A LEVEL SITE ENTRANCE:

The site will be made level, and all scraped material would be carefully stored in bunds at the perimeter of the site.

All scraped material will be kept on site.

## ADDITIONAL LIGHTING:

During Stages 1 site lighting will be supplemented with additional mobile, construction lighting (up to 9m masts). Current lighting design is for up to 9m high silenced mini lighting tower. The lighting design is shown in the planning application drawings.

The layout and arrangement of the site infrastructure will be subject to planning conditions.

## SOIL BUNDING:

Up to 3m high x 6m wide soil bunds formed from 300mm of topsoil and any subsoil required will be scraped from the site. Topsoil and subsoil will be stored separately if required.

Soil compacted in layers to the required depth on the bund, possibly with protective geotextile and impermeable HDPE membrane layer as reinforcement at required depth. Soil bunds will be grassed with a seeded geotextile blanket to improve stability and provide visual as well as acoustic screening.

## WELL CELLAR AND CONDUCTOR INSTALLATION:

The well cellar and stove pipe (up to 36" steel casing, approximately 6m deep) will be installed by excavation, and a 2.5m diameter concrete ring installed and heat sealed to the lining to provide an impermeable seal. This method of installation ensures that there is an impermeable cellar from which the well can be drilled, having sealed off the surface layers. Following lining and surfacing the site, a conductor/ surface rig (mast <32m) may install the surface conductor casing to provide a stable surface platform from which to drill subsequent sections of the well and to isolate any shallow groundwater from the rest of the well. The surface casing is anticipated to be installed to approximately 610 m (2,000 ft) at this well. It would be securely cemented into place, with a full column of cement to surface to seal any underground flow paths.

The concrete well cellar will be lined with 2.5m diameter manhole rings supported on mass concrete poured against the ring. The ring will be sealed with an HDPE liner. If a conductor rig is used, it would sit on four 300mm deep reinforced concrete strips lying on 150 mm of compacted fill on a waterproof HDPE liner and geotextile membrane. The design will be subject to planning conditions and approval by the Environment Agency

## MONITORING BOREHOLES:

Installed under permitted development rights (and not forming part of this application) to allow ongoing monitoring of groundwater.

Monitoring will be agreed with the Environment Agency, and will be subject to the conditions of the Environmental Permit.

## SITE AREA:

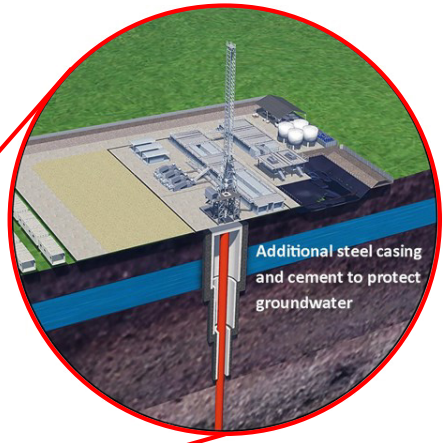
Total site area approximately 1.2ha designed with 1 in 100 falls to channel water to perimeter surface water storage pipe and tank. Ramps developed for safe access and egress from hardstanding areas. Pedestrian segregation fencing placed on all sides of hardstanding area. Concrete pad developed in centre of site for rig. Concrete kerb stones (cable tray support) at required spacing and positions within the hardstanding area, as shown on the planning application drawings.

Drilling platform will comprise 300mm deep reinforced concrete strips lying on an impermeable HDPE liner and geotextile membrane. The layout and arrangement of the site infrastructure will be subject to planning conditions.

## ACCOMMODATION AND WELFARE FACILITIES:

Offices and welfare facilities will be provided to accommodate personnel and space for workshops and storage. Welfare facilities and toilets are self-contained and not connected to sewer. Solid and liquid waste are removed from site by licensed contractor as needed.

The layout and arrangement of the site infrastructure will be subject to planning conditions. Waste management activities will be subject to the conditions of the Environmental Permit from the Environment Agency.




| Emission source |
| --- |
| Description |
| Mitigation |

FIGURE P3

FEATURES OF THE VERTICAL CORE WELL SITE DURING STAGE 1

DATE: 15/05/2017

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www.ineosshale.com

### DRILLING FLUIDS

Drilling fluids are used to circulate drill cuttings back to the surface. The fluids will be stored within a closed-loop system comprising mud pumps and mud tanks with cuttings removed as they are circulated from the well.

In addition to the mitigation provided by the closed-loop system, the management of solid and aqueous materials will be subject to planning conditions from the local planning authority and also the conditions of the Standard Rules Environmental Permit. All drilling fluids will be standard rules compliant and authorised by the Environment Agency for use in well construction locations, thereby minimising waste generation. Any oil-based fluids used would conform to the requirements of the Environment Agency Standard Rules permit.

### VERTICAL CORE WELL DRILLING

The vertical core well would be drilled at various diameters, which progressively decrease with depth. Each diameter would be lined with a steel casing string secured in place with cement. The casing would be pressure tested to ensure well integrity following cementing. The casing would protect the surrounding geology, including groundwater, isolate different pressure regimes within the well, and ensure well integrity.

The well design would be approved by an independent Well examiner and be subject to Health and Safety Executive (HSE) notification and Oil and Gas Authority (OGA) approval prior to the commencement of operations. A Coal Authority, Energy Access Agreement would also be required to agree well design through coal seams.

### DRILLING RIG

Up to 60m high (rig shown in photograph is likely to be similar to that used by INEOS). Additional lighting required to light mast and rig floor for night working. The lighting will be low intensity and angled to the floor to prevent overspill and angled away from sensitive receptors.

The layout and arrangement of the site infrastructure will be subject to planning conditions from the local planning authority.

### VEHICLE CIRCULATION

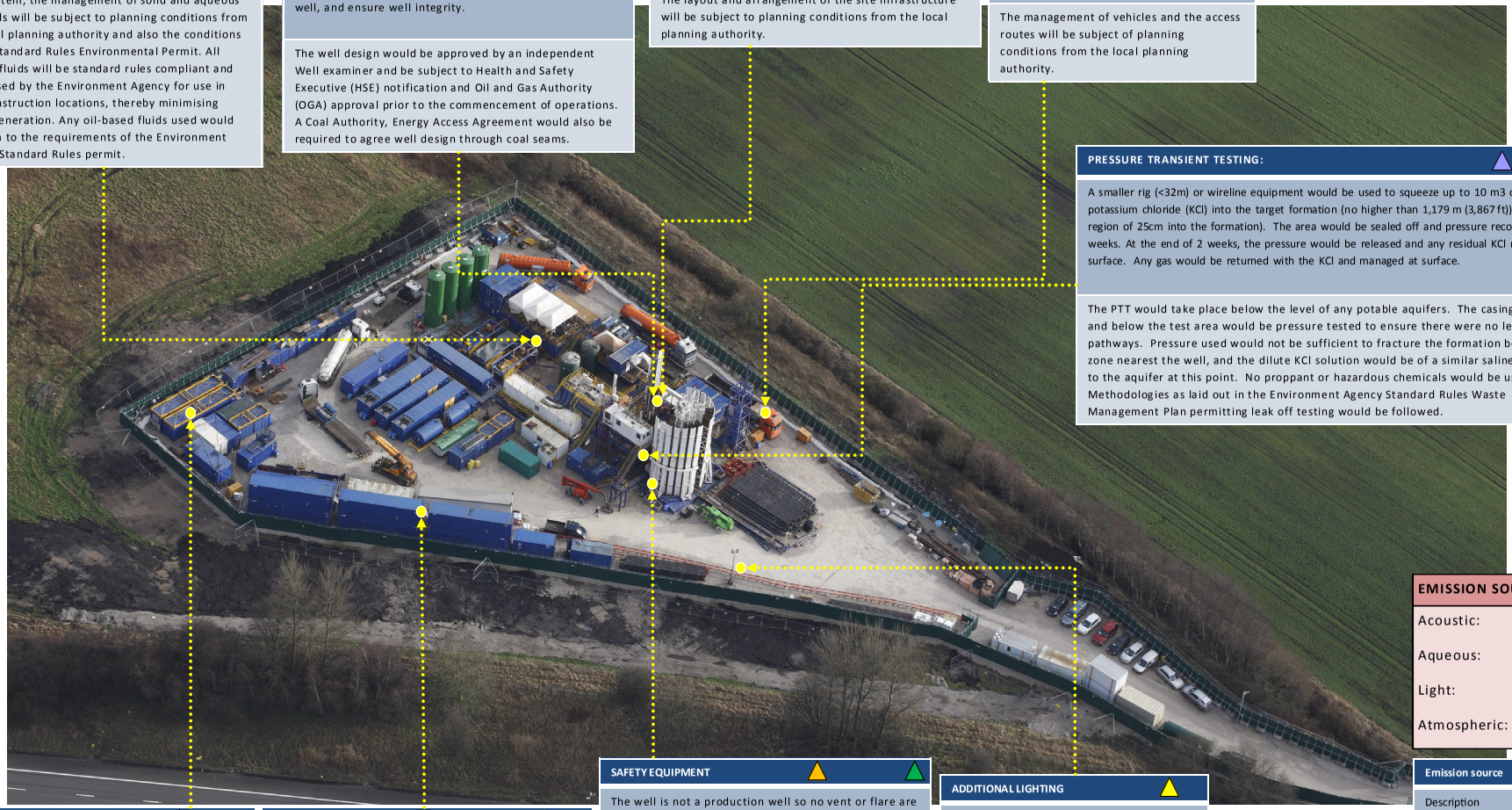
Vehicle circulation provided on site through careful layout design. A vehicle layby will be provided on site to allow parking of a 16.5m articulated vehicle. Sufficient space also provided so that such vehicle can manoeuvre on site without using the public highway.

The management of vehicles and the access routes will be subject of planning conditions from the local planning authority.

### PRESSURE TRANSIENT TESTING:

A smaller rig (<32m) or wireline equipment would be used to squeeze up to 10 m3 of 2-4% potassium chloride (KCl) into the target formation (no higher than 1,179 m (3,867 ft)) and in the region of 25cm into the formation). The area would be sealed off and pressure recorded over 2 weeks. At the end of 2 weeks, the pressure would be released and any residual KCl returned to surface. Any gas would be returned with the KCl and managed at surface.

The PTT would take place below the level of any potable aquifers. The casing above and below the test area would be pressure tested to ensure there were no leakage pathways. Pressure used would not be sufficient to fracture the formation beyond the zone nearest the well, and the dilute KCl solution would be of a similar saline solution to the aquifer at this point. No proppant or hazardous chemicals would be used. Methodologies as laid out in the Environment Agency Standard Rules Waste Management Plan permitting leak off testing would be followed.



### EMISSION SOURCES:

- Acoustic:
- Aqueous:
- Light:
- Atmospheric:

| Emission source |
|---|
| Description |
| Mitigation |

### WASTE ARISINGS

Solid and aqueous waste, including cuttings, waste water-based mud and cement, will be stored in a designated area in enclosed tanks where necessary and removed by a registered waste contractor.

Waste management activities will be subject to the conditions of the Environmental Permit from the Environment Agency.

### CABINS

Cabins stacked up to 2 units high will be placed around the perimeter of the site (over the site drainage pipe) to provide additional full-height screening.

The layout and arrangement of the site infrastructure will be subject to planning conditions from the local planning authority.

### SAFETY EQUIPMENT

The well is not a production well so no vent or flare are proposed on site, though the rig would incorporate a blow out preventer, methane monitoring and Safety Management Plan, in the unlikely case of an unexpected gas release during drilling.

The provision of safety equipment will be subject to the requirements of the Health and Safety Executive, and in terms of managing environmental risks, the conditions of the Environment Permit from the Environment Agency.

### ADDITIONAL LIGHTING

During Stage 2 site lighting will be supplemented with additional mobile lighting for the rig floor (up to 9m masts) and on the rig mast. This would be angled away from sensitive receptors and shielded where appropriate.

The lighting design will be subject to planning conditions from the local planning authority.

*Photograph used with permission from IGas*

FIGURE P4
FEATURES OF THE VERTICAL CORE WELL SITE DURING STAGE 2
DATE: 15/05/2017

INEOS Shale
38 Hans Crescent,
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# Confidential Appendix

This appendix provides acknowledgement of the photographs used in Table 4. Although some photographs are of indicative equipment from generic plant supplier websites (and are acknowledged as a courtesy), some potential suppliers have requested not to be named in the application. This separation is not made herein. It is requested that this appendix is excluded from the public domain.

CA1 http://www.gazatimber.co.uk/heras-fencing-panels/

CA2 http://www.unit-hire.co.uk

CA3 https://www.speedyservices.com/22_0104-h-mini-tower-lighting-tower-silenced-5-5m

CA4 https://www.simplygenerators.co.uk/product/caterpillar-500kva-low-hours/

CA5 https://www.speedyservices.com/41_0100-h-100kva-canopy-generator

CA6 http://www.riobravo-ofs.com/media/image-galleries/

CA7 http://www.riobravo-ofs.com/media/image-galleries/

CA8 http://www.hiwayfuelservices.com/rentals/

CA9 Dart Energy Well 5 at Airth, Scotland

CA10 http://www.schwing-stetter.co.uk/Pages/Equipment/EquipmentDetails.aspx?cat=truckmixers&id=22&ff=&fv=

CA11 cementsilos.com

CA12 http://bjservices.com

CA13 http://www.bdf.co.uk/gallery.php BDF rig 28

https://www.liebherr.com/en/gbr/products/mobile-and-crawler-cranes/mobile-cranes/ltm-mobile-cranes/details/ltm103021.html

CA14 http://www.tigercranes.com.au/all-terrain-cranes/

CA15 http://truckfax.blogspot.co.uk/2011/11/no-dinky-toy.html

CA16 https://www.esgsolutions.com/oil-and-gas/hydraulic-fracture-mapping-and-monitoring

CA17 Bomag tandem roller brochure

CA18 Komatsu D61EX dozer brochure

CA19 Hitachi Zaxis brochure

CA20 http://www.rbunton.co.uk/plant-hire-item/thwaites-6-tonne-power-swivel-wheeled-dumper/

CA21 BDF Rig 30 (IDECO BIR305) – approx. 28m tall – no top drive and Moor 400 (32m high when erect)

CA22 Boldon Drilling Rig 92 – up to 60 m tall

CA23 BDF Rig 25 – photo from rig summary inventory

CA24 http://www.tankservices.co.uk/19400l-transcube-container,-200tt,-transportable-diesel-tank/307.htm#

CA25 http://www.riobravo-ofs.com/media/image-galleries/

http://www.spartaengineering.com/portfolio/service-rig-mud-tank/

CA26 https://www.rigsupply.as/?lightbox=image_1twh

CA27 http://www.gnsolidscontrol.com/gn-products-list

CA28 http://www.bdf.co.uk/gallery.php?g=01-Rig%2092%20-%20Ideco%20ERD%20E900 https://www.nov.com/Segments/Wellbore_Technologies/WellSite_Services/Solids_Control/Mud_Tank_Systems.aspx

CA29 http://www.bdf.co.uk/gallery.php?g=01-Rig%2092%20-%20Ideco%20ERD%20E900

CA30 http://www.jeffweber.net/for-sale/for-sale-rebuilt-koomey-24-bottle-accumulator-185-000usd/1632.aspx

CA31 http://www.rigmanufacturing.com/2015/09/17/cameron-ciw-type-u-bop-10k-blowout-preventer-stack-annular-double-single-spool-valves-rebuilt-16a/

CA32 http://www.sital-containers.co.uk/production/off-shore/

CA33 http://www.cartelenergy.com/surface-rental/pipe-racks/