IGas Energy Production Limited

Glentworth West Drilling and Testing Operation

Waste Management Plan

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1. PURPOSE AND CONTEXT

This Waste Management Plan forms part of an application to the Environment Agency to authorise the undertaking of specific 'permitted activities' at a proposed new wellsite, Glentworth West. With regards to onshore oil and gas operations an activity that produces extractive waste is classified as a 'mining waste operation'.

A 'mining waste operation' is considered a 'regulated facility' under The Environmental Permitting (England and Wales) Regulations 2016, as amended (EPR2016) [REF.1]. Throughout the life of the wellsite this Waste Management Plan shall be considered a live 'operating technique' and must be complied with as it forms part of the environmental permit.

The Waste Management Plan sets out the necessary measures to ensure that extractive waste is managed in a controlled manner without endangering human health or harming the environment. The purpose of the Waste Management Plan is to demonstrate how IGas Energy Production Limited (herein referred to as the 'Operator') will minimise, treat, recover and dispose of extractive waste whilst taking into account the principle of sustainable development. The Waste Management Plan has been produced in accordance with EPR2016 which has been transposed, in part, from the Mining Waste Directive (MWD) [REF.2]. This Waste Management Plan has also been compiled based on the requirements and guidance from the Environment Agency's How to comply with your environmental permit guidance 6.14 [REF.3].

For clarity, domestic legislation derived from European Union legislation such as the MWD and the Waste Framework Directive (WFD) [REF.4] continues to have an effect in domestic law following the UK's withdrawal from the European Union in accordance with the European Union (Withdrawal) Act 2018 [REF.5]. The MWD and WFD are therefore still applicable to this Waste Management Plan and activities performed by the 'Operator'.

The primary purpose of the Waste Management Plan is to demonstrate that the 'mining waste operation' will meet the requirements of EPR2016 and, in turn, the MWD and WFD.

All figures included in this document, for example volumes, tonnages, formation depth represent best estimates at the time of document production, and may change, as operations develop.

2. SCOPE

This Waste Management Plan is applicable to the Glentworth West Wellsite and all operations conducted therein. It is applicable to the 'Operator', its contractors and subcontractors and may be used in support of an application to the Environment Agency for an environmental permit under EPR2016.

In addition to the management of extractive waste, a 'regulated facility' may require an environmental permit that facilitates the deposit or accumulation of extractive waste in a 'mining waste facility'. The definition of a 'mining waste facility' is based on the site having a designated area for the accumulation or deposit of waste that are subject to certain timescales, depending on the nature and source of the waste.

It has been concluded that a 'mining waste facility' designation is not applicable when assessing the proposal against Article 3 (15) of the MWD due to the waste not being accumulated or deposited within the specified time periods. A 'mining waste facility' is therefore not being applied for as part of the permit application.

Due to the 'mining waste operation' not being considered a 'mining waste facility' there is no assessment required to determine whether the 'mining waste facility' would be considered 'Category A'.

3. ABBREVIATIONS AND DEFINITIONS

“:	Imperial Inch
Active Area:	The area of the regulated facility whereby permitted activities are undertaken
BAT:	Best Available Technique
EPR2016:	The Environmental Permitting (England and Wales) Regulations 2016
GLN12:	Glentworth 12 Well
GLN12z:	Glentworth 12z Sidetrack
Installation Activity:	Has the meaning given within Regulation 2 of EPR2016
HDPE:	High Density Polyethylene
m:	Metres
MD:	Measured Depth
Mining Waste Operation:	Has the meaning given within Regulation 2 of EPR2016
Non-active Area:	The area of the regulated facility whereby permitted activities are not undertaken
NORM:	Naturally Occurring Radioactive Material
Operating Technique:	Documents approved by the regulator to ensure compliance with the issued permit
Operator:	Has the meaning given within Regulation 7 of EPR2016
Permitted Activities:	Any activity or operation defined within Schedule 1 to 29 of EPR2016
Regulated Facility:	Has the meaning given within Regulation 8 of EPR2016
TVD:	True Vertical Depth
TVDSS:	True Vertical Depth below Sea Level

Table 1: Abbreviations and Definitions

4. ENVIRONMENTAL PERMIT AND GENERAL DESCRIPTION

The proposed Glentworth West Wellsite has yet to be constructed and does not currently hold an environmental permit. No permitted activities are authorised under EPR2016.

4.1 Development Description

The 'Operator' is proposing to construct a new site to be known as the Glentworth West Wellsite. The purpose of the new wellsite is to accommodate future drilling, testing and production operations to further develop the Glentworth oil field. In brief, the site construction will be designed to house a drilling rig, well test spread, storage tanks, production equipment and any other ancillary equipment as necessary.

Site construction works will include the upgrading of the current access track, excavation of topsoil and subsoil and relocating it to the western boundary stored separately as part of the bunding to mitigate visual impact. An impermeable liner will be installed to mitigate against any spillages or onsite pollution events with a concrete well cellar, well pad and associated drainage also installed. The Glentworth West Wellsite will have security fencing installed around the perimeter. Whilst the construction of the wellsite is not covered under EPR2016, the embedded mitigation such as the impermeable liner forms part of the 'Operators' obligation to protect the environment.

Following site construction, the 'Operator' is proposing to drill a new appraisal borehole with the purpose of investigating the Mexborough Rock reservoir.

The well will then be the subject of an extended period of testing comprising of two phases. In total the testing phase will take place over a period of 12 months within which time produced fluid (a mixture of oil and water) will be flowed to surface and stored in dedicated storage tanks pending collection by road tanker to the Welton Gathering Centre for processing. Small volumes of associated gas will be produced alongside the produced fluids. In the first instance the flowrate will be unstable and suitable mitigation in the form of a shrouded flare will need to be deployed to facilitate efficient combustion across a wide scope of flowrate and pressures. Once the production rates have settled down it is proposed to substitute the shrouded flare for a higher efficiency enclosed flare, designed to operate within a specific flowrate range. The two-phase approach provides the 'Operator' with confidence that the waste gas can be safely managed and disposed of for the 12 month period.

The well may also be the subject of an acid wash to increase near wellbore permeability, cleaning out any blocked channels within the near wellbore area that may have been caused by the initial drilling operation. This activity may be undertaken a number of times throughout the lifetime of the development following well construction.

Following the 12 month well test the well will be the subject of a suspension period in which the 'Operator' will make a decision over the future of the GLN12 well with one of two options being considered.

- The well shall be the subject of an abandonment and decommissioning programme and the site restored.
- The wellsite shall be developed further with the drilling of additional wells (subject to future regulatory consents).

For clarity well abandonment and decommissioning is being considered as part of this permit application, though timescale for which this activity could be undertaken cannot be confirmed as it is contingent on the outcome of the well testing phase.

4.2 Proposed Permitted Activities

To facilitate the proposed development a number of activities will need to be permitted under EPR2016. As no permit currently exists for the Glentworth West Wellsite the following activities are required as outlined in the following subsections.

4.2.1 Mining Waste Operation

Schedule 20 of EPR2016 defines a mining waste operation as being the management of extractive waste, whether or not it involves a waste facility. The drilling of the GLN12 borehole and GLN12z sidetrack is considered a mining waste operation as it results in the production, and therefore management of extractive waste in the form of drilling cuttings, muds and other extractive waste streams. Furthermore, the testing phase will also result in extractive waste in the form of associated natural gas, as will the proposed acid wash which may result in spent acid being produced.

For clarity the volume of gas to be incinerated is anticipated to be significantly below 10 tonnes per day and as such the flaring of natural gas is considered to fall within Schedule 20 of EPR2016 as opposed to a Schedule 1, Section 5.1 Installation.

4.2.2 Installation

Schedule 1, Part 2 of EPR2016 details a number of activities that are classified as an Industrial Emissions Activity including 'Energy Activities' (Chapter 1). Energy Activities include the storage of crude oil and the specific activity is cited under EPR2016, Schedule 1, Part 2, Chapter 1, Section 1.2, Part A(1) (e)(i).

'The loading, unloading, handling or storage of, or the physical, chemical or thermal treatment of crude oil.'

The proposed operation has the potential to involve the handling and storage of crude oil within the site, and as such a permit will need to be in place to permit the loading, unloading, handling or storage of, or the physical, chemical or thermal treatment of crude oil.

4.2.3 Radioactive Substances Activity

Schedule 23 of EPR2016 provides for the control of Naturally Occurring Radioactive Material (NORM). Schedule 23 defines the production of oil and gas as a NORM industrial activity and therefore any accumulation of radioactive waste, which exceeds concentrations set out in Table 1 of Schedule 23 of EPR2016.

Due to the potential production of oil and gas as part of the well testing phase a standard rules permit is being applied for.

5. OBJECTIVES OF THE WASTE MANAGEMENT PLAN

The objectives of the Waste Management Plan are derived from Article 5 of the MWD. These objectives are detailed as follows:

- *To prevent or reduce waste production and its harmfulness, in particular, by considering:*
  - *waste management in the design phase and in the choice of method used for mineral extraction and treatment;*
  - *the changes that the extractive waste may undergo in relation to an increase in surface area and exposure to conditions above ground;*
  - *placing extractive waste back into the excavation void after extraction of the mineral, as far as is technically and economically feasible and environmentally sound in accordance with existing environmental standards at the Community level and with the requirements of the Directive, where relevant;*
  - *putting topsoil back in place after the closure of the mining waste facility or if this is not practically feasible, reusing topsoil elsewhere; and*
  - *using less dangerous substances for the treatment of mineral resources.*

With regards to the prevention and reduction of waste production, the location of the well is determined by the target formation and geology. The location is also determined by other considerations such as planning constraints, access agreements etc. The design of the well is informed by all of these factors and as such the minimisation of waste from a design basis is constrained by the selection of hole sizes that will achieve the planned targets.

Extractive waste will be stored at surface in dedicated areas within the 'regulated facility'. Extractive waste will have minimal contact with above ground conditions as they will be confined to enclosed / partially enclosed tanks with exception of natural gas and rock cuttings.

Placing extractive waste back into the extraction void is not feasible as the well is cased, cemented and then tested for oil and/or gas. In short, the extraction voids need to remain in order to produce from the well.

The Glentworth West Wellsite will include the excavation of top soil and sub soil which will be stored in separate soil bunds and acting as natural screening for the site. At the end of the development the site will be restored and the soil will be laid back from whence it came, restoring the site to its pre-development condition.

Where practicable, dangerous substances will be substituted with less dangerous substances for the treatment of mineral resources. However, the substances must be able to fulfil the same function and to the same standard.

- *To encourage the recovery of extractive waste by means of recycling, reusing or reclaiming such waste, where this is environmentally sound in accordance with existing environmental standards at Community level and with the requirements of the Directive where relevant.*

Where possible waste will be recovered to surface and re-used for further well operations. Such examples include the re-use of drilling fluid and brine where applicable and selling back the oil based mud to the supplier.

- *To ensure short and long term safe disposal of the extractive waste, in particular by considering, during the design phase, management during the operation and after-closure of a mining waste facility and by choosing a design which:*
  - *requires minimal and, if possible, ultimately no monitoring, control and management of the closed mining waste facility;*
  - *prevents or at least minimises any long term negative effects for example attributable to migration of airborne or aquatic pollutants from the mining waste facility; and*
  - *ensures the long-term geotechnical stability of any dams or heaps rising above the pre-existing ground surface.*

With regards to the 'mining waste operation', no extractive waste shall remain at the wellsite indefinitely. Upon closure of the site it will be restored to its natural state with the removal of all site surface equipment. The wellhead will also be mechanically cut off below the surface (after the required monitoring period). All extractive waste shall be treated / disposed in accordance with the receiving facilities environmental permit. There is no 'mining waste facility' proposed at the wellsite.

6. WASTE MANAGEMENT ARRANGEMENTS

6.1 Waste Definition

A waste is defined in Article 3(1) of the MWD by reference to Article 3(1) of the WFD. The definition is; *'waste' shall mean any substance or object which the holder discards or intends or is required to discard.*

The wastes are defined in Article 3 of the Directive as inert, non-hazardous or hazardous and are as follows:

Hazardous Waste: A hazardous waste is defined as a waste that has one or more of the fifteen specified hazardous properties listed in Annex III to the WFD. The application of this is determined by the List of Wastes Decision [REF.7].

Non Hazardous Waste: A waste which is neither classed as inert or hazardous.

Inert Waste: Waste which does not undergo any significant physical, chemical or biological transformations. Inert waste will not dissolve burn or otherwise physically or chemically react, biodegrade or adversely affect other matter with which it comes into contact in a way likely to give rise to environmental pollution or harm human health. The total leachability and pollutant content of the waste and the ecotoxicity of the leachate must be insignificant and in particular not endanger the quality of surface water and/or groundwater.

6.2 Waste Classification

A list of waste streams, together with their respective European Waste Catalogue (EWC) codes has been provided within Table 5 to 12. To ensure that the Waste Management Plan remains suitable and sufficient in the event of contamination, both Hazardous and Non-Hazardous EWC codes have been applied to the waste stream. Such an example includes circulation fluid (brine) which ordinarily would be assessed as EWC code '01 05 08' but may be assessed onsite as EWC code '01 05 06*' should it be contaminated with a hazardous substance above a certain threshold. i.e. oil based fluid or hydrocarbons.

The 'Operator' is required to assess and classify its waste (both extractive and non extractive) by using the correct code from the Environment Agency's Waste Classification Technical Guidance WM3 [REF.8].

6.3 Hierarchy of Waste Management

The 'Operator' and its contractors follow The Waste (England and Wales) Regulations 2011 (WR2011) [REF.9], which lays out a hierarchy of waste management, derived from the WFD. This hierarchy has been outlined in Figure 1.

	Most Preferred	
Prevention		Using less materials in design and manufacture. Keeping products for longer i.e. re-use. Longer term waste prevention includes gas distribution to national transmission system if feasible.
Preparing for Re-Use		Checking, cleaning, repairing, refurbishing, whole items or spare parts.
Recycle		Turning waste into a new substance or product. This can include gas to grid concepts.
Other Recovery		Incineration with energy recovery, gasification and pyrolysis which produce energy and materials from waste.
Disposal		Landfill and incineration without energy recovery.
	Least Preferred	

Figure 1: Waste Hierarchy

The Wellsite Supervisor is appointed by the 'Operator' to exercise overall control of the wellsite operations, in accordance with The Borehole Sites and Operations Regulations 1995 (BSOR1995) [REF.10]. In addition, the Wellsite Supervisor will also be the person responsible for waste management during the drilling of the Glentworth West well and subsequent sidetrack.

The management of waste onsite will include:

- waste management in accordance with WR2011, waste hierarchy;
- monitoring of all waste storage vessels;
- liaison with third party waste advisors with respect to waste sampling, analysis and classification;
- compiling and keeping records of all waste transfer notes where this is not undertaken by the waste carrier; and
- managing the collection and offsite disposal of all waste streams.

The 'Operator' will appoint competent waste brokers, dealers and carriers where necessary who shall be responsible for the transportation of all waste streams to the relevant Environment Agency permitted waste treatment facility. Waste brokers, dealers and carriers will hold relevant certificates issued by the Environment Agency, which shall be inspected prior to being appointed.

The Wellsite Supervisor shall at all times, together with all employees and contractors:

- promote awareness of the Waste Management Plan and its effectiveness; and
- monitor, assess, record and report on waste generation, segregation, treatment and disposal.

7. WASTE GENERATING ACTIVITIES

The following section describes the various extractive wastes arising from the Glentworth West proposal together with their waste classification and estimated quantities. Non extractive waste is not subject to an environmental permit under the MWD, and as such has not been included in detail.

For clarity, the only source of extractive waste concerned with this Waste Management Plan shall be from the drilling and subsequent testing of the Glentworth West Wellsite. The extractive waste will be produced from the well and be stored in dedicated storage vessels within the 'regulated facility'.

7.1 Proposed Activities

The proposed activities will be undertaken in accordance with the Environment Agency Onshore oil and gas sector guidance [REF.11]. Well operations will be undertaken in accordance with BSOR1995, The Offshore Installations and Wells (Design & Construction, etc) Regulations 1996 (DCR1996) [REF.12] and other relevant legislation standards and guidance.

7.1.1 Preliminary Works

To facilitate the drilling of the GLN12 appraisal borehole and the well test spread a new site known as the Glentworth West Wellsite is being constructed. Whilst the surface construction activities are not considered 'permitted activities' under EPR2016, it is important to outline how the site has been designed to ensure environmental containment should an onsite pollution event occur.

The wellsite will be constructed by initially removing topsoil and subsoil and relocating it to the western boundary in separate soil bunds. The purpose of creating soil bunds is twofold, it is stored onsite to enable the wellsite remediation phase to utilise the previously excavated soils and whilst stored provides mitigation against visual impact to any nearby receptors. This method prevents the accumulation of waste. If required, the subsoil may be the subject of a 'cut to fill' method which involves the excavation of top soil from the higher areas of the site and relocating it to the lower areas of the site to create a level plateau.

Once the wellsite is level a ditch will be excavated around the perimeter of the 'active area' of the wellsite. The perimeter ditch will form part of the wellsites containment measures ensuring that any rainwater and surface spillages are contained to the wellsite. Following the excavation of the perimeter ditch the 'active area' will be overlaid with a High Density Polyethylene (HDPE) membrane to provide integrity and ensure any surface water and spillages flow to the perimeter ditch for subsequent collection by road tanker. The HDPE will be protected by two layers of non-woven geo-textile matting which will be placed above and below the HDPE membrane to provide protection from the underlying ground and from the site surface, reinforcing the site integrity. The HDPE membrane will be integrity tested during its installation.

Stone aggregate will be used for the surface of both the 'active' and 'non active' area of the wellsite. For clarity the 'non active' area of the wellsite whilst within the 'regulated facility' boundary is to house a car parking area, fire water tanks and potentially offices.

A drilling cellar will be constructed in the centre of the 'active area' of wellsite for housing the wellhead. Typically, well cellars are constructed around the large diameter casings using precast concrete rings encased in a concrete jacket surround. The impermeable membrane is incorporated into the cellar construction to maintain environmental integrity of the active area of the wellsite. The exact design of the well cellar has yet to be confirmed. A concrete drilling pad will be constructed at surface, immediately surrounding the drilling cellars. The concrete pad will be sized and constructed to take the ground loading of the drilling rig.

For clarity, construction operations associated with the development are not the subject of this waste management plan as it is not considered extractive waste. However the principles of the waste management, and in turn the WR2011 are applicable to construction waste and shall be managed in accordance with the waste hierarchy.

7.1.2 Drilling of the Glentworth 12 Borehole and Glentworth 12 Sidetrack

The exact well design will be contingent on the actual conditions encountered during drilling, however an indication of how the well will be constructed is provided in this section as Figure 2 and Figure 3.

In order to drill the well several drilling fluid additives will be required. All drilling fluid additives shall be the subject of approval by the Environment Agency prior to the undertaking of any drilling activities. The 'Operator' is proposing to use several drilling additives, details of which have been provided within a Chemical Inventory together with the location on where these additives shall be used within the well. The drilling fluids will be selected and matched to underground conditions.

Age	Formation Tops	TVDSS (m)	MDGL (m)	Glentworth 12 Pilot Hole Casing and Cementing	Hole Size	Casing Size	Mud System	Cemented
Quaternary	Drift							
Jurassic	Lower Lias	28	0		17.5"	13.375"	WBM	Cemented
	Hydraulic Lst	-97	127					
Triassic	Lilstock Fm	-108	138					
	Westbury Fm	-115	144					
	Blue Anchor Fm	-121	150					
	Mercia Mudstone	-136	165					
	Glenparva Fm	-142	172					
	Sherwood Sandstone Fm	-386	415				WBM	Cemented
Permian	Upper Marl	-669	699					
	Anhydrite Marker	-702	733					
	Base Anhydrite Marker	-707	738					
	Upper Magnesian Limestone	-717	748					
	Middle Marl	-746	778					
	Lower Magnesian Limestone	-785	820					
	Lower Marl	-875	926		12.25"	9.625"		
	Base Permian Unconformity	-894	950					
Westphalian 'C'	Ravenfield Rock	-924	993					
	Wickersley Rock	-935	1009					
	Wickersley Rock Base	-952	1036					
	Ackworth Rock	-978	1082				OBM	Cemented
	Ackworth Rock Base	-1009	1144					
	Top MB	-1012	1150					
	Shafton Coal	-1032	1195		8.5"	7"		
	Top Mexborough Sandstone (Seismic Pick)	-1042	1220					
	Base Mexborough Sandstone	-1061	1276		6" 4.125"	5" 2.875"	WBM or OBM	Open Hole
Westphalian 'B'	Sharlston Top Coal	-1088	1345					
	TD	**-1119**	**1411**		**Not To Scale**			

Note: All formations and casing setting depths +/- 150 meters.

Figure 2: GLN12 Indicative Well Montage

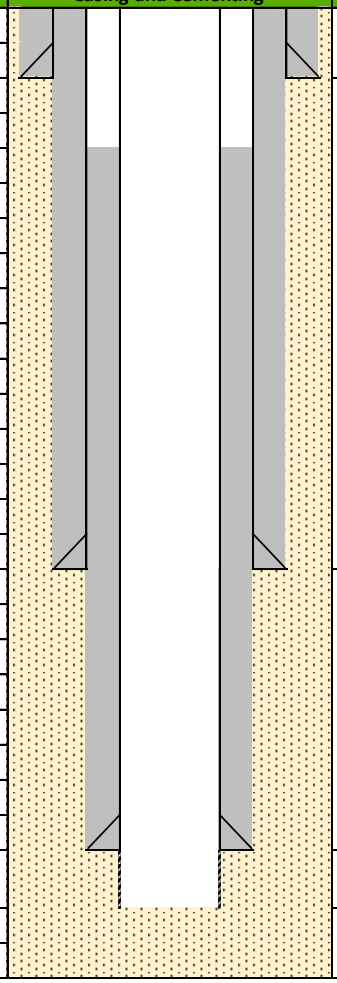
Age	Formation Tops	TVDSS (m)	MDGL (m)	Glentworth 12z Sidetrack Casing and Cementing	Hole Size	Casing Size	Drilling Mud	Cemented
Quaternary	Superficial Drift				17.5"	13.375"	WBM	Cemented
Jurassic	Lower Lias	28	0					
	Hydraulic Limestone	-97	127					
Triassic	Lilstock Formation	-108	138					
	Westbury Formation	-115	144					
	Blue Anchor Formation	-121	150					
	Mercia Mudstone Group	-136	165					
	Glenparva Formation	-142	172					
	Sherwood Sandstone Formatio	-386	415				WBM	Cemented
Permian	Upper Marl	-669	699					
	Anhydrite Marker	-702	733					
	Base Anhydrite Marker	-707	738					
	Upper Magnesian Limestone	-717	748					
	Middle Marl	-746	778					
	Lower Magnesian Limestone	-785	820					
	Lower Marl	-875	926		12.25"	9.625"		
	Base Permian Unconformity	-894	950					
Westphalian 'C'	Ravenfield Rock	-924	993					
	Wickersley Rock	-935	1009					
	Wickersley Rock Base	-952	1036				OBM	Cemented
	Ackworth Rock	-978	1082					
	Ackworth Rock Base	-1009	1144					
	Top MB	-1012	1150		8.5" 6" 4.125	7" 5" 2.875"		
	Shafton Coal	-1032	1195					
	Top Mexborough Sandstone (Seismic Pick)	-1042	1220		4.125"	2.875"	WBM or OBM	Open Hole / Slotted
	TD	**-1052**	**1815**		**Not To Scale**			
Note: All formations and casing setting depths +/- 150 meters.								

Figure 3: GLN12z Indicative Well Montage

7.1.3 Well Testing

The well testing phase can be split into two phases commonly referred to as a well clean up phase and an extended well testing phase. The entire well testing phases will take no longer than 12 months. It is anticipated based on data from the neighbouring wells that oil is the primary commodity and natural gas has the potential to be associated.

7.1.3.1 Well Clean Up

A well clean up is conducted when trying to bring the reservoir fluids to surface for the first time following a drilling campaign, after a maintenance shutdown, after a period of non-operation. The aim of the well clean up is to get the reservoir fluids to surface and flowing at a consistent rate for onward extended well testing.

A well clean up will involve the use of a well testing spread, typically consisting of at least a choke manifold, surface safety valve, three-phase separator, a heater unit, fluid storage tanks, a vent line and a combustion unit.

Once at surface, gas and produced fluids will be diverted by temporary pipework to a separator, which will separate out the produced fluids and gas. The mixed fluids (oil and water), will be diverted via temporary pipework to dedicated storage tanks onsite for subsequent offsite removal to the Welton Gathering Centre which is also operated by the 'Operator'. Waste gas produced as a result of the well clean-up operations shall be managed in accordance with the approved Best Available Technique (BAT) as demonstrated by the Waste Gas Management Plan. It is considered that a shrouded flare unit will be considered BAT due to its capability to operate over a wide ranging flowrate.

7.1.3.2 Extended Well Testing

Should the well clean up phase indicate that hydrocarbons are present then testing operations will continue with the extended well testing stage. An extended well testing stage is a longer duration test, which is carried out to assess the commercial viability of the well and establish detailed gas and oil composition.

Once at surface, gas and produced fluids will be diverted by temporary pipework to a separator, which will separate out the produced fluids and gas. The mixed fluids (oil and water), will be diverted via temporary pipework to dedicated storage tanks onsite for subsequent offsite removal to the Welton Gathering Centre which is also operated by the 'Operator'. Waste gas produced as a result of the well clean-up operations shall be managed in accordance with the approved BAT as demonstrated by the Waste Gas Management Plan. It is considered that an enclosed flare unit will be considered BAT due to its capability to incinerate highly efficiently within its designed operating capabilities.

The mixed fluids (oil and water) produced during the extended well test has the potential to contain low levels of Naturally Occurring Radioactive Material (NORM) and as such will require an RSR permit for the accumulation and disposal of radioactive waste associated with the onshore oil and gas industry. A Standard Rules 2014 No.4 permit will be applied for.

The purpose of an extended well test is to analyse the flow characteristics of a formation over an extended period.

7.2 Well Treatment - Acid Wash

During drilling the geological formation nearest to the wellbore may become damaged and the natural permeability of the target formation may be reduced by the fine particles created during drilling, along with some of the drilling muds. The fine particles and drilling muds block, or blind, the natural pore spaces in the rock. An acid wash is used to clean the well out following drilling in order to return the natural porosity and permeability of the damaged formation.

The acid is pumped, directly to the area of geological formation that requires cleaning. Only a small volume of dilute acid is applied. The pressures applied to pump the acid in to the well should be enough to counterbalance the down-hole pressure and slightly exceed the formation pressure. The pressure applied allows the acid to move down the well and a short distance in to the formation. This enables the rock and fine particles to be dissolved and creates narrow channels to enable flow between the near wellbore formation and the wellbore.

An acid wash activity requires low pressures, and the Environment Agency considers it to be a well treatment, rather than a geological formation treatment. With respect to the protection of the groundwater environment this is considered to be a very low risk activity.

7.3 Well Abandonment and Decommissioning

If it is concluded by the 'Operator' that the well is not commercially viable then a decision will be made whether or not to abandon and decommission the well. Should the decision be taken to abandon the well it will be abandoned in accordance with industry guidance, in force at the time of well decommissioning. Currently this requires all distinct permeable zones penetrated by the well to be isolated from each other and from surface by a minimum of one permanent barrier.

The initial design and construction of the well takes into consideration the permeable zones encountered during the drilling operation and whether any of these zones are hydrocarbon-bearing or over-pressured and water-bearing. Construction of the borehole has provided adequate sealing of these zones when cementing in the various steel casing strings.

If any permeable zone penetrated by the well is hydrocarbon-bearing or over-pressured and water-bearing then the requirement is for two permanent barriers from surface, the second barrier being a back-up to the first.

Once the well is abandoned, the casing strings will be mechanically cut off at 1.5 m below original ground level and a steel plate welded over the top. The pre-cast concrete drilling cellar would then be removed and the site restored to its former use.

In addition to industry guidance the well abandonment(s) will be undertaken in accordance with The Borehole Sites and Operations Regulations 1995 [REF.5] and The Offshore Installations and Wells (Design & Construction) Regulations 1996 [REF.6] and all other applicable industry guidance and standards and reviewed by an independent well examiner.

7.4 Extractive Waste Management

An assessment of the potential extractive waste arising from the drilling operations has been undertaken. The information obtained as part of the initial assessment includes each extractive waste's classification, quantity and storage method together with the prevention, minimisation, treatment and disposal options as required by the MWD.

For clarity, the waste volumes provided below are worst case insofar as both water based mud and oil based being considered. Should only water based mud be considered, no oil based mud would be needed, however both the maximum volumes for oil based mud and water based mud (and rock cuttings) have been provided.

Water Based Mud (Fresh Water)				
Classification, Quantity and Storage	**Default Classification:**	Non-Hazardous	**EWC Code:**	01 05 04
	Potential Classification:	Hazardous	**EWC Code:**	01 05 06*
	Estimated Quantity:	240m^3 / 285 Tonnes	**Dust / Odour Potential:**	Limited Potential
	Onsite Storage:	Enclosed / Partially Enclosed Storage Tank	**Storage Duration:**	<2 Weeks
Operation / Activity	Drilling fluids are used to aid in the drilling process by lubricating and cooling the drill bit, maintaining filter cake to prevent drilling fluid invasion into formation, circulating to surface the rock cuttings from the drilling process and for well control by maintaining a prescribed hydrostatic pressure within the well to prevent the uncontrolled release of formation fluids under pressure			
Prevention and Minimisation	Drilling fluid waste is minimised by continually reusing the mud in a closed loop system and sustained by way of filtering out rock cuttings and finer particles of rock. The rock cuttings tank is a fluid separator tank with shale shakers equipped with appropriate screen sizes, which allows drilling mud that coats the rock cuttings to percolate, collect and be pumped back into the closed loop mud system.			
Treatment and Disposal	Drilling muds become a waste when no longer required for use in the operation and will be transferred from the circulating mud system on the drilling rig to a vacuum tanker for removal offsite via licenced haulier to a permitted facility for treatment.			
Remaining in the Formation	None, all mud shall be circulated out.			
Monitoring	An inspection of the waste storage vessel shall be carried out prior to being used and will be subject to regular inspections and maintained in accordance with manufacturers recommendations.			

Table 2: Water Based Mud (Fresh Water) Waste Table

Water Based Mud (Salt Saturated)				
Classification, Quantity and Storage	**Default Classification:**	Non-Hazardous	**EWC Code:**	01 05 08
	Potential Classification:	Hazardous	**EWC Code:**	01 05 06*
	Estimated Quantity:	940m^3 / 1,035 Tonnes	**Dust / Odour Potential:**	Limited Potential
	Onsite Storage:	Enclosed / Partially Enclosed Storage Tank	**Storage Duration:**	<2 Weeks
Operation / Activity	Drilling fluids are used to aid in the drilling process by lubricating and cooling the drill bit, maintaining filter cake to prevent drilling fluid invasion into formation, circulating to surface the rock cuttings from the drilling process and for well control by maintaining a prescribed hydrostatic pressure within the well to prevent the uncontrolled release of formation fluids under pressure			
Prevention and Minimisation	Drilling fluid waste is minimised by continually reusing the mud in a closed loop system and sustained by way of filtering out rock cuttings and finer particles of rock. The rock cuttings tank is a fluid separator tank with shale shakers equipped with appropriate screen sizes, which allows drilling mud that coats the rock cuttings to percolate, collect and be pumped back into the closed loop mud system.			
Treatment and Disposal	Drilling muds become a waste when no longer required for use in the operation and will be transferred from the circulating mud system on the drilling rig to a vacuum tanker for removal offsite via licenced haulier to a permitted facility for treatment.			
Remaining in the Formation	None, all mud shall be circulated out.			
Monitoring	An inspection of the waste storage vessel shall be carried out prior to being used and will be subject to regular inspections and maintained in accordance with manufacturers recommendations.			

Table 3: Water Based Mud (Salt Saturated) Waste Table

Oil Based Mud				
Classification, Quantity and Storage	**Default Classification:**	Hazardous	**EWC Code:**	01 05 05*
	Potential Classification:	-	**EWC Code:**	-
	Estimated Quantity:	120m^3 / 130 Tonnes	**Dust / Odour Potential:**	Limited Potential
	Onsite Storage:	Enclosed / Partially Enclosed Storage Tank	**Storage Duration:**	<2 Weeks
Operation / Activity	Drilling fluids are used to aid in the drilling process by lubricating and cooling the drill bit, maintaining filter cake to prevent drilling fluids invasion into formation circulating to surface the rock cuttings from the drilling process and for well control by maintaining a prescribed hydrostatic pressure within the well to prevent the uncontrolled release of formation. fluids under pressure			
Prevention and Minimisation	Drilling fluid waste is minimised by continually reusing the mud in a closed loop system and sustained by way of filtering out rock cuttings and finer particles of rock. The rock cuttings tank is a fluid separator tank with shale shakers equipped with appropriate screen sizes, which allows drilling mud that coats the rock cuttings to percolate, collect and be pumped back into the closed loop mud system. Whenever oil-based drilling mud exceeds the prescribed solids and mud weight increases, due to finer particles of rock cuttings in the mud, the drilling mud needs to be centrifuged, which is performed onsite, through a centrifuge built in the close drilling mud system.			
Treatment and Disposal	Low toxicity oil-based drilling fluids are at the end of usage returned back to the supplier for treatment and reusage. A small volume of low toxicity oil-based mud, contaminated with clean up fluid results from rig tank and equipment cleaning, which is transferred to a vacuum tanker for removal offsite via licenced haulier to a permitted facility.			
Remaining in the Formation	None, all mud shall be circulated out.			
Monitoring	An inspection of the waste storage vessel shall be carried out prior to being used and will be subject to regular inspections and maintained in accordance with manufacturers recommendations.			

Table 4: Oil Based Mud Waste Table

Water Based Cuttings (Salt Saturated)				
Classification, Quantity and Storage	**Default Classification:**	Non-Hazardous	**EWC Code:**	01 05 08
	Potential Classification:	Hazardous	**EWC Code:**	01 05 06*
	Estimated Quantity:	130m^3 / 300 Tonnes	**Dust / Odour Potential:**	Limited Potential
	Onsite Storage:	Storage Container	**Storage Duration:**	<2 Weeks
Operation / Activity	The drilling of the borehole will commence with the drilling and installation of a casing string known as a surface conductor. The near surface clays and sands within which the surface conductor casing will be set will be removed. The clay and sand will be circulated out of the well using either an auger or water-based drilling fluids and return to the surface where it is transferred to an open tank.			
Prevention and Minimisation	The ability to prevent or minimise cuttings is limited given that the formation needs to be removed to allow the conductor casing to be installed.			
Treatment and Disposal	The cuttings will be transported offsite via licenced haulier to a permitted facility for treatment.			
Remaining in the Formation	None, all cuttings shall be circulated out.			
Monitoring	An inspection of the waste storage vessel shall be carried out prior to being used and will be subject to regular inspections and maintained in accordance with manufacturers recommendations.			

Table 5: Water Based Cuttings (Salt Saturated) Waste Table

Oil Based Cuttings				
Classification, Quantity and Storage	**Default Classification:**	Hazardous	**EWC Code:**	01 05 05*
	Potential Classification:	-	**EWC Code:**	-
	Estimated Quantity:	40m^3 / 90 Tonnes	**Dust / Odour Potential:**	Limited Potential
	Onsite Storage:	Storage Container	**Storage Duration:**	<2 Weeks
Operation / Activity	The drilling of the borehole will commence with the drilling and installation of a casing string known as a surface conductor. The near surface clays and sands within which the surface conductor casing will be set will be removed. The clay and sand will be circulated out of the well using either an auger or water-based drilling fluids and return to the surface where it is transferred to an open square tank.			
Prevention and Minimisation	The ability to prevent or minimise cuttings is limited given that the formation needs to be removed to allow the conductor casing to be installed.			
Treatment and Disposal	The cuttings will be transported offsite via licenced haulier to a permitted facility for treatment.			
Remaining in the Formation	None, all cuttings shall be circulated out.			
Monitoring	An inspection of the waste storage vessel shall be carried out prior to being used and will be subject to regular inspections and maintained in accordance with manufacturers recommendations.			

Table 6: Oil Based Cuttings Waste Table

Well Brine				
Classification, Quantity and Storage	**Default Classification:**	Non-Hazardous	**EWC Code:**	01 05 08
	Potential Classification:	Hazardous	**EWC Code:**	01 05 06*
	Estimated Quantity:	60m^3 / 72 Tonnes	**Dust / Odour Potential:**	Limited Potential
	Onsite Storage:	Enclosed / Partially Enclosed Storage Tank	**Storage Duration:**	<2 Weeks
Operation / Activity	The well may be the subject of a period of suspension using brine. In addition, brine is also used as circulation fluid following well treatments to recover spent treatment additives such as acid. Following suspension or circulation operations the brine will be circulated out of the well to an onsite storage tank. During suspension operations all surplus brine will be removed from the well. Brine remaining within the well during suspension operations is not considered a waste as it is serving a 'well control' function.			
Prevention and Minimisation	The brine will be stored onsite for subsequent reuse should it remain fit for purpose. i.e. sufficiently weighted. The brine may be re-used if it is to be reapplied to the well in the near future.			
Treatment and Disposal	Once the brine has fully served its purpose it will be removed from the site via a licenced haulier to a permitted treatment facility where it is managed in accordance with the permitted controls of the water treatment facility. No treatment is being considered at the wellsite.			
Remaining in the Formation	None. Any brine remaining in the formation is not considered a waste as it is performing a purpose.			
Monitoring	An inspection of the waste storage vessel shall be carried out prior to being used and will be subject to regular inspections and maintained in accordance with manufacturers recommendations.			

Table 7: Well Brine Waste Table

Cement				
Classification, Quantity and Storage	**Default Classification:**	Non-Hazardous	**EWC Code:**	17 01 01
	Potential Classification:	-	**EWC Code:**	-
	Estimated Quantity:	30m^3 / 60 Tonnes	**Dust / Odour Potential:**	Limited Potential
	Onsite Storage:	Skips	**Storage Duration:**	<2 Weeks
Operation / Activity	Cement returns from the casing of the well may result in waste cement. In addition, not all cement may be used and surplus made at site.			
Prevention and Minimisation	Careful planning and calculation will be taken prior to cementation operation being undertaken to prevent unnecessary volumes being produced. The cement will be batched mixed to allow control of quantities being used, which further prevents and/or minimises cement waste. The cement operation will be undertaken by a competent contractor to reduce the amount of potential wastes produced from the returns to surface. The volume of waste cement is expected to be minimal.			
Treatment and Disposal	Excess returns to surface will be transferred to a number of skips and left to dry onsite for subsequent removal and disposal to an environmental agency permitted waste facility where it recycled as building rubble for use within the building industry.			
Remaining in the Formation	None. Cement within the formation, be it between the casing and formation (wellbore annulus) is a critical component of the well construction and integrity.			
Monitoring	Competent supervision to review the cement calculations to prevent and / or minimise cement waste. The building skips will be inspected prior to use to ensure they are suitable for holding cement.			

Table 8: Cement Waste Table

Spent Acid				
Classification, Quantity and Storage	**Default Classification:**	Non-Hazardous	**EWC Code:**	01 05 08
	Potential Classification:	-	**EWC Code:**	-
	Estimated Quantity:	375 Tonnes	**Dust / Odour Potential:**	Limited Potential
	Onsite Storage:	Enclosed / Partially Enclosed Storage Tank	**Storage Duration:**	<2 Weeks
Operation / Activity	Acid is used to remove production-resisting completion-induced formation matrix damage. As the acid reacts with minerals within the formation the chemical reaction produces a near neutral solution, generally mildly acidic. The solution produced as part of the reaction with the minerals will be lifted out of the wellbore into a closed tank and stored onsite for subsequent removal via a licenced haulier to an Environment Agency permitted waste water treatment works facility where it is processed, treated and discharged in accordance with the permitted controls of the water treatment facility.			
Prevention and Minimisation	The acid will be used in stages to ensure its use is minimised. The reaction of the acid with minerals produces a near neutral solution. This reaction, and in turn the waste generated, is unavoidable. Careful planning will be taken prior to any acid squeeze being undertaking to ensure the minimisation of the amount of acid used, which in turn reduces the amount of waste generated by the operation.			
Treatment and Disposal	The spent acid will be lifted out of the wellbore into a tank and stored onsite for subsequent removal via a licenced haulier to an Environment Agency permitted waste water treatment works facility where it is processed, treated and discharged in accordance with the permitted controls of the facility. Should the acid return not fully spent (slightly acidic) then a neutralising agent such as soda ash will be used.			
Remaining in the Formation	None. The reaction of the acid with the minerals produces chlorides, which are classified as non-hazardous. The chloride solution will be lifted out of the formation and collected at surface.			
Monitoring	An inspection of the waste storage vessel shall be carried out prior to being used and will be subject to regular inspections and maintained in accordance with manufacturers recommendations.			

Table 9: Spent Acid

Produced Water				
Classification, Quantity and Storage	**Default Classification:**	Non-Hazardous	**EWC Code:**	01 01 02
	Potential Classification:	-	**EWC Code:**	-
	Estimated Quantity:	Unknown	**Dust / Odour Potential:**	Limited Potential
	Onsite Storage:	Enclosed / Partially Enclosed Storage Tank	**Storage Duration:**	<2 Weeks
Operation / Activity	There is a very low possibility of formation water being produced in isolation as it will be considered as produced fluid (oil and water mix) which is considered a product. However, in the event produced water is produced without oil, then it will be considered an extractive waste.			
Prevention and Minimisation	The ability to prevent or minimise recovery of formation water is extremely limited. No consideration has been given at this stage for reinjection of produced formation water as the operation is exploratory. Formation water cannot be reused onsite due to unknown components within the formation water and high salinity.			
Treatment and Disposal	Depending on the outcome of radionuclide analysis formation water will be transported via a licenced haulier to either an Environment Agency permitted waste water treatment works facility where it is processed, treated and discharged in accordance with the permitted controls of the water treatment facility, or to a bespoke RSR permitted waste treatment facility for treatment and disposal in accordance with the BAT. Produced fluid (which is not considered a waste) will be taken offsite to the Welton Gathering Centre for processing. For clarity no treatment will take place onsite.			
Remaining in the Formation	None. Formation water naturally occurs within certain hydrocarbon bearing formations and is only considered as a waste when produced from the well.			
Monitoring	An inspection of the waste storage vessel shall be carried out prior to being used and will be subject to regular inspections and maintained in accordance with manufacturers recommendations. An appointed a Radioactive Waste Advisor who will advise on the correct and appropriate monitoring arrangements.			

Table 10: Produced Water

Natural Gas				
Classification, Quantity and Storage	**Default Classification:**	Hazardous	**EWC Code:**	16 05 04*
	Potential Classification:	-	**EWC Code:**	-
	Estimated Quantity:	<10 Tonnes per Day	**Dust / Odour Potential:**	Limited Potential
	Onsite Storage:	Enclosed / Partially Enclosed Storage Tank	**Storage Duration:**	<2 Weeks
Operation / Activity	During the well testing phase there is a likelihood of associated natural gas being produced from the target formation. Well testing is undertaken to determine the commercial viability of a potential prospect.			
Prevention and Minimisation	The ability to prevent or minimise associated natural gas is extremely limited during the well testing phase as it is a result of the need to test the wells production capability. The waste gas shall be managed in accordance with the identified BAT, which in this instance is a flare unit for both the well clean up phase and the extended well testing phase.			
Treatment and Disposal	Natural gas is separated from produced fluids at surface and diverted via pipework to a flare located onsite for incineration which is considered BAT. Each flare unit for both phases of the well testing operation will be the subject of Environment Agency approval.			
Remaining in the Formation	None. Natural gas naturally occurs within certain hydrocarbon bearing formations and is only considered as a waste when produced from the well.			
Monitoring	During flaring operations, the flare will be managed through onsite supervision and interlinked safety and performance systems (e.g. pressure/flow safety ESD valves, combustion temperature) to ensure its effectiveness and efficiency. Gas rates through the flare can be controlled using the choke manifold and metered in the gas line inlet line.			

Table 11: Natural Gas

7.5 Treatment of Extractive Waste

Drilling mud may require treatment within the site boundary. An assessment of the potential waste treatment processes confirms that an 'installation activity' would not be required as the treatment plant will not include a capacity exceeding:

- 50 tonnes per day for non hazardous waste for disposal - using chemical, biological or physical treatment;
- 75 tonnes per day for non hazardous waste for recovery - using biological treatment; or
- 10 tonnes per day for hazardous waste.

Drilling mud will form part of a closed loop system with treatment of the mud being limited to physical treatment to filter our cuttings to prolong the use of the mud and reduce overall waste mud volumes. The treatment is not for disposal purposes but rather ongoing recovery.

7.6 Management of Non Extractive Waste

Throughout the operations, non-extractive wastes will be generated onsite which may include, but is not limited to:

- Surface run-off water;
- Waste water and sewage;
- Waste engine, gear and lubricating oils;
- Waste hydraulic oils;
- Oil rags and absorbents;
- Waste oil filters;
- Paper and cardboard;
- Canteen waste;
- Wood; and
- Metal.

7.7 Treatment of Non-Extractive Waste

Non-extractive wastes will not be treated at the wellsite. They will be segregated and stored according to their EWC Code pending collection by a licenced waste carrier for onward treatment and/or disposal.

7.8 Management of Naturally Occurring Radioactive Material

A standard rules permit to accumulate and dispose of Naturally Occurring Radioactive Material (NORM) from the wellsite will be acquired.

A competent Radiation Protection Supervisor and/or Radioactive Waste Advisor will be appointed to ensure that NORM is managed correctly.

8. RISKS POSED TO THE ENVIRONMENT AND HUMAN HEALTH

The risks posed by the 'mining waste operation' has been addressed within an Environmental Risk Assessment which forms part of any application to the Environment Agency and is considered an 'operating technique'. The Environmental Risk Assessment (which is qualitative) considers activities which have the potential to cause harm to the environment and human health (pollution damage).

The Environmental Risk Assessment has concluded that the risk to the Environment and Human Health is 'insignificant' not least due to the type of activities being undertaken, the nature of the waste and the mitigation measures adopted by the 'Operator'.

The Environmental Risk Assessment follows the Environment Agency's source-pathway-receptor' model and includes the risks posed from the site operations in relation to:

- accidents and incidents;
- air Emissions;
- dust;
- noise;
- odour
- release to water;
- global warming potential; and
- waste.

9. POINT SOURCE EMISSIONS

There are no point source emissions associated with the drilling operation. Temporary exhaust emissions will be present at the site whilst the Glentworth West Well and Sidetrack are being drilled. However common point source emissions associated with onshore oil and gas developments, such as the flaring of natural gas for waste incineration, does not form part of the drilling operation, though a safety flare may be deployed as part of the drilling campaign as a safety device only.

During the well testing phase (both clean up and extended well test) a flare unit will be deployed at the wellsite. The flare unit will be considered an emission point to air. There are no proposed point source emissions to either land, surface water or groundwater as part of this development.

10. PROPOSED PLAN FOR CLOSURE AND SITE AFTERCARE

Prior to the site closure, abandonment of the well and restoration of the wellsite a Site Closure Plan will be developed by the 'Operator' and submitted to the Environment Agency for approval.

As a minimum the Site Closure Plan will consider both the decommissioning and abandonment of the well(s) and the restoration and aftercare of the wellsite.

10.1 Well Abandonment and Decommissioning

Upon cessation of activities the well will be abandoned in accordance with industry guidance, in force at the time of well decommissioning, currently requires all distinct permeable zones penetrated by the well to be isolated from each other and from surface by a minimum of one permanent barrier.

The initial design and construction of the well takes into consideration the permeable zones encountered during the drilling operation and whether any of these zones are hydrocarbon-bearing or over-pressured and water-bearing. Construction of the borehole has provided adequate sealing of these zones when cementing in the various steel casing strings.

If any permeable zone penetrated by the well is hydrocarbon-bearing or over-pressured and water-bearing then the requirement is for two permanent barriers from surface, the second barrier being a back-up to the first.

Once the well is abandoned, the casing strings will be mechanically cut off at 1.5 m below original ground level and a steel plate welded over the top. The pre-cast concrete drilling cellar would then be removed and the site restored to its former use.

In addition to industry guidance the well abandonment(s) will be undertaken in accordance with BSOR1995 and DCR1996 and all other applicable industry guidance and standards and reviewed by independent well examiner.

10.2 Restoration and Aftercare

All extractive waste shall be removed from the wellsite prior to restoration.

All surface equipment will be purged clean, dismantled and removed from the wellsite. buildings and structures will be demolished and removed. The containment systems and associated management of surface water will continue to be implemented until all equipment has been removed from the site.

plant and structures have been removed from the site, the site surface will be inspected for contaminants and placed within skips pending collection. Any material which shows evidence of contamination shall be segregated and collected independently of its uncontaminated counterparts.

Samples will be obtained throughout the restoration process to demonstrate that there has been no deterioration to the environment. Samples taken will include surface water, groundwater and soil analysis.

The results of the monitoring will form part of the Site Condition Report, which will be issued to the Environment Agency upon surrender of the environmental permit.

Upon completion of the restoration phase the site will be the subject of an aftercare programme to ensure the condition of the land is comparable with adjacent land and its pre-development condition.

REFERENCES

1. The Environmental Permitting (England and Wales) Regulations 2016
Available at: https://www.legislation.gov.uk/uksi/2016/1154/contents/made

2. Council Directive 2006/21/EC on the management of waste from extractive industries and amending Directive 2004/35/EC
Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02006L0021-20090807&from=EN

3. Environment Agency. (2011). *EPR 6.14 How to comply with you environmental permit. [Additional guidance for: mining waste operations.* Version 2.0]
Available at:
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/296493/LIT_8451_eb68e4.pdf

4. Council Directive 2008/98/EC on waste and repealing certain Directives
Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02008L0098-20180705&from=EN

5. European Union (Withdrawal) Act 2018
Available at: https://www.legislation.gov.uk/ukpga/2018/16/contents/enacted

6. Council Directive 2010/75/EU on the industrial emissions (integrated pollution prevention and control)
Available at https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32010L0075&from=EN

7. Commission Decision (2000/532/EC) replacing Decision 94/3/EC establishing a list of wastes pursuant to Article 1(a) of Council Directive 75/442/EEC on waste and Council Decision 94/904/EC establishing a list of hazardous waste pursuant to Article 1(4) of Council Directive 91/689/EEC on hazardous waste.
Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32000D0532&from=EN

8. Environment Agency. (2021). *Waste Classification [Guidance on the classification and assessment of waste.* 1st Edition v1.2 GB]
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9. The Waste (England and Wales) Regulations 2011
Available at: https://www.legislation.gov.uk/uksi/2011/988/contents/made

10. The Borehole Sites and Operations Regulations 1995
Available at: https://www.legislation.gov.uk/uksi/1995/2038/contents/made

11. Environment Agency, Onshore Oil and Gas Sector Guidance
Available at: https://www.gov.uk/guidance/onshore-oil-and-gas-sector-guidance

12. The Offshore Installations and Wells (Design & Construction, etc) Regulations 1996
Available at: https://www.legislation.gov.uk/uksi/1996/913/contents

APPENDIX 1 - REGULATED FACILITY BOUNDARY PLAN

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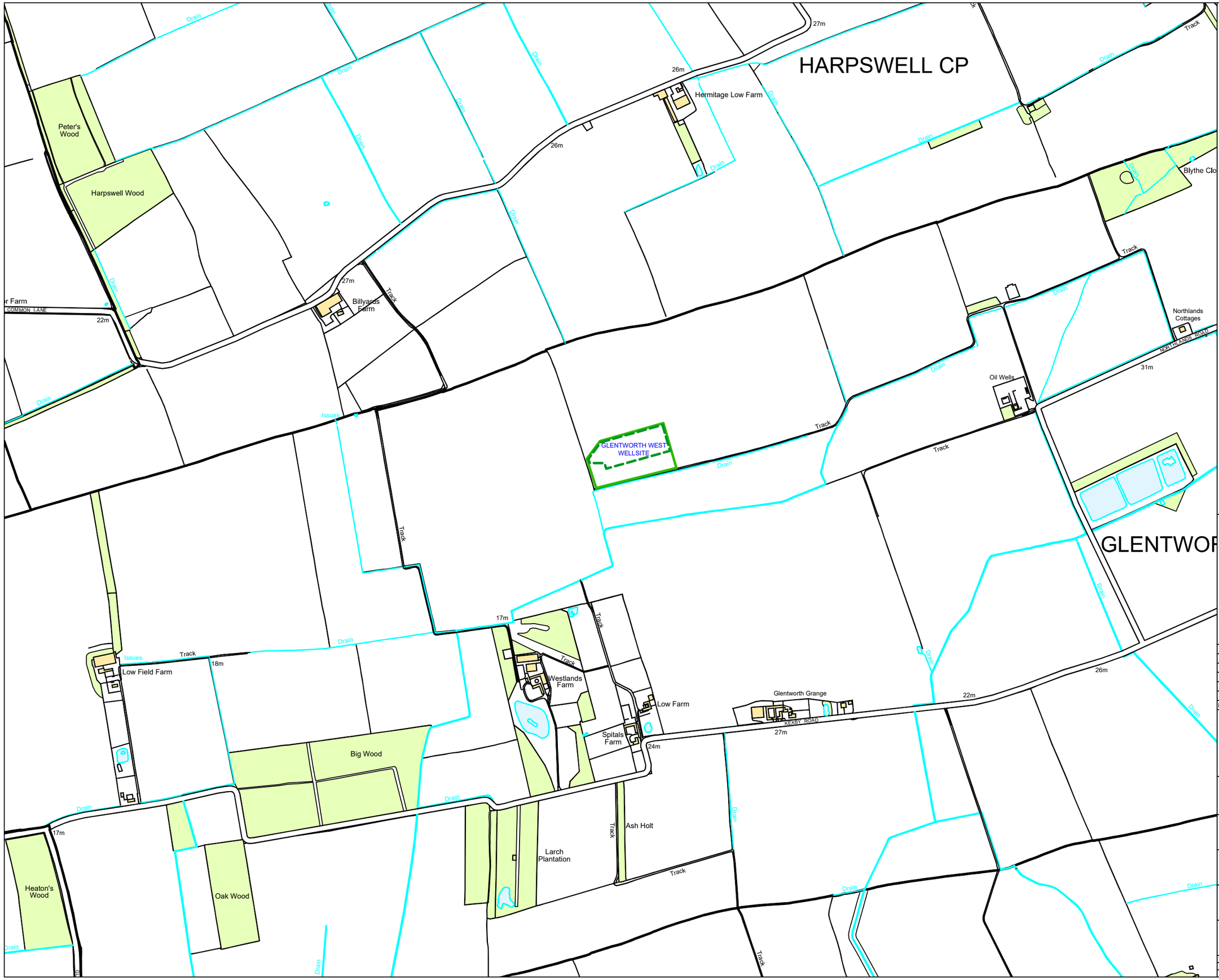

KEY:

PERMIT BOUNDARY (MINING WASTE & NORM)

PERMIT BOUNDARY (OIL STORAGE)

WATER FEATURE (PONDS, DRAINS)

NOTES:

REVISION HISTORY				
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0	OCT22	JF	FIRST ISSUE	JF
REV	DATE	BY	DETAILS	APR

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FROM CONCEPTION TO COMPLETION

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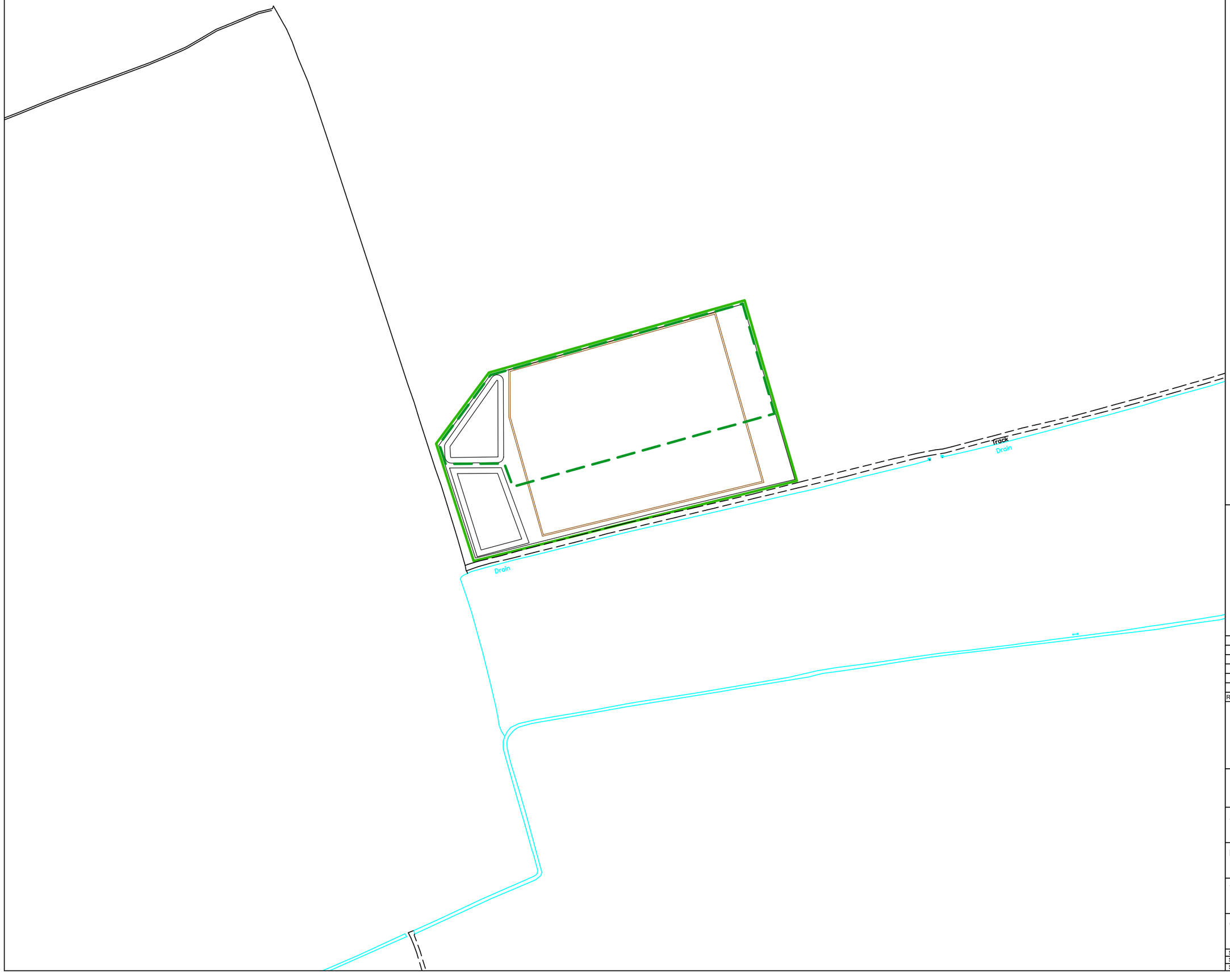
SITE: GLENTWORTH WEST WELLSITE, LINCOLNSHIRE

PROJECT: DRILLING & TESTING OPERATIONS

TITLE: LOCATION PLAN

CLIENT: IGAS ENERGY PRODUCTION LIMITED

Scale:	1:10,000	DWG. No:
Size:	A3	ZG-IGAS-GLEN-EPR-01
Sheet:	1 of 1	



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NOTES:

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SITE: GLENTWORTH WEST WELLSITE, LINCOLNSHIRE

PROJECT: DRILLING & TESTING OPERATIONS

TITLE: LOCATION PLAN

CLIENT: IGAS ENERGY PRODUCTION LIMITED

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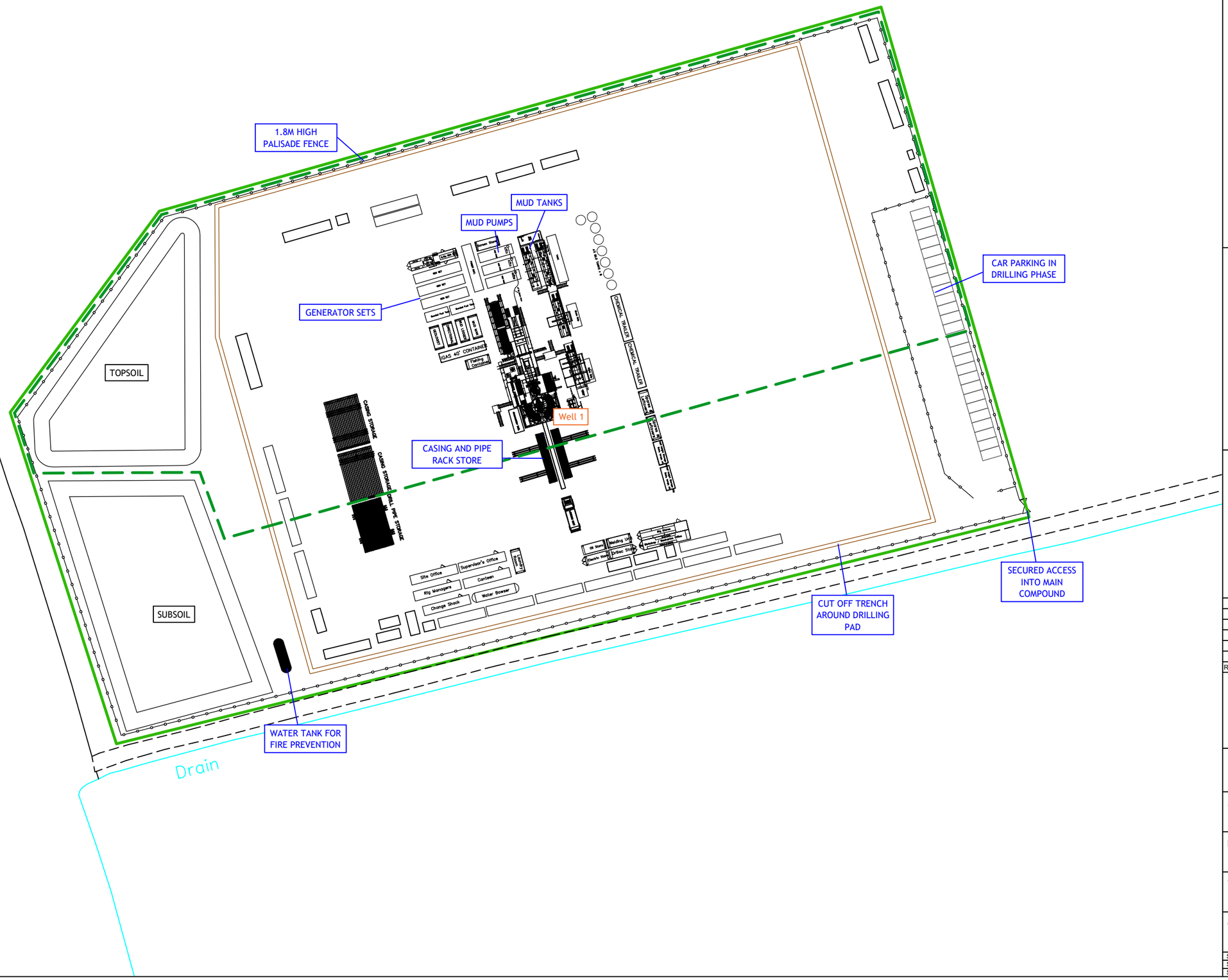

KEY:

PERMIT BOUNDARY (MINING WASTE & NORM)

PERMIT BOUNDARY (OIL STORAGE)

WATER FEATURE (PONDS, DRAINS)

EMISSIONS POINT:

NOTES:

REVISION HISTORY				
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SITE: GLENTWORTH WEST WELLSITE, LINCOLNSHIRE

PROJECT: DRILLING & TESTING OPERATIONS

TITLE: SITE LAYOUT PLAN - DRILLING PHASE

CLIENT: IGAS ENERGY PRODUCTION LIMITED

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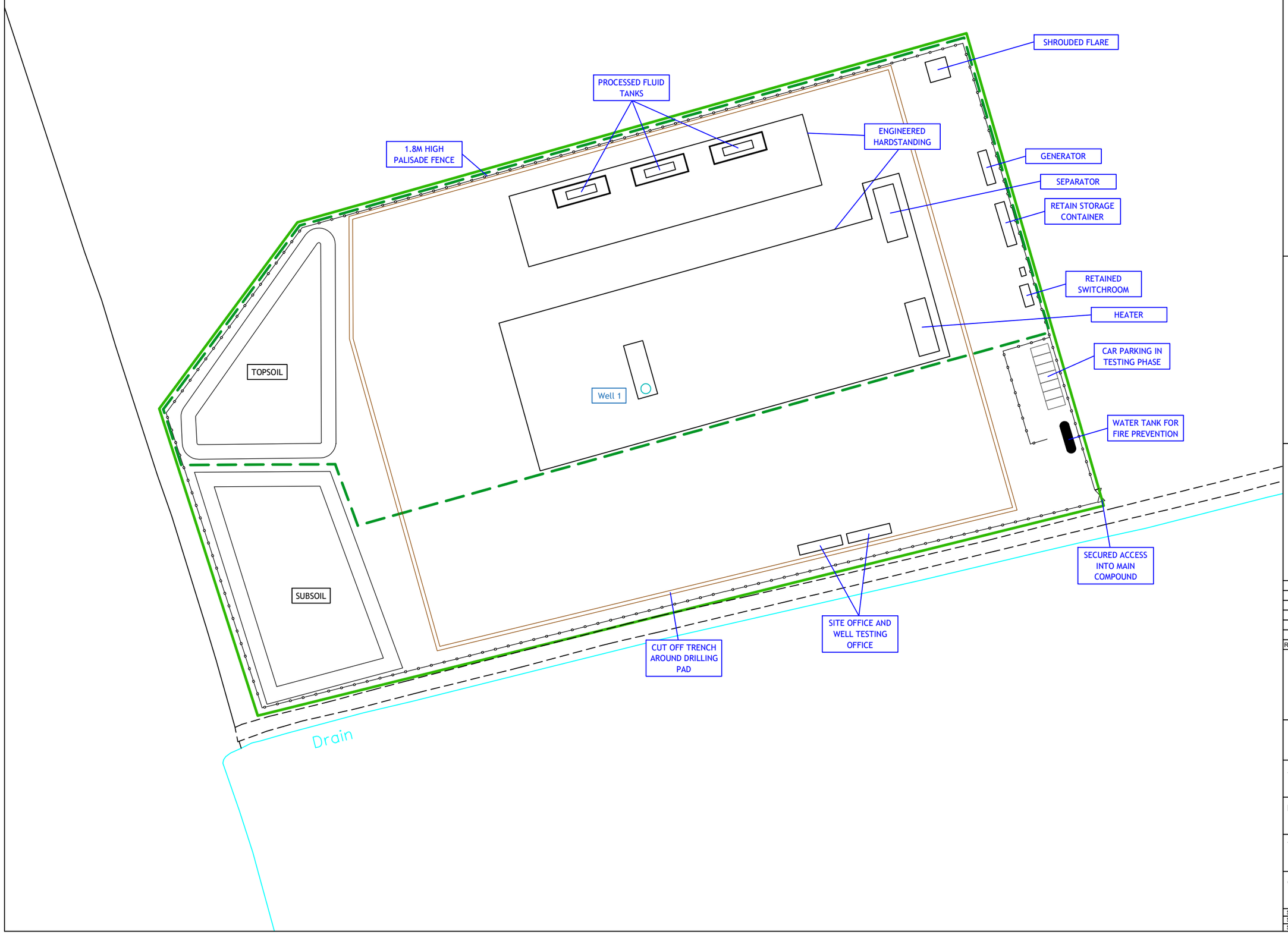

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PERMIT BOUNDARY (MINING WASTE & NORM)

PERMIT BOUNDARY (OIL STORAGE)

WATER FEATURE (PONDS, DRAINS)

EMISSIONS POINT:

NOTES:

REVISION HISTORY

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SITE: GLENTWORTH WEST WELLSITE, LINCOLNSHIRE

PROJECT: DRILLING & TESTING OPERATIONS

TITLE: SITE LAYOUT PLAN - INITIAL WELL TESTING PHASE

CLIENT: IGAS ENERGY PRODUCTION LIMITED

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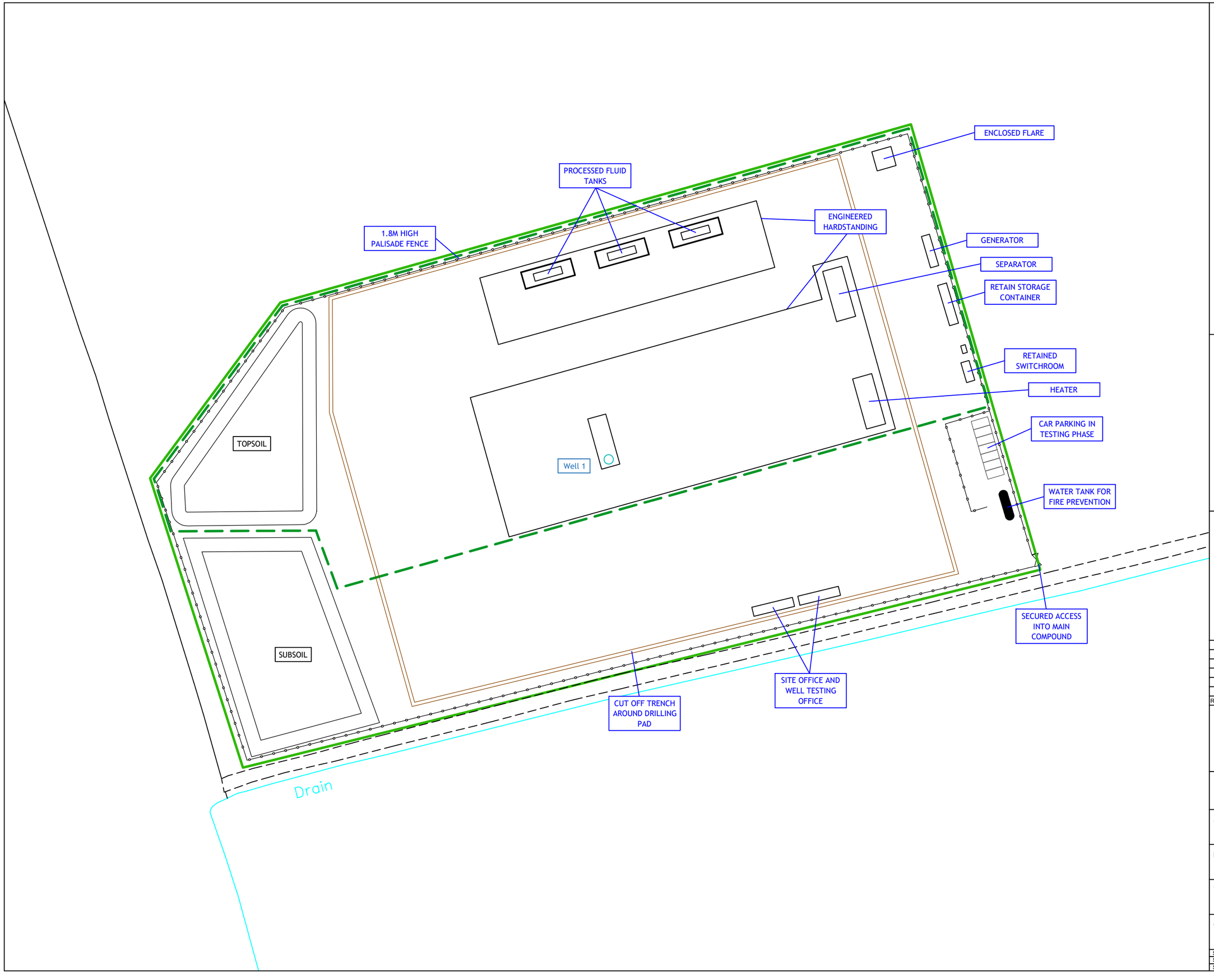

KEY:

PERMIT BOUNDARY (MINING WASTE & NORM)

PERMIT BOUNDARY (OIL STORAGE)

WATER FEATURE (PONDS, DRAINS)

EMISSIONS POINT:

NOTES:

REVISION HISTORY

REV	DATE	BY	DETAILS	APR
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–	–	–	–	–
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–	–	–	–	–
0	OCT22	JF	FIRST ISSUE	JF

ZETLAND GROUP
FROM CONCEPTION TO COMPLETION

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SITE: GLENTWORTH WEST WELLSITE, LINCOLNSHIRE

PROJECT: DRILLING & TESTING OPERATIONS

TITLE: SITE LAYOUT PLAN - EXTENDED WELL TESTING PHASE

CLIENT: IGAS ENERGY PRODUCTION LIMITED

Scale:	1:1,000
Size:	A3
Sheet:	1 of 1

DWG. No: ZG-IGAS-GLEN-EPR-05

APPENDIX 2 - CHEMICAL INVENTORY

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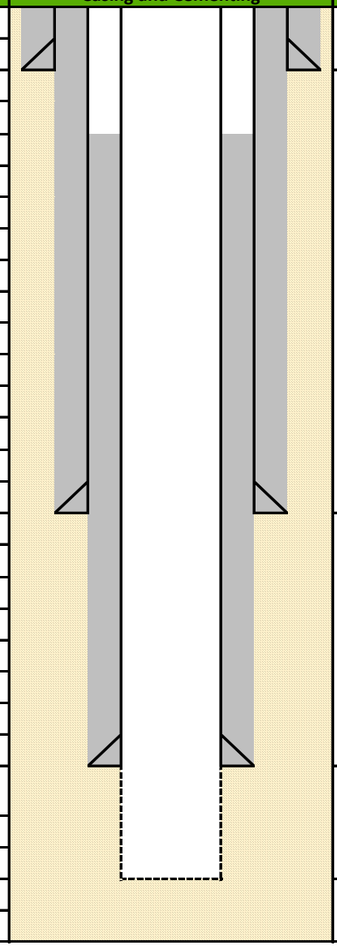
Age	Formation Tops	Description	TVDSS (m)	MDGL (m)
Quaternary	Drift			
Jurassic	Lower Lias	Mudstone: medium dark grey, firm to sticky, slightly calcareous, becoming more silty with depth	28	0
	Hydraulic Lst		-97	127
Triassic	Lilstock Fm	Shale: light brown/orange to dark black silty shales, occasion streaks of green mudstone. Gypsum	-108	138
	Westbury Fm	Dark grey mudstones or shales with subordinate thin limestones, sandstones and fossiferous arenaceous units.	-115	144
	Blue Anchor Fm	Mudstone: red/brown, soft amorphous, occasionally silty and anhydritic	-121	150
	Mercia Mudstone	Sequence of brown and red-brown, calcareous clays and mudstones	-136	165
	Glenparva Fm	Mudstone and siltstone, reddish brown, blocky; common veins, nodules and beds of gypsum; a few beds of dolomitic sandstone.	-142	172
	Sherwood Sandstone Fm	Sandstone quartzose, clear to translucent, loose to subangular, mod sorted, occ silic cement	-386	415
Permian	Upper Marl	Marl: red to dark brown claystone and siltstone.	-669	699
	Anhydrite Marker	Abundant anhydrite	-702	733
	Base Anhydrite Marker		-707	738
	Upper Magnesian Limestone	Limestone and Dolomite, off white to light grey, firm, micro crystalline	-717	748
	Middle Marl	Dolomites and Marl: off white grey, firm-moderately hard, translucent, with red brown and grey marls.	-746	778
	Lower Magnesian Limestone	Limestone and Dolomite, off white to light grey, firm, micro crystalline	-785	820
	Lower Marl	Marl: red to dark brown claystone and siltstone.	-875	926
	Base Permian Unconformity	Rapid lithological change, possible drilling break.	-894	950
Westphalian 'C'	Ravenfield Rock	Sandstone and Mudstone, light grey, amorphous blocky, locally very silty. Good traces of coal and pyrite	-924	993
	Wickersley Rock	Sandstone: medium, becoming finer and silty with depth	-935	1009
	Wickersley Rock Base	Mudstone: light grey, amorphous blocky, locally very silty. Good traces of coal and pyrite	-952	1036
	Ackworth Rock	Sandstone: medium, loose, moderate sorting, gas shows	-978	1082
	Ackworth Rock Base	Sandstone: medium, becoming finer and silty with depth	-1009	1144
	Top MB	Shale: marine Band	-1012	1150
	Shafton Coal	Coal	-1032	1195
	Top Mexborough Sandstone (Seismic Pick)	Sandstone: Clear to translucent, medium, loose, subangular to subrounded, well sorted, good spericity,, moderate fluorescence, golden cut.	-1042	1220
	Base Mexborough Sandstone	Mudstone: light grey, amorphous blocky, locally very silty.	-1061	1276
Westphalian 'B'	Sharlston Top Coal	Coal	-1088	1345
	TD	**TD**	**-1119**	**1411**

Note: All formations and casing setting depths +/- 150 meters.



Hole Size	Casing Size	Mud System	Cemented
17.5"	13.375"	WBM	Cemented
12.25"	9.625"	WBM	Cemented
8.5"	7"	OBM	Cemented
6" 4.125"	5" 2.875"	WBM or OBM	Open Hole

Not To Scale

Age	Formation Tops	Description	TVDSS (m)	MDGL (m)	Glentworth 12z Sidetrack Casing and Cementing	Hole Size	Casing Size	Drilling Mud	Cemented
Quaternary	Superficial Drift								
Jurassic	Lower Lias	Mudstone: medium dark grey, firm to sticky, slightly calcareous, becoming more silty with depth	28	0		17.5"	13.375"	WBM	Cemented
	Hydraulic Limestone		-97	127					
Triassic	Lilstock Formation	Shale: light brown/orange to dark black silty shales, occasion streaks of green mudstone. Gypsum	-108	138					
	Westbury Formation	Dark grey mudstones or shales with subordinate thin limestones, sandstones and fossiferous arenaceous units.	-115	144					
	Blue Anchor Formation	Mudstone: red/brown, soft amorphous, occasionally silty and anhydritic	-121	150					
	Mercia Mudstone Group	Sequence of brown and red-brown, calcareous clays and mudstones	-136	165					
	Glenparva Formation	Mudstone and siltstone, reddish brown, blocky; common veins, nodules and beds of gypsum; a few beds of dolomitic sandstone.	-142	172					
	Sherwood Sandstone Formation	Sandstone quartzose, clear to translucent, loose to subangular, mod sorted, occ silic cement	-386	415					
Permian	Upper Marl	Marl: red to dark brown claystone and siltstone.	-669	699				WBM	Cemented
	Anhydrite Marker	Abundant anhydrite	-702	733					
	Base Anhydrite Marker		-707	738					
	Upper Magnesian Limestone	Limestone and Dolomite, off white to light grey, firm, micro crystalline	-717	748					
	Middle Marl	Dolomites and Marl: off white grey, firm-moderately hard, translucent, with red brown and grey marls.	-746	778					
	Lower Magnesian Limestone	Limestone and Dolomite, off white to light grey, firm, micro crystalline	-785	820					
	Lower Marl	Marl: red to dark brown claystone and siltstone.	-875	926		12.25"	9.625"		
	Base Permian Unconformity	Rapid lithological change, possible drilling break.	-894	950					
Westphalian 'C'	Ravenfield Rock	Sandstone and Mudstone, light grey, amorphous blocky, locally very silty. Good traces of coal and pyrite	-924	993					
	Wickersley Rock	Sandstone: medium, becoming finer and silty with depth	-935	1009					
	Wickersley Rock Base	Mudstone: light grey, amorphous blocky, locally very silty. Good traces of coal and pyrite	-952	1036					
	Ackworth Rock	Sandstone: medium, loose, moderate sorting, gas shows	-978	1082				OBM	Cemented
	Ackworth Rock Base	Sandstone: medium, becoming finer and silty with depth	-1009	1144		8.5"	7"		
	Top MB	Shale: marine Band	-1012	1150		6"	5"		
	Shafton Coal	Coal	-1032	1195		4.125	2.875"		
	Top Mexborough Sandstone (Seismic Pick)	Sandstone: Clear to translucent, medium, loose, subangular to subrounded, well sorted, good spericity,, moderate fluorescence, golden cut.	-1042	1220		4.125"	2.875"	WBM or OBM	Open Hole / Slotted Liner
	TD		**-1052**	**1815**					

Note: All formations and casing setting depths +/- 150 meters.

Not To Scale

Chemical Inventory - Glentworth 12 and 12z									
Product Name	**Purpose**	**UN No**	**Class**	**Hazardous Chemical Composition (SDS Section 3)**	**Weight %**	**CAS Number**	**Hazard Statements**	**PBT/vPvB Assessment**	**Comments**
17.5" Hole Section - Water Based Mud - Primary									
Caustic Soda	pH Control	1823	8	Sodium Hydroxide	60-100	1310-73-2	H290 H314	Not Classified	
MI Gel	Viscosifier	-	-	Crystalline Silica (impurity)	<10	14808-60-7	Not Classified	Not Classified	
MI Wate	Weighting Agent	-	-	Barite	60-100	13462-86-7	Not Classified	Not Classified	
				Crystalline Silica (impurity)	5-10	14808-60-7			
Soda Ash	Calcium Reducer	-	-	Sodium Carbonate	60-100	497-19-8	H319	Not Classified	
17.5" Hole Section - Water Based Mud - Contingency									
Duo-Vis	Viscosifier	-	-	Glyoxal	<1	107-22-2	EUH208	Not Classified	Glyoxal hazardous under JAGDAG. Cannot be used within hole section
Flowzan	Viscosifier	-	-	No Hazardous Components	-	-	Not Classified	Not Classified	Requires supplier disclosure if not already assessed on record.
Kwik Seal NS Regular	Loss Circulation Material	-	-	No Hazardous Components	-	-	Not Classified	Not Classified	Requires supplier disclosure if not already assessed on record.
MI Pac (All Grades)	Fluid Loss Additive	-	-	Polyanionic Cellulose	60-100	Proprietary	Not Classified	Not Classified	Requires supplier disclosure if not already assessed on record.
MI-X II	Loss Circulation Material	-	-	Cellulose Fibre	60-100	Proprietary	Not Classified	Not Classified	Requires supplier disclosure if not already assessed on record.
				Crystalline Silica (impurity)	<2	14808-60-7			
Safe Carb (All Grades)	Loss Circulation Material	-	-	Calcium carbonate	60-100	471-34-1	Not Classified	Not Classified	
				Crystalline Silica (impurity)	<1	14808-60-7			
Sodium Bicarbonate	pH Reducer	-	-	Sodium Bicarbonate	60-100	144-55-8	Not Classified	Not Classified	
Sugar	Retarder	-	-	Sucrose	60-100	57-50-1	Not Classified	Not Classified	
				Crystalline Silica (impurity)	<1	14808-60-7			
12.25" Hole Section - Water Based Mud - Primary									
Caustic Soda	pH Control	1823	8	Sodium Hydroxide	60-100	1310-73-2	H290 H314	Not Classified	
Defoam + NS	Defoamer	-	-	No Hazardous Components	60-100	-	Not Classified	Not Classified	Requires supplier disclosure if not already assessed on record.
Drilling Starch	Fluid Loss Additive	-	-	No Hazardous Components	60-100	Proprietary	Not Classified	Not Classified	Requires supplier disclosure if not already assessed on record.
Duo-Vis	Viscosifier	-	-	Glyoxal	<1	107-22-2	EUH208	Not Classified	
MB-5111	Biocide	-	-	(Ethylenedioxy)dimethanol	60-100	3586-55-8	H302 H315 H318	Not Classified	
MI Pac (All Grades)	Fluid Loss Additive	-	-	Polyanionic Cellulose	60-100	Proprietary	Not Classified	Not Classified	Requires supplier disclosure if not already assessed on record.
MI Wate	Weighting Agent	-	-	Barite	60-100	13462-86-7	Not Classified	Not Classified	
				Crystalline Silica (impurity)	5-10	14808-60-7			
Nuosept 78	Biocide	2810	6.1	2,2',2''-(hexahydro-1,3,5-triazine-1,3,5-triyl) triethanol	78	4719-04-4	H302 H317 H319 H330 H372	Toxic	
Potassium Chloride Brine	Shale Inhibition	-	-	Potassium Chloride	5-30	7447-40-7	Not Classified	Not Classified	
Potassium Chloride	Shale Inhibition	-	-	Potassium Chloride	60-100	7447-40-7	Not Classified	Not Classified	
Soda Ash	Calcium Reducer	-	-	Sodium Carbonate	60-100	497-19-8	H319	Not Classified	
12.25" Hole Section - Water Based Mud - Contingency									
Citric Acid	Stuck Pipe	-	-	2-hydroxypropane-1,2,3-tricarboxylic acid	60-100	5949-29-1	H319	Not Classified	
Dynared (All Grades)	Loss Circulation Material	-	-	No Hazardous Components	-	-	Not Classified	Not Classified	Requires supplier disclosure if not already assessed on record.
Flowzan	Viscosifier	-	-	No Hazardous Components	-	-	Not Classified	Not Classified	Requires supplier disclosure if not already assessed on record.
Form-A-Blok	Loss Circulation Material	-	-	Wollastonite (Ca(SiO3))	30-60	13983-17-0	Not Classified	Not Classified	
				Cellulose	10-30	9004-34-6			
				Kaolin	5-10	1332-58-7			
				Polyvinyl alcohol	5-10	9002-89-5			
Glydril MC	Clay Inhibition	-	-	Poly(oxy-1,2-ethanediyl), a-butyl-w-hydroxy-	60-100	9004-77-7	H318	Not Classified	
G Seal Plus (All Grades)	Loss Circulation Material	-	-	Graphite	5-10	7782-42-5	Not Classified	Not Classified	
				Crystalline Silica (impurity)	<1	14808-60-7			
Kwik Seal NS Regular	Loss Circulation Material	-	-	No Hazardous Components	-	-	Not Classified	Not Classified	Requires supplier disclosure if not already assessed on record.
Lube-776	Lubricant	-	-	Castor oil, sulfated, sodium salt	10-30	68187-76-8	H318	Not Classified	
MI Gel	Viscosifier	-	-	Crystalline Silica (impurity)	<10	14808-60-7	Not Classified	Not Classified	
MI-X II	Loss Circulation Material	-	-	Cellulose Fibre	60-100	Proprietary	Not Classified	Not Classified	Requires supplier disclosure if not already assessed on record.
				Crystalline Silica (impurity)	<2	14808-60-7			
Nut Shells (All Grades)	Loss Circulation Material	-	-	Crystalline Silica (impurity)	<1	14808-60-7	Not Classified	Not Classified	
Safe Carb (All Grades)	Loss Circulation Material	-	-	Calcium carbonate	60-100	471-34-1	Not Classified	Not Classified	
				Crystalline Silica (impurity)	<1	14808-60-7			
Safe Scav HSN	H2S Scavenger	2810	6.1	2,2',2''-(Hexahydro-1,3,5-triazin-1,3,5-triyl)triethanol	30-60	4719-04-4	H302 H317 H319 H330 H372	Not Classified	
				2-aminoethanol (Impurity)	<2	141-43-5			
				Formaldehyde (impurity)	<0.1	50-00-0			
SAPP	Stuck Pipe	-	-	Disodium dihydrogen diphosphate	60-100	7758-16-9	H319	Not Classified	
SOBO S Gold 08	Casing - Oil Degreaser	-	-	Tetrapotassium Pyrophosphate (TKPP)	1-5	7320-34-5	H319	Not classified	Biodegradable surfactants, surface use prior to running in hole.
				Alkylpolyglycoside C9-11	1-5	132778-08-6			
				Water	>80	7732-18-5			
Sodium Bicarbonate	pH Reducer	-	-	Sodium Bicarbonate	60-100	144-55-8	Not Classified	Not Classified	
Sugar	Retarder	-	-	Sucrose	60-100	57-50-1	Not Classified	Not Classified	
				Crystalline Silica (impurity)	<1	14808-60-7			
Ultracap	Clay Inhibition	-	-	Hexanedioic acid	1-<10	124-04-9	Not Classified	Not Classified	
Ultrahib	Clay Inhibition	2735	8	Reaction products of propane-1,2-diol, propoxylated by amination of the terminal hydroxyl groups	60-100	9046-10-0	H314	Not Classified	

Chemical Inventory - Glentworth 12 and 12z									
Product Name	**Purpose**	**UN No**	**Class**	**Hazardous Chemical Composition (SDS Section 3)**	**Weight %**	**CAS Number**	**Hazard Statements**	**PBT/vPvB Assessment**	**Comments**
8.5" Hole Section - Oil Based Mud - Primary									
Calcium Chloride	Brine Phase	-	-	Calcium chloride	60-100	10043-52-4	H319	Not Classified	
Calcium Chloride Brine	Brine Phase	-	-	Calcium chloride	30-60	10043-52-4	H319	Not Classified	
Ecotrol-RD	Fluid Loss Additive	-	-	Silica, amorphous	<=2	Proprietary	Not Classified	Not Classified	Requires supplier disclosure if not already assessed on record.
Lime	pH Control	-	-	Calcium hydroxide	60-100	1305-62-0	H315 H318 H335	Not Classified	
MI Wate	Weighting Agent	-	-	Barite	60-100	13462-86-7	Not Classified	Not Classified	
				Crystalline Silica (impurity)	5-10	14808-60-7			
Saraline 185V	Base Fluid	-	-	Alkanes C12-26, branched and linear	>90	90622-53-0	H227 H303 H304 H333 H336	Toxic	
VersaClean CBE	Emulsifier	-	-	Fatty acids, tall-oil, reaction products with diethylenetriamine, maleic anhydride, tetraethylenepentamine and triethylenetetramine	60-100	68990-47-6	H317	Not Classified	
				Hydrocarbons, C11-C14, n-alkanes, isoalkanes, cyclics, < 2% aromatics*	10-30	64742-47-8			
				(2-methoxymethylethoxy)propanol	5-10	34590-94-8			
Versatrol M	Fluid Loss Additive	-	-	No Hazardous Components	-	-	Not Classified	Not Classified	Requires supplier disclosure if not already assessed on record.
VG Supreme	Viscosifier	-	-	Crystalline Silica (impurity)	<3	14808-60-7	Not Classified	Not Classified	
8.5" Hole Section - Oil Based Mud - Contingency									
Citric Acid	Stuck Pipe	-	-	2-hydroxypropane-1,2,3-tricarboxylic acid	60-100	5949-29-1	H319	Not Classified	
Dynared (All Grades)	Loss Circulation Material	-	-	No Hazardous Components	-	-	Not Classified	Not Classified	Requires supplier disclosure if not already assessed on record.
EDC 95-11	Base Oil	-	-	Hydrocarbons, C15-C20, n-alkanes, isoalkanes, cyclics, <0.03% aromatics	100	64742-46-7	H304	Not Classified	
Form-A-Blok	Loss Circulation Material	-	-	Wollastonite (Ca(SiO3))	30-60	13983-17-0	Not Classified	Not Classified	
				Cellulose	10-30	9004-34-6			
				Kaolin	5-10	1332-58-7			
				Polyvinyl alcohol	5-10	9002-89-5			
G Seal Plus (All Grades)	Loss Circulation Material	-	-	Graphite	5-10	7782-42-5	Not Classified	Not Classified	
				Crystalline Silica (impurity)	<1	14808-60-7			
Kwik Seal NS Regular	Loss Circulation Material	-	-	No Hazardous Components	-	-	Not Classified	Not Classified	Requires supplier disclosure if not already assessed on record.
MI-X II	Loss Circulation Material	-	-	Cellulose Fibre	60-100	Proprietary	Not Classified	Not Classified	Requires supplier disclosure if not already assessed on record.
				Crystalline Silica (impurity)	<2	14808-60-7			
Nut Shells (All Grades)	Loss Circulation Material	-	-	Crystalline Silica (impurity)	<1	14808-60-7	Not Classified	Not Classified	
Safe Carb (All Grades)	Loss Circulation Material	-	-	Calcium carbonate	60-100	471-34-1	Not Classified	Not Classified	
				Crystalline Silica (impurity)	<1	14808-60-7			
Safe Scav HSN	H2S Scavenger	2810	6.1	2,2',2''-(Hexahydro-1,3,5-triazin-1,3,5-triyl)triethanol	30-60	4719-04-4	H302 H317 H319 H330 H372	Not Classified	
				2-aminoethanol (Impurity)	<2	141-43-5			
				Formaldehyde (impurity)	<0.1	50-00-0			
Safe Surf EU	Detergent	-	-	2-butoxyethanol	30-60	111-76-2	H302 H312 H315 H318 H332	Not Classified	
				D-Glucopyranose, oligomeric, C8-10 glycosides	5-10	68515-73-1			
SAPP	Stuck Pipe	-	-	Disodium dihydrogen diphosphate	60-100	7758-16-9	H319	Not Classified	
SOBO S Gold	Casing - Oil Degreaser	-	-	Tetrapotassium Pyrophosphate (TKPP)	1-5	7320-34-5	H319	Not Classified	Biodegradable surfactants, surface use prior to running in hole.
				Alkylpolyglycoside C9-11	1-5	132778-08-6			
				Water	>80	7732-18-5			
Soltex E	Clay Stability			Asphalt, Sulfonated, Sodium Salt	100	68201-32-1	Not Classified	Not Classified	
Sugar	Retarder	-	-	Sucrose	60-100	57-50-1	Not Classified	Not Classified	
				Crystalline Silica (impurity)	<1	14808-60-7			
Versagel HT	Viscosifier	-	-	No Hazardous Components	-	-	Not Classified	Not Classified	Requires supplier disclosure if not already assessed on record.
Versatwet	Oil Wetting Agent	-	-	Tall oil, polymerized, oxidized	60-100	68815-17-8	H315 H317	Not Classified	
WT-1040	Stuck Pipe	-	-	2-Butoxyethanol	60-100	111-76-2	H302 H312 H315 H319 H332	Not Classified	
8.5" Hole Section - Oil Based Mud - Clean Up									
Duo-Vis	Viscosifier	-	-	Glyoxal	<1	107-22-2	EUH208	Not Classified	
Safe Surf EU	Detergent	-	-	2-butoxyethanol	30-60	111-76-2	H302 H312 H315 H318 H332	Not Classified	
				D-Glucopyranose, oligomeric, C8-10 glycosides	5-10	68515-73-1			
Saraline 185V	Base Fluid	-	-	Alkanes C12-26, branched and linear	>90	90622-53-0	H227 H303 H304 H333 H336	Toxic	
8.5" Hole Section - Oil Based Mud - Clean Up Contingency									
EDC 95-11	Base Oil	-	-	Hydrocarbons, C15-C20, n-alkanes, isoalkanes, cyclics, <0.03% aromatics	100	64742-46-7	H304	Not Classified	
Flowzan	Viscosifier	-	-	No Hazardous Components	-	-	Not Classified	Not Classified	Requires supplier disclosure if not already assessed on record.
SOBO S Gold	Casing - Oil Degreaser	-	-	Tetrapotassium Pyrophosphate (TKPP)	1-5	7320-34-5	H319	Not Classified	Biodegradable surfactants, surface use prior to running in hole.
				Alkylpolyglycoside C9-11	1-5	132778-08-6			
				Water	>80	7732-18-5			

Chemical Inventory - Glentworth 12 and 12z									
Product Name	**Purpose**	**UN No**	**Class**	**Hazardous Chemical Composition (SDS Section 3)**	**Weight %**	**CAS Number**	**Hazard Statements**	**PBT/vPvB Assessment**	**Comments**
6" / 4.125" Hole Section - Water Based Mud - Primary (Option A)									
Caustic Soda	pH Control	1823	8	Sodium Hydroxide	60-100	1310-73-2	H290 H314	Not Classified	
Defoam + NS	Defoamer	-	-	No Hazardous Components	60-100	-	Not Classified	Not Classified	Requires supplier disclosure if not already assessed on record.
Drilling Starch	Fluid Loss Additive	-	-	No Hazardous Components	60-100	Proprietary	Not Classified	Not Classified	Requires supplier disclosure if not already assessed on record.
Duo-Vis	Viscosifier	-	-	Glyoxal	<1	107-22-2	EUH208	Not Classified	
Flo-Trol	Filtration Control	-	-	No Hazardous Components	-	-	Not Classified	Not Classified	Requires supplier disclosure if not already assessed on record.
Flo-Vis Plus	Viscosifier	-	-	Glyoxal	<1	107-22-2	EUH208	Not Classified	
Magnisium Oxide	pH Buffer	-	-	Magnisium Oxide	60-100	1309-48-4	Not Classified	Not Classified	
MB-5111	Biocide	-	-	(Ethylenedioxy)dimethanol	60-100	3586-55-8	H302 H315 H318	Not Classified	
MI Pac (All Grades)	Fluid Loss Additive	-	-	Polyanionic Cellulose	60-100	Proprietary	Not Classified	Not Classified	Requires supplier disclosure if not already assessed on record.
MI Wate	Weighting Agent	-	-	Barite	60-100	13462-86-7	Not Classified	Not Classified	
				Crystalline Silica (impurity)	5-10	14808-60-7			
Nuosept 78	Biocide	2810	6.1	2,2',2"-(hexahydro-1,3,5-triazine-1,3,5-triyl) triethanol	78	4719-04-4	H302 H317 H319 H330 H372	Toxic	
Potassium Chloride	Shale Inhibition	-	-	Potassium Chloride	60-100	7447-40-7	Not Classified	Not Classified	
Potassium Chloride Brine	Shale Inhibition	-	-	Potassium Chloride	5-30	7447-40-7	Not Classified	Not Classified	
PVD Salt	Weighting Agent	-	-	Sodium Chloride	60-100	7647-14-5	Not Classified	Not Classified	
Safe Carb (All Grades)	Loss Circulation Material	-	-	Calcium carbonate	60-100	471-34-1	Not Classified	Not Classified	
				Crystalline Silica (impurity)	<1	14808-60-7			
Soda Ash	Calcium Reducer	-	-	Sodium Carbonate	60-100	497-19-8	H319	Not Classified	
Sodium Chloride Brine	Weighting Agent			Sodium Chloride	30-60	7647-14-5	Not Classified	Not Classified	
Sodium Chloride (Salt)	Weighting Agent			Sodium Chloride	60-100	7647-14-5	Not Classified	Not Classified	
6" / 4.125" Hole Section - Water Based Mud - Contingency (Option A)									
Citric Acid	Stuck Pipe	-	-	2-hydroxypropane-1,2,3-tricarboxylic acid	60-100	5949-29-1	H319	Not Classified	
Dynared (All Grades)	Loss Circulation Material	-	-	No Hazardous Components	-	-	Not Classified	Not Classified	Requires supplier disclosure if not already assessed on record.
Flowzan	Viscosifier	-	-	No Hazardous Components	-	-	Not Classified	Not Classified	Requires supplier disclosure if not already assessed on record.
Form-A-Blok	Loss Circulation Material	-	-	Wollastonite (Ca(SiO3))	30-60	13983-17-0	Not Classified	Not Classified	
				Cellulose	10-30	9004-34-6			
				Kaolin	5-10	1332-58-7			
				Polyvinyl alcohol	5-10	9002-89-5			
Glass Bubbles HGS Series	Weight Reducer	-	-	Glass, oxide, chemicals	97-100	65997-17-3	Not Classified	Not Classified	
				Silicon Dioxide	0-3	7631-86-9			
Glass Bubbles iM16K	Weight Reducer	-	-	Glass, oxide, chemicals	97-100	65997-17-3	Not Classified	Not Classified	
				Silicon Dioxide	0-3	7631-86-9			
Glass Bubbles Type VS	Weight Reducer	-	-	Glass, oxide, chemicals	97-100	65997-17-3	Not Classified	Not Classified	
				Silicon Dioxide	0-3	7631-86-9			
Glass Bubbles Types K and S	Weight Reducer	-	-	Glass, oxide, chemicals	97-100	65997-17-3	Not Classified	Not Classified	
				Silicon Dioxide	0-3	7631-86-9			
Glydril MC	Clay Inhibition	-	-	Poly(oxy-1,2-ethanediyl), a-butyl-w-hydroxy-	60-100	9004-77-7	H318	Not Classified	
G Seal Plus (All Grades)	Loss Circulation Material	-	-	Graphite	5-10	7782-42-5	Not Classified	Not Classified	
				Crystalline Silica (impurity)	<1	14808-60-7			
Kwik Seal NS Regular	Loss Circulation Material	-	-	No Hazardous Components	-	-	Not Classified	Not Classified	Requires supplier disclosure if not already assessed on record.
Lube-776	Lubricant	-	-	Castor oil, sulfated, sodium salt	10-30	68187-76-8	H318	Not Classified	
MI-X II	Loss Circulation Material	-	-	Cellulose Fibre	60-100	Proprietary	Not Classified	Not Classified	Requires supplier disclosure if not already assessed on record.
				Crystalline Silica (impurity)	<2	14808-60-7			
Nut Shells (All Grades)	Loss Circulation Material	-	-	Crystalline Silica (impurity)	<1	14808-60-7	Not Classified	Not Classified	
Safe Scav HSN	H2S Scavenger	2810	6.1	2,2',2''-(Hexahydro-1,3,5-triazin-1,3,5-triyl)triethanol	30-60	4719-04-4	H302 H317 H319 H330 H372	Not Classified	
				2-aminoethanol (Impurity)	<2	141-43-5			
				Formaldehyde (impurity)	<0.1	50-00-0			
SAPP	Stuck Pipe	-	-	Disodium dihydrogen diphosphate	60-100	7758-16-9	H319	Not Classified	
SOBO S Gold	Casing - Oil Degreaser	-	-	Tetrapotassium Pyrophosphate (TKPP)	1-5	7320-34-5	H319	Not classified	Biodegradable surfactants, surface use prior to running in hole.
				Alkylpolyglycoside C9-11	1-5	132778-08-6			
				Water	>80	7732-18-5			
Sodium Bicarbonate	pH Reducer	-	-	Sodium Bicarbonate	60-100	144-55-8	Not Classified	Not Classified	
Sugar	Retarder	-	-	Sucrose	60-100	57-50-1	Not Classified	Not Classified	
				Crystalline Silica (impurity)	<1	14808-60-7			
Ultracap	Clay Inhibition	-	-	Hexanedioic acid	1-<10	124-04-9	Not Classified	Not Classified	
Ultrahib	Clay Inhibition	2735	8	Reaction products of propane-1,2-diol, propoxylated by amination of the terminal hydroxyl groups	60-100	9046-10-0	H314	Not Classified	

Chemical Inventory - Glentworth 12 and 12z									
Product Name	**Purpose**	**UN No**	**Class**	**Hazardous Chemical Composition (SDS Section 3)**	**Weight %**	**CAS Number**	**Hazard Statements**	**PBT/vPvB Assessment**	**Comments**
8.5" / 6" / 4.125" Hole Section - Oil Based Mud - Primary (Option B)									
Calcium Chloride	Brine Phase	-	-	Calcium chloride	60-100	10043-52-4	H319	Not Classified	
Calcium Chloride Brine	Brine Phase	-	-	Calcium chloride	30-60	10043-52-4	H319	Not Classified	
Ecotrol-RD	Fluid Loss Additive	-	-	Silica, amorphous	<=2	Proprietary	Not Classified	Not Classified	Requires supplier disclosure if not already assessed on record.
Lime	pH Control	-	-	Calcium hydroxide	60-100	1305-62-0	H315 H318 H335	Not Classified	
MI Wate	Weighting Agent	-	-	Barite	60-100	13462-86-7	Not Classified	Not Classified	
				Crystalline Silica (impurity)	5-10	14808-60-7			
Saraline 185V	Base Fluid	-	-	Alkanes C12-26, branched and linear	>90	90622-53-0	H227 H303 H304 H333 H336	Toxic	
VersaClean CBE	Emulsifier	-	-	Fatty acids, tall-oil, reaction products with diethylenetriamine, maleic anhydride, tetraethylenepentamine and triethylenetetramine	60-100	68990-47-6	H317	Not Classified	
				Hydrocarbons, C11-C14, n-alkanes, isoalkanes, cyclics, < 2% aromatics*	10-30	64742-47-8			
				(2-methoxymethylethoxy)propanol	5-10	34590-94-8			
Versatrol M	Fluid Loss Additive	-	-	No Hazardous Components	-	-	Not Classified	Not Classified	Requires supplier disclosure if not already assessed on record.
VG Supreme	Viscosifier	-	-	Crystalline Silica (impurity)	<3	14808-60-7	Not Classified	Not Classified	
8.5" / 6" / 4.125" Hole Section - Oil Based Mud - Contingency (Option B)									
Citric Acid	Stuck Pipe	-	-	2-hydroxypropane-1,2,3-tricarboxylic acid	60-100	5949-29-1	H319	Not Classified	
Dynared (All Grades)	Loss Circulation Material	-	-	No Hazardous Components	-	-	Not Classified	Not Classified	Requires supplier disclosure if not already assessed on record.
EDC 95-11	Base Oil	-	-	Hydrocarbons, C15-C20, n-alkanes, isoalkanes, cyclics, <0.03% aromatics	100	64742-46-7	H304	Not Classified	
Form-A-Blok	Loss Circulation Material	-	-	Wollastonite (Ca(SiO3))	30-60	13983-17-0	Not Classified	Not Classified	
				Cellulose	10-30	9004-34-6			
				Kaolin	5-10	1332-58-7			
				Polyvinyl alcohol	5-10	9002-89-5			
G Seal Plus (All Grades)	Loss Circulation Material	-	-	Graphite	5-10	7782-42-5	Not Classified	Not Classified	
				Crystalline Silica (impurity)	<1	14808-60-7			
Kwik Seal NS Regular	Loss Circulation Material	-	-	No Hazardous Components	-	-	Not Classified	Not Classified	Requires supplier disclosure if not already assessed on record.
MI-X II	Loss Circulation Material	-	-	Cellulose Fibre	60-100	Proprietary	Not Classified	Not Classified	Requires supplier disclosure if not already assessed on record.
				Crystalline Silica (impurity)	<2	14808-60-7			
Nut Shells (All Grades)	Loss Circulation Material	-	-	Crystalline Silica (impurity)	<1	14808-60-7	Not Classified	Not Classified	
Safe Carb (All Grades)	Loss Circulation Material	-	-	Calcium carbonate	60-100	471-34-1	Not Classified	Not Classified	
				Crystalline Silica (impurity)	<1	14808-60-7			
Safe Scav HSN	H2S Scavenger	2810	6.1	2,2',2''-(Hexahydro-1,3,5-triazin-1,3,5-triyl)triethanol	30-60	4719-04-4	H302 H317 H319 H330 H372	Not Classified	
				2-aminoethanol (Impurity)	<2	141-43-5			
				Formaldehyde (impurity)	<0.1	50-00-0			
Safe Surf EU	Detergent	-	-	2-butoxyethanol	30-60	111-76-2	H302 H312 H315 H318 H332	Not Classified	
				D-Glucopyranose, oligomeric, C8-10 glycosides	5-10	68515-73-1			
SAPP	Stuck Pipe	-	-	Disodium dihydrogen diphosphate	60-100	7758-16-9	H319	Not Classified	
SOBO S Gold	Casing - Oil Degreaser	-	-	Tetrapotassium Pyrophosphate (TKPP)	1-5	7320-34-5	H319	Not Classified	Biodegradable surfactants, surface use prior to running in hole.
				Alkylpolyglycoside C9-11	1-5	132778-08-6			
				Water	>80	7732-18-5			
Soltex E	Clay Stability			Asphalt, Sulfonated, Sodium Salt	100	68201-32-1	Not Classified	Not Classified	
Sugar	Retarder	-	-	Sucrose	60-100	57-50-1	Not Classified	Not Classified	
				Crystalline Silica (impurity)	<1	14808-60-7			
Versagel HT	Viscosifier	-	-	No Hazardous Components	-	-	Not Classified	Not Classified	Requires supplier disclosure if not already assessed on record.
Versatwet	Oil Wetting Agent	-	-	Tall oil, polymerized, oxidized	60-100	68815-17-8	H315 H317	Not Classified	
WT-1040	Stuck Pipe	-	-	2-Butoxyethanol	60-100	111-76-2	H302 H312 H315 H319 H332	Not Classified	
8.5" / 6" / 4.125" Hole Section - Oil Based Mud - Clean Up									
Duo-Vis	Viscosifier	-	-	Glyoxal	<1	107-22-2	EUH208	Not Classified	
Safe Surf EU	Detergent	-	-	2-butoxyethanol	30-60	111-76-2	H302 H312 H315 H318 H332	Not Classified	
				D-Glucopyranose, oligomeric, C8-10 glycosides	5-10	68515-73-1			
Saraline 185V	Base Fluid	-	-	Alkanes C12-26, branched and linear	>90	90622-53-0	H227 H303 H304 H333 H336	Toxic	
8.5" / 6" / 4.125" Hole Section - Oil Based Mud - Clean Up Contingency									
Drispac (all grades)									
EDC 95-11	Base Oil	-	-	Hydrocarbons, C15-C20, n-alkanes, isoalkanes, cyclics, <0.03% aromatics	100	64742-46-7	H304	Not Classified	
Flowzan	Viscosifier	-	-	No Hazardous Components	-	-	Not Classified	Not Classified	Requires supplier disclosure if not already assessed on record.
SOBO S Gold	Casing - Oil Degreaser	-	-	Tetrapotassium Pyrophosphate (TKPP)	1-5	7320-34-5	H319	Not Classified	Biodegradable surfactants, surface use prior to running in hole.
				Alkylpolyglycoside C9-11	1-5	132778-08-6			
				Water	>80	7732-18-5			
Versa-Out									This is a system (mixture of several products) the make up is prepriatory. Requires
Versamod									
Versapro RDF									This is a system (mixture of several products) the make up is prepriatory. Requires

Chemical Inventory - Glentworth 12 and 12z									
Product Name	**Purpose**	**UN No**	**Class**	**Hazardous Chemical Composition (SDS Section 3)**	**Weight %**	**CAS Number**	**Hazard Statements**	**PBT/vPvB Assessment**	**Comments**
Completions - Cased Hole									
Duo-Vis	Viscosifier	-	-	Glyoxal	<1	107-22-2	EUH208	Not Classified	
Flowzan	Viscosifier	-	-	No Hazardous Components	-	-	Not Classified	Not Classified	Requires supplier disclosure if not already assessed on record.
Nuosept 78	Biocide	2810	6.1	2,2',2''-(hexahydro-1,3,5-triazine-1,3,5-triyl) triethanol	78	4719-04-4	H302 H317 H319 H330 H372	Toxic	
Potassium Chloride Brine	Shale Inhibition	-	-	Potassium Chloride	5-30	7447-40-7	Not Classified	Not Classified	
Potassium Chloride	Shale Inhibition	-	-	Potassium Chloride	60-100	7447-40-7	Not Classified	Not Classified	
Safe Cor	Corrosion Inhibitor	-	-	Ethanol, 2,2-oxybis-, reaction products with ammonia, morpholine derivatives	30-60	68909-77-3	H319 H412	Not Classified	
Safe Scav HSN	H2S Scavenger	2810	6.1	2,2',2''-(Hexahydro-1,3,5-triazin-1,3,5-triyl)triethanol	30-60	4719-04-4	H302 H317 H319 H330 H372	Not Classified	
				2-aminoethanol (Impurity)	<2	141-43-5			
				Formaldehyde (impurity)	<0.1	50-00-0			
Safe Scav NA	Oxygen Scavenger	-	-	Water	30-60	7732-18-5	H319 EUH301	Not Classified	
				Ammonium Hydrogensulfite	30-60	10192-30-0			
				Sulfur Dioxide	<1	7446-09-5			
Safe Surf EU	Detergent	-	-	2-butoxyethanol	30-60	111-76-2	H302 H312 H315 H318 H332	Not Classified	
				D-Glucopyranose, oligomeric, C8-10 glycosides	5-10	68515-73-1			
SOBO S Gold	Casing - Oil Degreaser	-	-	Tetrapotassium Pyrophosphate (TKPP)	1-5	7320-34-5	H319	Not classified	Biodegradable surfactants, surface use prior to running in hole.
				Alkylpolyglycoside C9-11	1-5	132778-08-6			
				Water	>80	7732-18-5			
SI-414N	Scale Inhibitor			2-Butenedioic acid (Z)-, polymer with sodium 2-propene-1-sulfonate	10-30	68715-83-3	H314	Not Classified	
				Sodium Hydroxide	5-<10	1310-73-2			
				Sodium Chloride (impurity)	1-5	7647-14-5			
				Sodium Sulfate (Impurity)	1-5	7757-82-6			
Breaker Options									
Breakdown Breaker	Breaker System	-	-	Dipotassium ethylenediaminetetraacetate	10-30	2001-94-7	H315 H319	Not Classified	
				2-butoxyethanol	1-5	111-76-2			
				Potassium hydroxide	>=0.5<2	1310-58-3			
D-Solver Extra	Chealant	-	-	N-(2-Hydroxyethyl)ethylenediaminetriacetic acid	10-30	150-39-0	H315 H319	Not Classified	
				Trisodium [{2-[bis(carboxylatomethyl)amino]ethyl}(2-hydroxyethyl)amino]acetate	10-30	139-89-9			
				2,2'',2''-nitrilotriacetic acid	<5	139-13-9			
Flowbak	Well Stimulation	-	-	Water	60-100	7732-18-5	H317 H318	Not Classified	
				D-Glucopyranose, oligomeric, C8-10 glycosides	30-60	68515-73-1			
				Citrus Extract	1-5	68647-72-3			
Potassium Chloride Brine	Shale Inhibition	-	-	Potassium Chloride	5-30	7447-40-7	Not Classified	Not Classified	
SD-4092	Chealant	-	-	Glycine, N,N-1,2-ethanediylbis[N-(carboxymethyl)-, tetrapotassium salt	10-30	5964-35-2	H315 H319	Not Classified	
Sodium Chloride Brine	Weighting Agent			Sodium Chloride	30-60	7647-14-5	Not Classified	Not Classified	
Wellzyme III	Enzyme	-	-	Carbohydrate	10-30	Proprietary	EUH208	Not Classified	Requires supplier disclosure if not already assessed on record.
				Amylase, .alpha.-	<1	9000-90-2			
Cementing									
AbandaCem LT	Non-Shrinking Cement	-	-	Portland Cement	60-100	65997-15-1	H315 H317 H318 H335 H351 H373	Not Classified	
				Crystalline Silica, Quartz	1-5	14808-60-7			
Barite	Weight Additive	-	-	Crystalline Silica, Quartz	1-5	14808-60-7	H351 H373	Not Classified	
Bentonite	Extender	-	-	Crystalline Silica, Quartz	1-5	14808-60-7	H351 H373	Not Classified	
				Crystalline Silica, Cristobalite	0.1-1	14464-46-1			
				Crystalline Silica, Tridymite	0.1-1	15468-32-3			
BridgeMaker II LCM	Fluid Loss Additive	-	-	No Hazardous Components	60-100	-	-	Not Classified	Requires supplier disclosure if not already assessed on record.
Cement Class G Dyckerhoff	Base Cement	-	-	Portland cement	60-100	65997-15-1	H315 H317 H318 H335 H351 H373	Not Classified	
				Crystalline Silica, Quartz	1-5	14808-60-7			
CFR-8L	Cement Dispersant	-	-	No Hazardous Components	60-100	-	-	Not Classified	Requires supplier disclosure if not already assessed on record.
Expandacem LT NS	Non-Shrinking Cement	-	-	Ethylene Glycol	<0.1	107-21-1	H315 H317 H318 H335 H351 H373	Not Classified	
				Portland Cement	60-100	65997-15-1			
				Acetic Acid	<0.1	64-19-7			
				Crystalline Silica, Quartz	1-5	14808-60-7			
Halad 300L NS	Fluid Loss Additive	-	-	Oxazlidine	0.1-1	Proprietary	H350	Not Classified	
HR-4L	Retarder	-	-	No Hazardous Components	60-100	-	-	Not Classified	Requires supplier disclosure if not already assessed on record.
Musol Solvent	Solvent	-	-	Ethylene glycol monobutyl ether	60-100	111-76-2	H302 H312 H315 H319 H332	Not Classified	
NF-6	Defoamer	-	-	No Hazardous Components	60-100	-	-	Not Classified	Requires supplier disclosure if not already assessed on record.
SA-1015	Suspending Agent	-	-	No Hazardous Components	60-100	-	-	Not Classified	Requires supplier disclosure if not already assessed on record.
SEM-1205	Surfactant	-	-	Fatty alcohol C8-10, ethoxylated, sulfated, mono-isopropanolamine salt	60-100	1812871-14-9	H315 H318 H412	Not Classified	
Silicalite Liquid	Extender Stabiliser	-	-	No Hazardous Components	60-100	-		Not Classified	Requires supplier disclosure if not already assessed on record.
Tuned Spacer E+	Cement Spacer	-	-	Crystalline Silica, Quartz	1-5	14808-60-7	H351 H373	Not Classified	
WellLife 734	Cement Enhancer	-	-	No Hazardous Components	60-100	-		Not Classified	Requires supplier disclosure if not already assessed on record.
Acidisation									
Hydrochloric Acid	Acidisation	1789	8	Hydrochloric Acid	15	7647-01-0	H290 H315 H319 H335	Not Classified	