WASTE MANAGEMENT PLAN

RE-EPRA-WNB-WMP-005

Revision 6

January 2023

WNB Permit Variation

APPROVAL LIST

	Title	Name	Signature
Prepared By	HSE & Permit Advisor	Sean Smart	
Reviewed By	Operations Engineer	Caroline Foster	
Approved By	Country Manager	Tom Selkirk	

REVISION LIST

Revision	Date	Description
0	08/09/2015	New Permit Application to the Environment Agency.
1	11/12/2015	Revision following Environment Agency Schedule 5 Response.
2	22/01/2016	Revision following Environment Agency Schedule 5 Response.
3	18/03/2016	Revision following Environment Agency Schedule 5 Response.
4	13/04/2016	Revision following Environment Agency Request for Information.
5	06/03/2020	Variation Permit Application to the Environment Agency.
6	30/01/2023	Minor Variation Permit Application to the Environment Agency

TABLE OF CONTENTS

1. Purpose and Context 5
2. Scope 6
3. Definitions 7
4. Environmental Permitting (England and Wales) Regulations 2016 8
4.1 Current Operational Status 8
5. Objectives of the Waste Management Plan 9
6. Waste Management Arrangements 11
6.1 Waste Definition 11
6.2 Waste Classification 11
6.3 Hierarchy of Waste Management 12
7. Waste Generating Activities 13
7.1 Proposed Activities 13
7.1.1 Drilling Operations 13
7.2 Contingency Sidetracks 15
7.2.1 Lateral Wells 15
7.3 Well Testing 15
7.3.1 Well Clean-up Phase 15
7.3.2 Extended Well Test 16
7.4 Well Completion 17
7.5 Wellbore Clean Up 18
7.6 Acidisation 18
7.6.1 Acid Wash and Squeeze 18
7.6.2 Treatment of Surplus Acid 20
7.6.3 Alkali Wash and Squeeze 20
7.7 Solvent Treatment and Pre-Flush 21
7.8 Well Lifting Techniques 21
7.8.1 Nitrogen Lift 21
7.8.2 Carbon Dioxide Lift 21
7.8.3 Mechanical lift 22
7.9 Drilling of the Second Borehole 23
7.10 Well Abandonment and Partial Well Abandonment 23
7.11 Extractive Waste Management 24
7.12 Treatment of Extractive Waste 38
7.13 Management of Non-Extractive Waste 39
7.14 Treatment of Non-Extractive Waste 39
7.15 Management of Naturally Occurring Radioactive Material 39
8. Risk Posed to the Environment and Human Health 40
9. Measures to Minimise Environmental Impact 41
9.1 Chemicals used at Surface 41
10. Wellsite Management 42
10.1 Foul Water and Sewage 42
10.2 Releases to Groundwater 42
10.3 Releases to Air 43
10.4 Noise 43
10.5 Release of Odorous Emissions 43
10.6 Natural Gas or Oil 43
10.7 Security 43

10.8 Complaints 43
10.9 Containment within the Wellbore 44
10.10 Fire Response 44
10.11 Incident Reporting and Investigation 44
11. Alterations to the Plan 45
12. Plan for Closure 46
12.1 Well Abandonment 46
12.2 Wellsite Restoration 46
References 47
Appendix 1 - Regulated Facility Boundary Plan 49
Appendix 2 - Chemical Inventory and Wellbore Schematic 51

Figure 1: Waste Hierarchy 12

Table 1: Definitions 7
Table 2: List of Activities Currently Permitted 8
Table 3: Indicative Well Design 14
Table 4: Waste Clays and Sand 24
Table 5: Water Based Rock Cuttings 25
Table 6: Fresh Water Drilling Muds and Waste 26
Table 7: Salt Saturated and KCl Rock Cuttings 27
Table 8: Salt Saturated and KCl Rock Cuttings (Lateral Well) 28
Table 9: Chloride Containing Drilling Muds and Waste 29
Table 10: Chloride Containing Drilling Muds and Waste (Lateral Well) 30
Table 11: Oil Based Muds and Waste 31
Table 12: Oil Based Muds and Waste 32
Table 13: Spent Acid 33
Table 14: Spent Alkali 34
Table 15: Well Suspension Brine 35
Table 16: Well Suspension Oil 35
Table 17: Carbon Dioxide 36
Table 18: Nitrogen 36
Table 19: Formation Water 37
Table 20: Natural Gas 38

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 the West Newton B Wellsite. 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 Rathlin Energy (UK) 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.

At the time of writing all activities detailed within this this document have already been consented under EPR2016. The purpose of this revision is to include the extractive wastes associated with the use of oil based mud (OBM).

2. SCOPE

This Waste Management Plan is applicable to the West Newton B 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. DEFINITIONS

":	Imperial Inch
BAT:	Best Available Technique
BSOR1995:	The Borehole Sites and Operations Regulations 1995
Category A:	Has the meaning given within Regulation 2 of EPR2016
DCR1996:	Offshore Installations and Wells (Design & Construction, etc) Regulations 1996
EGMBE:	Ethylene Glycol Monobutyl Ether.
EPR2016:	The Environmental Permitting (England and Wales) Regulations 2016
EWC:	European Waste Catalogue
EWT:	Extended Well Test.
Groundwater Activity:	Has the meaning given within Regulation 2 of EPR2016
HCl:	Hydrochloric Acid.
HDPE:	High Density Polyethylene.
Installation Activity:	Has the meaning given within Regulation 2 of EPR2016
KCl:	Potassium Chloride.
km:	Kilometres.
m:	Metres
m3:	metres cubed / cubic metres.
mg/l:	milligrams per litre.
Mining Waste Facility:	Has the meaning given within Regulation 2 of EPR2016
Mining Waste Operation:	Has the meaning given within Regulation 2 of EPR2016
mm:	millimetres.
mmscfd:	Million Standard Cubic Feet Per Day.
MWD:	Mining Waste Directive
NORM:	Naturally Occurring Radioactive Material
OBM:	Oil Based Mud.
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
Radioactive Substances Activity:	Has the meaning given within Regulation 2 of EPR2016.
Regulated Facility:	Has the meaning given within Regulation 8 of EPR2016
TVD:	True Vertical Depth
Water Discharge Activity:	Has the meaning given within Regulation 2 of EPR2016.
WBM:	Water Based Mud.
WCU:	Well Clean Up.
WFD:	Waste Framework Directive
WGMP:	Waste Gas Management Plan.
WNB-1:	West Newton B Well 1.
WNB-2:	West Newton B Well 2.
WR2011:	The Waste (England and Wales) Regulations 2011.

Table 1: Definitions

4. ENVIRONMENTAL PERMITTING (ENGLAND AND WALES) REGULATIONS 2016

The West Newton B Wellsite has historically been the subject of a number of permit applications and variations. Table 2 provides a summary of the 'permitted activities' currently permitted at the wellsite.

Permitted Activities				
Permit	**Ref.**	**Description**	**Activity**	**EPR2016**
EPR/DB3503HL	A1	Non-hazardous mining waste operation.	Mining Waste	Schedule 20
	A2	Waste gas flare incineration in excess of 10 tonnes per day.	Installation	Schedule 1
	A3	Surface water activity.	Water Discharge	Schedule 21
EPR/EB3301MB	-	SR 2015 No.2 Oil Storage Activity.	Installation	Schedule 1
EPR/LB3094DK	A1	Accumulation of radioactive waste on the premises.	Radioactive Substances	Schedule 23
	A2	Disposal of radioactive waste on or from the premises.		

Table 2: List of Activities Currently Permitted

4.1 Current Operational Status

The West Newton B Wellsite is currently inactive pending the commencement of the WNB-2 Well drilling operations.

The site is consented for the management of extractive waste associated with the drilling and subsequent testing and treatment of the WNB-1 and WNB-2 wells under Activity A1 of permit EPR/DB3503HL. The site is not considered a 'mining waste facility' but is considered a 'mining waste operation'.

During the well testing phase it is anticipated that natural gas will be produced at a rate greater than 0.5 mmscfd (circa 10 tonnes) and as such to ensure the safe management of the natural gas (extractive waste) it requires incineration in accordance with Best Available Technique (BAT). Activity A2 of permit EPR/DB3503HL consents this activity as an 'installation activity'.

The West Newton B Wellsite was constructed with mitigation measures built into its design in the form of a high-density polyethylene (HDPE) liner installed across the base of the site to capture any pollution events should they occur as part of site operations. As a result of the HDPE, rain water accumulates within the site and is stored in perimeter containment ditches. Activity A3 of Permit EPR/DB3503HL consents the discharge of the collected rainwater to a nearby watercourse, subject to a sampling and analysis programme. This is considered a 'water discharge activity'.

As the development is exploratory, it is foreseeable that crude oil will be present onsite as a result of the well testing operations. To enable the storage of crude oil at the West Newton B Wellsite a Standard Rules Permit (SR2015 No.2) was obtained. The storage capacity shall not exceed 500 tonnes of crude oil. Environmental permit EPR/EB3301MB consents this activity as a 'installation activity'

As with crude oil, the scenario exists as part of the exploratory operations that formation water will be present onsite as a result of the well testing operations. Formation water has the potential to produce naturally occurring radioactive material (NORM). It is uncertain as to whether NORM will be evident within the formation water, however a Standard Rules 2014. No4. Permit (EPR/LB3094DK) is in place for the accumulation and disposal of radioactive waste from NORM resulting from the production of oil and gas. This is considered a 'radioactive substances activity'.

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 wells are determined by the target formation and geology. The location was also determined by other considerations such as planning constraints, access agreements etc. The design of the well was 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 would 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.

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 West Newton B Wellsite was constructed by excavating top soil and sub soil and stored at the site in a bund acting as both a means of storage and as screening against any visible impact to neighbouring properties. The soils will be laid back from whence it came, restoring the site to its pre-development condition and negating any waste.

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 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.

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.6].
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 4 to 19.

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.7].

6.3 Hierarchy of Waste Management

The 'Operator' and its contractors follow The Waste (England and Wales) Regulations 2011 (WR2011) [REF.8], 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.9]. In addition, the Wellsite Supervisor will also be the person responsible for waste management during wellsite operations.

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.

The quantity of each waste will be recorded as it is removed from site. All records of waste movements (extractive and non-extractive wastes) will be retained by the 'Operator' and made available for inspection by the Environment Agency on request.

7. WASTE GENERATING ACTIVITIES

The following section describes the various extractive wastes arising from the West Newton B development, 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.

7.1 Proposed Activities

The proposed activities will be undertaken in accordance with the Environment Agency Onshore oil and gas sector guidance [REF.10]. 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 Drilling Operations

Having previously drilled and tested the WNB-1 well the 'Operator' is proposing to drill and test a second well known as WNB-2. The second borehole is required to investigate and test the extent of any potential petroleum reservoir encountered during the drilling and testing of the first borehole. The second borehole may also be required to investigate and test a formation that, through interpretation, was predicted but not encountered during the drilling of the first borehole.

The second of the two exploratory boreholes will be drilled and constructed in a similar way to the first. The exact design and construction will be determined using information obtained during the initial drilling operation.

The formation tops are estimated, based on the actual formation tops from the well logs and samples collected during the construction of WNB-1 well. The specific casing depth will not rely on the estimate provided within this application but will be determined by the actual formation top, as determined by sample and log evaluation whilst drilling.

Details of the extractive wastes and associated volumes have been provided within Section 7.11 and full details of the drilling fluids used for the drilling of the well(s) has been provided within the Chemical Inventory.

7.1.1.1 Surface Conductor

A conductor casing will be drilled and cemented in the top section of the wellbore. The top section will be drilled with a geotechnical drilling rig will be typically drilled with air and/or water based mud. Once the hole has been drilled a conductor casing (typically 24" (609mm)) will be run and cemented back to surface.

7.1.1.2 Main Drilling Operation

Once the surface conductor has been set, a conventional oilfield drilling rig will be used to drill the remainder of the exploratory borehole, which is described below in order of sequence in Table 3.

The 'Operator' is required to submit a WR11 method statement notification to the Environment Agency under the Water Resources Act 1991 [REF.12] prior to searching for petroleum minerals for each well. The WR11 notification will be submitted alongside the BSOR submission to the Health and Safety Executive detailing the casing design, depths, drilling fluid and well integrity parameters.

Hole Section	Depths	Fluid	Casing & Integrity Programme
Surface Conductor	To 80m TVD	Air and/or water based fluid	Typically 20" Casing Run and cemented back to surface.
17 ½" Conductor	Below bottom of cretaceous chalk	Bentonite polymer water based fluid	Typically 13 $^{3}/_{8}$" Casing Applied cement as per design to verify barrier integrity and returns to surface.
12 ¼" Surface	Through Sherwood Sandstone	KCl polymer water based mud system	Typically 9 $^{5}/_{8}$" Casing Cement to provide two barriers of integrity. Integrity tested at shoe
8 ½" Intermediate	Below Sherwood Sandstone to Permian	Salt saturated polymer water based mud system and / or OBM	7" Casing Cement to provide two barriers of integrity Integrity tested at shoe. Maybe left uncemented over producing zone.

Table 3: Indicative Well Design

As a contingency, the 'Operator' is considering the use of OBM within the deeper sections of any proposed drilling operation.

7.1.1.3 Logging

Geological logging is undertaken during well construction to determine whether formations encountered during drilling may contain petroleum. The borehole logs assist in determining specific zones, which justify subsequent testing.

7.1.1.4 Perforation

In order to establish communication between the formation(s) being tested and the wellbore the casing must be perforated.

The perforating operation, in particular the use of explosive charges, is regulated by the Police Authority and the Health and Safety Executive. Perforating may be undertaken several times as deemed necessary by the 'Operator'.

Once the casing has been perforated, the fired perforating guns will be recovered at a time determined within the operation.

7.2 Contingency Sidetracks

As a contingency, each well may require a side track in the unlikely event of a sub-surface well constraint. As this is a contingency option it is impossible to predict the size or depth of a side track, however it is standard oilfield practice to bypass the constraint.

The 'Operator' will confirm the estimated quantity of waste in writing to the Environment Agency if a contingency side track is required. The letter will set out updated estimated waste and classification of the waste stream.

7.2.1 Lateral Wells

Each of the exploration wells will consist of an initial vertical borehole or deviated borehole drilled from surface into the subsurface target formation. A decision will be made to kick off and side track followed by a deviation to a horizontal wellbore. It is also possible, for the second well, to drill a horizontal wellbore without an initial vertical wellbore. Details of wells will be written within the WR11 submission.

For the purposes of the waste estimation a lateral well of 2 km has been assessed. Estimated waste quantities for the drilling of the 2 km lateral well have been provided within Section 7.11 of this Waste Management Plan.

7.3 Well Testing

Upon completion, the well(s) will be the subject to subsequent, clean up and testing. The purpose of the well test is to evaluate the commercial viability of the hydrocarbon reservoir, if encountered. The test will be conducted in two parts consisting of a Well Clean Up (WCU) and an Extended Well Test (EWT). During the well test hydrocarbons will be produced. A Waste Gas Management Plan (WGMP) has been developed specifically for the management of waste gas as a result of the well testing phase.

For clarity, the WCU and EWT may be undertaken several times throughout the development. The proposal is to target several isolated zones within the Permian section, each zone has the potential to contain oil, gas or a combination of the two. The reason for multiple well tests is due to the zones within the Permian section being distinct and isolated. Information obtained from a specific zone is highly unlikely to inform the behaviour of the other zones within the target formation due its natural variability.

7.3.1 Well Clean-up Phase

A WCU will involve the use of a well testing spread, typically consisting of at least a choke manifold, surface safety valve, three-phase separator, fluid storage tanks, vent line(s) and a combustion unit(s). The WGMP has determined that the BAT for the management of gas during the WCU phase is the use of a shrouded ground flare. The 'Operator' is proposing to flow gas during the WCU phase at a maximum rate of 2.5 mmscfd.

Ordinarily, natural gas flows to surface unaided however, during a WCU the rate of natural gas produced is likely to fluctuate unpredictably. Any composition data acquired during WCU may not be accurate due to being comingled with wellbore fluids when natural gas is flowed to surface, together with any produced fluids (oil, condensate and flowback water). Once at surface, natural gas and produced fluids will be diverted by temporary pipework to a three-phase separator, which will separate out oil and condensate, flowback water and natural gas. Oil and condensate, which for clarity is not a waste, will be diverted via temporary pipework to dedicated storage tanks onsite for subsequent offsite removal by a licenced haulier to a permitted refinery for sale. Produced water, which is considered a waste, will be diverted via temporary pipework to dedicated storage tanks onsite for subsequent offsite removal by a licenced haulier to an Environment Agency permitted water treatment facility where it is processed, treated and discharged in accordance with the permitted controls of the water treatment facility.

Natural gas separated during the three-phase separation will be diverted by temporary pipework to a flare located onsite for incineration. At the point of incineration, the natural gas is considered a waste.

To aid the initial flow of petroleum, nitrogen may be injected into the wellbore to displace wellbore fluids, reducing its hydrostatic weight. Nitrogen is classified as an inert waste and venting of such is considered a closed loop system, insofar as nitrogen is extracted from the atmosphere and is vented back atmosphere. No nitrogen would remain in the formation. For clarity, carbon dioxide may be utilised to displace wellbore fluids in lieu of Nitrogen.

Coil tubing may first be run into the base of well. Nitrogen will then be pumped through and out of the coil tubing positioned at the base of the well. The nitrogen will then flow to surface displacing (pushing) the fluid in the well back to surface. This process reduces the hydrostatic weight of the fluid column in the wellbore, which in turn allows the gas to flow to surface.

The flare proposed for the West Newton B WCU operations is a single tip shrouded flare with a 'tube type' burner provided by PW Well Services Limited, which is considered by the 'Operator' as BAT based on the justification detailed within the WGMP. The flare is equipped with a propane fuelled permanently lit pilot, which ensures that ignition takes place as soon as natural gas is present and reignites if there is a break in flow.

7.3.2 Extended Well Test

Should the WCU phase indicate that hydrocarbons are present then testing operations will commence with the EWT stage. An EWT 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, produced fluids and hydrocarbons will be diverted by temporary pipework to a three-phase separator, which will separate out oil and condensate, formation water and associated natural gas. Oil and condensate, which for clarity is not a waste, will be diverted via temporary pipework to dedicated storage tanks onsite for subsequent offsite removal by a licenced haulier to a permitted refinery for sale. Formation water, which is considered a waste, will be diverted via temporary pipework to dedicated storage tanks onsite for subsequent offsite removal by a licenced haulier to an Environment Agency permitted water treatment facility where it is processed, treated and discharged in accordance with the permitted controls of the water treatment facility.

Formation water produced during the EWT has the potential to contain low levels of NORM. Samples of formation water will be sent to a laboratory holding the appropriate accreditations for radionuclide analysis by gamma spectrum. Depending on the outcome of radionuclides 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 BAT.

If gas can be flowed at a high flow rate the 'Operator' has identified that the Aereon CEB 4500, which has the capability to incinerate natural gas at a maximum flow rate of 3.5 mmscfd, as the most appropriate incineration unit. At a maximum the rate of which gas shall be flowed will be 7 mmscfd, requiring 2 x CEB 4500 units. It should be noted that the maximum capacity for the CEB units is accurate to within 10%, as such the Air Quality Impact Assessment produced in support of this application has assumed a worst case of 3.85 mmscfd per CEB 4500 unit (7.8 mmscfd total, once an additional 0.1 mmscfd contingency is applied).

If oil is flowed, the associated gas encountered is likely to flow at a lower and variable rate. In the event that oil is produced with variable associated gas flow, the appropriate flare (either PW or Aeron Unit(s)) will be utilised based on WCU data.

Details of these incineration units can be found in the WGMP.

The purpose of an extended well test is to analyse the flow characteristics of a formation, which may contain petroleum, over an extended period. The duration of the extended well test will differ, whether oil or gas is being flow tested.

7.3.2.1 EWT - Oil

Ordinarily, to aid the flow of oil to surface, a pumping mechanism is required. For the purpose of an EWT, the primary approach is to use a pumping mechanism in which oil will be pumped to surface, together with any other produced fluids (condensate and formation water) and associated natural gas.

Due to the unknown composition, quantity and pressure of any natural gas encountered during the West Newton B exploratory operations, the generation of electricity by means of a gas-powered generator and connection to the national grid is not considered feasible for such a temporary operation.

Due to the infrastructure required to suitably store natural gas onsite in a liquid state for subsequent offsite transfer to a liquid natural gas receiving facility it is not feasible for such a temporary operation.

The duration of an EWT associated with oil bearing formations will be determined based on test objectives, formations maximum achievable flow rate, surface equipment limitations and total volume of gas incineration allowed by permit.

During the EWT, sufficient gas incineration unit(s) and storage in the form of cylindrical tanks, will be available on site, supported by tanker haulage to remove oil and condensate or formation water for sale or disposal respectively.

7.3.2.2 EWT - Natural Gas

Ordinarily, natural gas flows to surface unaided. Natural gas is flowed to surface, together with any produced fluids (oil, condensate and formation water).

Due to the unknown composition, quantity and pressure of any natural gas encountered during the West Newton B exploratory operations, the generation of electricity by means of a gas-powered generator and connection to the national grid is not considered feasible for such a temporary operation.

Due to the infrastructure required to suitably store natural gas onsite in a liquid state for subsequent offsite transfer to a liquid natural gas receiving facility it is not feasible for such a temporary operation.

The duration of an EWT associated with natural gas will be determined based on test objectives, formations maximum achievable flow rate, surface equipment limitations and total volume of gas incineration allowed by permit. During the EWT, sufficient gas incineration unit(s) and storage in the form of cylindrical tanks, will be available on site, supported by tanker haulage to remove oil and condensate or formation water for sale or disposal respectively.

7.4 Well Completion

The completion may consist of a wide range of techniques including a liner, cased or open hole. The completion itself does not impact on the waste classification or quantities of waste produced. Details of the completion will be outlined within the WR11 submission.

On completion of the drilling phase, circulation runs will be conducted to remove residual muds or debris from the drilling using fresh water or brine. The waste from the circulation run will be managed at surface using the same techniques as the drilling phase. Waste classification and quantities are estimated in Section 7.11 of this Waste Management Plan.

7.5 Wellbore Clean Up

A clean up assembly will be run into the well and will scrape and remove any debris from the perforations. Fresh water, brine or base oil will be circulated down the work string during the wellbore cleaning operation and will circulate out to surface any debris. The debris, consisting of small steel scrapings, will be separated from the fluid at surface using conventional shakers and circulating tanks. The steel scrapings are anticipated to be negligible, due to the design of the perforation guns, insofar as they have been designed to minimise debris by reducing external burrs (steel edges) which form as the jet exists the casing. The shaker will capture any debris from the circulated fluid and divert them to a cuttings skip for subsequent offsite removal from site for offsite recycling and/or disposal at an Environment Agency permitted waste treatment facility. The waste will be tested by the waste treatment facility, the results of which will determine the treatment and/or disposal method to be used. Such treatment and/or disposal method will be in accordance with the waste treatment facility's environmental permits.

7.6 Acidisation

7.6.1 Acid Wash and Squeeze

To improve the flow of petroleum within the Permian formation, an acid, such as hydrochloric Acid (HCl) at 15% concentration with water (i.e. 150 kg of HCl with 850 kg of water), is applied to the formation through the wellbore. The operation is very much akin to acidisation of boreholes in the water well industry and results in high permeability channels through which water or petroleum can flow.

Should the 'Operator' determine that the formation may benefit from alternative acidic products as part of an acid wash and squeeze activity then they will be used in addition to the HCl treatment.

An acid wash is designed to remove scale or similar deposits from perforations and well-completion components. The acid wash can be used to repair formation blinding and help restore the natural porosity of the formation.

An acid wash is applying the acid to the formation under pressure not exceeding the fracture pressure of the formation.

The proposed dilution of acid will be made up of one or more of the following:

- HCl (≤ 15% Concentration);
- Acetic Acid (≤ 10% Concentration);
- Formic Acid (≤ 10% Concentration); and
- Citric Acid (≤ 10% Concentration).

Corrosion and iron inhibitors will be added to the acid solution, the same chemicals previously approved for use under the trade name Protekt 15 Plus as part of the previously approved chemical inventory, namely:

- Tallowalkylamine ethoxylates (1-3% Concentration);
- Formaldehyde reaction productions, oleylamine (1-3% Concentration);
- Proprietary antifoam (0.5-1% Concentration); and
- Proprietary dispersants (Protekt 318 (1-2% Concentration)).

EGMBE may be added to the acid solution at a concentration of circa 10%.

The acid solution (comprising of acid, inhibitors, ethylene glycol monobutyle ether (EGMBE) and water) will be mixed at surface prior to being applied to the formation.

The proposed dilution of hydrochloric acid is 15%, which is circulated across the perforations using 1 m^3 of HCl solution per meter of perforation plus an initial 1 m^3 of HCl solution as a pre-wash. The process of washing the perforations is repeated until there is adequate clean-up of the perforation.

Following the washing of the perforations, the acid is then squeezed into the near formation, again at 1 m^3 of acid per metre of perforation. The process may be repeated several times as necessary to ensure a reaction within the target formation has restored natural pathways.

The acid is squeezed into the natural formation below the facture gradient and will remain within the near wellbore target formation. The acids primary and only objective is to reinstate natural permeability within the near target formation existing natural pathways.

If more than one interval within the Permian interval is to be tested, the operation will be repeated.

The HCI reacts with the calcite through dissolution to produce Carbon Dioxide (CO_2), water (H_2O) and chloride ions (CI). The chloride ions exist in the water and pair to form calcium chloride ($CaCl_2$). The chemical equation is as follows:

$2HCl + CaCO_3 \rightarrow CaCl_2 + H_2O + CO_2$

Calcium chloride (salt) is not a hazardous substance and must therefore be considered as a non-hazardous pollutant.

A similar reaction will take place for the acetic, citric and formic acid, as for the HCl insofar as non-hazardous salts being produced alongside water and carbon dioxide.

For clarity, the term '*acid squeeze*' used within this Waste Management Plan has been defined within the Environment Agency's January 2018 publication [REF.13] as:

An "acid squeeze" is an oil industry term that is generally used when the intention is for the acid to not travel far from the well in to the geological formation. It is most frequently used when the permeability of the geological formation is very low. An acid squeeze results in the acid being squeezed in to the rock formation and dissolving the rock. It may also result in opening up new fractures, although very small and close to the well. This may enhance or create new flow paths to enable the well to be more productive. Exactly the same processes are at work as in acid washing, matrix acidisation and fracture acidisation, but just at a very local scale to the well due to the poor permeability of the geological formation. The Environment Agency assesses each proposed type of acidisation activity on a site specific basis prior to deciding whether the activity is acceptable or not, and whether an environmental permit can be granted or whether an exclusion applies.

Formation water produced in petroleum production wells in North Yorkshire from the Permian interval is considered representative of the formation water anticipated within the Permian interval at West Newton B, with a natural salinity of some 349,000 mg/l. The Permian interval lies at a depth of some 1,400 m below ground level and is isolated from near surface aquifers, groundwater and those users and the environment dependent on them by some 1,150 m of overlying low permeability formations.

Deeper aquifers within the Jurassic, Triassic and Permian are not considered to be important receptors due to their depth and high salinity or mineralised groundwater quality.

The quantity and concentration of acid introduced to the formation must be considered in the context of the naturally occurring concentrations in the receiving water. In this case, given the natural salinity levels of the Permian interval in the North Yorkshire wells and this being considered representative of the same formation at West Newton B, the receiving water is hyper-saline and the addition of the calcium carbonate as a result of introducing acid to the formation will obviate any present or future danger of deterioration in the quality of the receiving groundwater.

Whilst the injection of hydrochloric acid within deep saline water bearing formations is a 'groundwater activity', the activity is considered de minimis and can be excluded under Schedule 22 3 (3) of EPR2016. The acid wash/squeeze within the Permian Carbonate does not, therefore, require a groundwater permit.

7.6.2 Treatment of Surplus Acid

Following the retrieval of acid to surface it is anticipated that it will be considered 'spent' i.e. neutralised following the chemical reaction with the formation. As a contingency, the returns will be tested at the choke to determine acidity by using litmus papers. In the event the acid is not fully spent and remains slightly acidic the 'Operator' will treat the acid using soda ash (sodium carbonate) or other acid neutraliser. The soda ash will be used at surface and will not be used within the well; however, it will be the same chemical that was approved for the West Newton B drilling operations.

The anticipated acidic levels are uncertain due to the 15% mixture being diluted in water from the well and in the tank. Soda ash will be added in stages and tested with litmus paper until the waste volume is neutralised.

7.6.3 Alkali Wash and Squeeze

As an alternative to using acid, an alkali product is also being proposed. Evaluation of core samples obtained as part of the drilling operations have concluded that whilst the target formation reacts with the acid, the reaction takes place very quickly and does not provide enough residence time to clean up the full extent of any skin damage, as it reacts immediately with the face of the formation, and not the full extent of the near wellbore natural fractures.

The 'Operator' is proposing to use an alkali based product (Dissolvine Stimwell DDH-P) which has been tested on core samples and provides longer residence times allowing the full extent of the small near wellbore channels to be cleaned out.

As with an acid wash, the alkali wash involves the solution being pumped down the well and circulated around the annulus, washing the 'face' of the formation, exposing any nearby perforations. A squeeze is a similar technique insofar as the alkali being pumped down the well, it is then applied with pressure (not exceeding fracture pressure) so as to squeeze through the natural fractures within the formation, having been potentially blocked by previous drilling activities. The squeeze operation is applied so as to treat the near wellbore area only, cleaning out existing fractures, not creating new fractures.

As with acid, the injection of Dissolvine within deep saline water bearing formations is a 'groundwater activity'. However, it is again expected that the activity is considered de minimis and can be excluded under Schedule 22 3 (3) of EPR2016. The alkali wash/squeeze, utilising the Dissolvine is therefore not expected to require a permit for a 'groundwater activity'.

It is anticipated that the alkali wash and squeeze process may be undertaken a number of times depending on the discrete zones perforated. Each squeeze would involve the application of up to 1m3 of 25% alkali solution per 1m of perforation, with no more than 30m of formation being treated.

Following the retrieval of alkali to surface it is anticipated that it will be considered 'spent' i.e. neutralised following the chemical reaction with the formation. As a contingency, the returns will be tested at the choke to determine pH by using litmus papers. In the event the alkali is not fully spent and remains slightly alkali the 'Operator' will treat the alkali using citric acid. The citric acid will be used at surface and will not be used within the well. The anticipated pH levels are uncertain due to the 25% mixture being diluted in water from the well and in the tank. Citric acid will be added in stages and tested with litmus paper until the waste volume is neutralised.

As with the acid wash and squeeze, the alkali wash and squeeze may need to be repeated throughout the lifetime of the well. As with the fractures becoming blocked by the initial drilling activity, subsequent well testing operations may cause particulates to build up within the natural fractures overtime reducing near wellbore permeability.

7.7 Solvent Treatment and Pre-Flush

Due to the nature of the oil bearing formation and its mineralogy, a solvent treatment preflush may be required in advance of any wash and squeeze activity taking place to counter any emulsification of fluids in the formation. The solvent pre-flush is a process of removing the build-up of hydrocarbons on the rock within the near wellbore area. It consists of circa 0.3 m^3 EGMBE per 0.7 m^3 of water or brine per 1 m of perforation, with no more than 25 m of formation being treated. The solvent strips the hydrocarbon coating from the near wellbore formation allowing any subsequent acid/alkali wash and squeeze treatment to make efficient and uninterrupted contact with the near wellbore formation. For clarity, no solvent remains within the formation as it is brought back to surface, comingled with produced oil, or displaced with brine or spent acid/alkali.

A solvent treatment may be undertaken in isolation, or prior to an acid or alkali wash and squeeze. The order in which the fluids are retrieved to surface will be in the reverse order in which they were applied. A solvent treatment solution would therefore be retrieved to surface following the retrieval of either the spent acid or spent alkali.

The use of EGMBE as a solvent pre-flush continues to have benefit and will be used again as a pre-flush to the acid solution. Protekt 318 will be added to EGMBE for corrosion and iron control (inhibitors) at 1-2% concentration.

7.8 Well Lifting Techniques

If the well does not flow (lift) naturally, the following techniques are available to artificially lift hydrocarbons to surface:

- Nitrogen or carbon dioxide lift (gas lift).
- Mechanical lift; or
- Electric subsurface pump.

7.8.1 Nitrogen Lift

To aid the initial flow of hydrocarbons (oil and gas), nitrogen may be injected into the wellbore to displace wellbore fluids, reducing its hydrostatic weight. Nitrogen is classified as an inert waste and venting of such considered a closed loop system, insofar as nitrogen is extracted from the atmosphere and is vented back atmosphere. No nitrogen would remain in the formation.

7.8.2 Carbon Dioxide Lift

The purpose of carbon dioxide injection is to assist in the removal of all wellbore fluids and near wellbore debris sustained during the drilling operation, thus restoring near wellbore permeability. In comparison to Nitrogen injection, carbon dioxide injection allows for greater fluid volume injection, which in turn provides greater formation penetration rates and the recovery of wellbore debris.

Each carbon dioxide injection treatment requires circa 2 m^3 and 3 m^3 litres of liquid carbon dioxide per 10 m interval being treated, which is pumped in liquid state from surface through the wellbore and into the formation.

Due to the temperature of the formation, the state of the carbon dioxide changes rapidly from a liquid to a gas. This process results in a rapid expansion of carbon dioxide, which forces the formation fluid and near wellbore debris from the formation into the wellbore and back to surface. All liquid carbon dioxide injected into the formation will return to surface in a gaseous state and will be passed through the three-phase separator.

Whilst the injection of liquid carbon dioxide within deep saline water bearing formations is a 'groundwater activity', the liquid carbon dioxide will return to surface in a gaseous state. No injected carbon dioxide will remain in the formation and therefore the injection of liquid carbon dioxide is considered de minimus and can be excluded under Schedule 22 3 (3) of EPR2016 from requiring a 'groundwater activity' permit.

Waste classification and quantities are estimated in Section 7.11 of this Waste Management Plan.

For clarity, carbon dioxide may be used within the gas lift process in lieu of nitrogen.

7.8.3 Mechanical lift

The technique of artificially lifting liquids using a mechanical lift rather than a gas lift has the same aim as those methods previously described within the Waste Management Plan, to lift wellbore and reservoir fluids to surface where they will be handled at surface in the same manner as previously stated (produced fluids shall be separated into oil, water and gas and stored or incinerated accordingly). The mechanical lift can accommodate fluctuations in flow rate and changes in pressure by adjusting, at surface, the stroke length and/or speed.

The introduction of a mechanical lift technique is not principally used to manage an extractive waste i.e. the oil itself is a product, however as described above the biproducts of the mechanical lift will be formation water and natural gas, which have already been described and assessed within the Waste Management Plan.

The use of a mechanical lift technique does not introduce new waste streams or change the volume or chemical composition of the returning waste formation fluids (produced water and natural gas) therefore does not change the conclusions and assessment of the Waste Management Plan.

There are a number of mechanical lifting techniques that could be employed including the use of a 'Beam Pump' or a 'Rod Pumping Hydraulic Pump Jack'.

Both techniques involve running a rod string into the well to attach to a downhole pump located in the bottom of the tubing string. The rods are then lifted and lowered into the well by the surface equipment.

The fluids can be handled in two ways within the well. If there is little, or no associated gas recovered from the reservoir then all the fluids are pumped up the tubing string to surface. The fluids are then handled as described previously, by going through a three-phase separator and being separated into oil, water and gas. The gas is directed to the gas incineration unit and the oil and water are sent to onsite storage tanks. If larger quantities of associated gas are expected from the reservoir then the gas will flow up the annulus and be directed straight from the wellhead to the gas incineration unit, whilst the rest of the fluids will be handled as previously described.

At surface the rod string runs through the wellhead and pressure control equipment. The pressure control equipment is designed to contain all wellbore fluids. The proposed well test is scheduled for up to six weeks and equipment will be pressure tested before the start of the well test.

The installation of a mechanical lifting technique does not add any substantial risks of fugitive emissions due to the short-term nature of the operation and the use of the pump assembly as described above. The 'Operator' will utilise a competent contractor to install and maintain the mechanical lifting equipment. The mechanical lifting equipment arriving to site will be inspected for certification to ensure acceptable seals and O rings (or equivalent engineered design) are installed in pressure control equipment to prevent leaks.

The Leak Detection and Repair Plan and Fugitive Risk Assessment provides for review following installation of the well test equipment and shall therefore be revised following installation of equipment, prior to commencement of

operations and as part of its inspection programme. The mechanical lifting equipment will be included within the Leak Detection and Repair Plan, the Odour Risk Assessment and the Environmental Risk Assessment.

The waste associated with this operation is the same as previously assessed and will be managed at surface as previously described.

Once at surface, fluids will be diverted by temporary pipework to a three-phase separator, which will separate out oil, gas and produced fluids. Oil and produced fluids will be diverted via temporary pipework to dedicated storage tanks onsite for subsequent offsite removal for sale and disposal respectively. Oil, which for clarity is not considered a waste, will be transported by a licenced haulier to a permitted refinery for sale. Formation water cannot be reused onsite due to unknown components within the formation water and high salinity. Therefore, formation water is considered a waste, and will be tested at a laboratory and its components determined and will be transported by a licenced haulier to an Environment Agency permitted water treatment facility where it is processed, treated and discharged in accordance with the permitted controls of the water treatment facility.

Any natural gas separated during the three-phase separation will be diverted by temporary pipework to a ground flare located onsite for incineration. At the point of incineration, the natural gas is considered a waste. The flare is equipped with a propane fuelled permanently lit pilot, which ensures that ignition takes place as soon as natural gas is present and reignites if there is a break in flow. Air dispersion modelling and assessment of the flare has been undertaken.

7.9 Drilling of the Second Borehole

For the purpose of this Waste Management Plan, the design and construction of the second exploratory borehole will be similar to that of the first, insofar as the depths, borehole diameter and produced wastes. For clarity, the expected waste quantities detailed within Section 7.11 of this Waste Management Plan represents the construction and subsequent testing of a single borehole.

7.10 Well Abandonment and Partial Well Abandonment

In the event that the well(s) is not successful in establishing commercially producible petroleum, the well(s) will be abandoned in accordance with Oil & Gas UK guidelines for the suspension and abandonment of wells, which 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. 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.

In addition to the Oil & Gas UK guidelines for the suspension and abandonment of wells, the well abandonment(s) will be undertaken in accordance with both BSOR1995 and DCR1996.

The initial design and construction of the well(s) 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 boreholes will therefore provide adequate sealing of these zones when cementing in the various steel casing strings, ensuring compliance with the Oil & Gas UK guidance.

Based on a borehole construction, which complies with Oil & Gas UK guidance for the suspension and abandonment of wells, the internal section of last cemented casing sting will be subject to well abandonment. The operation involves the setting of cement barriers, extended above and below the permeable zone(s). Retainers are positioned within the internal casing string immediately below the required cement depth, which prevents the cement from moving or slumping during setting.

Once the well(s) 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.

7.11 Extractive Waste Management

An assessment of the potential extractive waste arising from the 'mining waste operation' 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 (WBM) and oil based mud (OBM) 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.

Waste Clays and Sand (Exploratory Well)		
Waste Classification, Quantity and Storage	**Classification**	Non Hazardous
	EWC Code	01 04 09
	Estimated Quantity	24 m^3 per well
	Onsite Storage	1 x 31 m^3 Open Square Tank
	Storage Duration	Maximum 7 Days
	Odour Potential	No Odour Anticipated
Operation / Activity	The drilling of the exploratory borehole will commence with the drilling and installation of a casing string known as a surface conductor. The drilling operation will be carried out using a geotechnical drilling rig which will auger or conventionally drill the near surface clays and sands within which the surface conductor casing will be set and cemented into position. 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.	
Waste Prevention and Minimisation	The ability to prevent or minimise clay and sand recover is limited given that the formation needs to be removed to allow the conductor casing to be installed. The selection of the drilling bit will be such that it minimises the hole size required to install the conductor casing which in turn keeps the clay and sand recovery to a minimum.	
Waste Treatment and Disposal	The clay and sand will be transported offsite via a licenced haulier to a permitted composting facility where it is blended into compost after compost has been sanitised.	
Waste Remaining in the Formation	None. Extractive process only.	
Monitoring	The Operator provides competent supervision to ensure the operation is carried out in accordance with an approved drilling programme. An inspection of the open square tank that contain the clay and sand shall be carried out prior to being used and will be subject to visual weekly inspections and annual thickness checks.	

Table 4: Waste Clays and Sand

Water Based Rock Cuttings (Exploratory Well)		
Waste Classification, Quantity and Storage	**Classification**	Non Hazardous
	EWC Code	01 05 04
	Estimated Quantity	66 m^3 per well
	Onsite Storage	1 x 31 m^3 Open Top Fluid Separator Tank (Drill Cuttings); and 1 x 20 m^3 Open Top Tank (Centrifuge)
	Storage Duration	Maximum 7 Days
	Odour Potential	No Odour Anticipated
Operation / Activity	Drilling muds are used in a closed loop system, within which the rock cuttings are circulated to surface and removed by vibrating screens (shakers) into an open top tank, which is also a fluid separator tank. Finer particles of rock cuttings are then extracted from the drilling mud by a centrifuge and the drilling mud is circulated back down the well.	
Waste Prevention and Minimisation	The ability to prevent or minimise rock cuttings recover is limited given that the formation needs to be removed to allow the casing to be installed. The selection of the drilling bit will be such that it minimises the hole size required to install each string of casing which, in turn, keeps the recover to a minimum. The rock cuttings tank is a fluid separator tank (perforated false floor), which allows drilling mud coating the rock cuttings to percolate down through the false floor where it is collected and pumped back into the closed loop mud system.	
Waste Treatment and Disposal	Rock cuttings will be transferred from the rock cuttings tank to a sealed road bulker by a hydraulic grab arm fitted to the rock cuttings tank and transported offsite via licenced haulier to a permitted composting facility where it is blended into compost after compost has been sanitised.	
Waste Remaining in the Formation	None. Extractive process only.	
Monitoring	The Operator provides competent supervision to ensure the operation is carried out in accordance with an approved drilling programme. An inspection of the rock cuttings tanks shall be carried out prior to being used and will be subject to visual weekly inspections and annual thickness checks.	

Table 5: Water Based Rock Cuttings

Fresh Water Drilling Muds and Waste (Exploratory Well)		
Waste Classification, Quantity and Storage	**Classification**	Non Hazardous
	EWC Code	01 05 04
	Estimated Quantity	208 m^3 per well
	Onsite Storage	Minimum 95 m^3 Open Top Active Tank System on Rig. 1 x 31 m^3 Open Top Tank (Drill Cuttings) and 1 x 20 m^3 Open Top Tank (Centrifuge)
	Storage Duration	Maximum 7 Days
	Odour Potential	No Odour Anticipated
Operation / Activity	Drilling muds are used to aid in the drilling process by lubricating the drill bit, 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 natural gas or formation pressure. Drilling muds are used in a closed loop system, within which the rock cuttings are circulated to surface and removed by vibrating screens (shakers). Finer particles of rock cuttings are then extracted from the drilling mud by a centrifuge and the drilling mud is circulated back down the well.	
Waste Prevention and Minimisation	Drilling mud waste is minimised by continually reusing the mud in a closed loop system and sustained by way filtering out rock cuttings and finer particles of rock. The rock cuttings tank is a fluid separator tank (perforated false floor), which allows drilling mud coating the rock cuttings to percolate down through the false floor where it is collected and pumped back into the closed loop mud system. Whenever the drilling mud weight exceeds the prescribed mud weight, due to finer particles of rock cuttings in the mud, the drilling mud needs to be diluted. Dilution may require the removal of a prescribed volume of active drilling mud and diluting the remaining volume with new drilling mud. Periodically, the drilling mud system will be completely changed, which will depend on the formation being drilled.	
Waste Treatment and Disposal	Drilling muds are used in a closed loop system and become a waste when no longer required for use in the operation. In such an event the drilling mud will be transferred from the active mud system on the drilling rig to a vacuum tanker for removal offsite via licenced haulier to a permitted composting facility where it is blended into compost after compost has been sanitised.	
Waste Remaining in the Formation	None. Any drilling muds remaining within the formation exist as a filter cake on borehole wall and forms part of the well construction. It is not considered a waste.	
Monitoring	The Operator provides competent supervision to ensure the operation is carried out in accordance with an approved drilling programme. An inspection of the mud tank system, including transfer lines, hoses etc. shall be carried out prior to being used and will be subject to visual weekly inspections and annual thickness checks.	

Table 6: Fresh Water Drilling Muds and Waste

Salt Saturated and KCL Rock Cuttings (Exploratory Well)		
Waste Classification, Quantity and Storage	**Classification**	Non Hazardous
	EWC Code	01 05 08
	Estimated Quantity	101 m^3 - (based on TD with 8 ½" hole) per well
	Onsite Storage	1 x 31 m^3 Open Top Fluid Separator Tank (Drill Cuttings) and 1 x 20 m^3 Open Top Tank (Centrifuge)
	Storage Duration	Maximum 7 Days
	Odour Potential	No Odour Anticipated
Operation / Activity	Drilling muds are used in a closed loop system, within which the rock cuttings are circulated to surface and removed by vibrating screens (shakers) into an open top tank, which is also a fluid separator tank. Finer particles of rock cuttings are then extracted from the drilling mud by a centrifuge and the drilling mud is circulated back down the well.	
Waste Prevention and Minimisation	The ability to prevent or minimise rock cuttings recover is limited given that the formation needs to be removed to allow the casing to be installed. The selection of the drilling bit will be such that it minimises hole size required to install each string of casing which in turn keeps the waste recover to a minimum. The rock cuttings tank is a fluid separator tank (perforated false floor), which allows drilling mud coating the rock cuttings to percolate down through the false floor where it is collected and pumped back into the closed loop mud system.	
Waste Treatment and Disposal	Rock cuttings will be transferred from the rock cuttings tank to a sealed road bulker by a hydraulic grab arm fitted to the rock cuttings tank and transported offsite via licenced haulier to a permitted composting facility where it is blended into compost after compost has been sanitised.	
Waste Remaining in the Formation	None. Extractive process only.	
Monitoring	The Operator provides competent supervision to ensure the operation is carried out in accordance with an approved drilling programme. An inspection of the rock cuttings tanks shall be carried out prior to being used and will be subject to visual weekly inspections and annual thickness checks.	

Table 7: Salt Saturated and KCl Rock Cuttings

Salt Saturated and KCL Rock Cuttings (Lateral Well)		
Waste Classification, Quantity and Storage	**Classification**	Non Hazardous
	EWC Code	01 05 08
	Estimated Quantity	267 m^3 - (based on 2km lateral well)
	Onsite Storage	1 x 31 m^3 Open Top Fluid Separator Tank (Drill Cuttings) and 1 x 20m^3 Open Top Tank (Centrifuge)
	Storage Duration	Maximum 7 Days
	Odour Potential	No Odour Anticipated
Operation / Activity	Drilling muds are used in a closed loop system, within which the rock cuttings are circulated to surface and removed by vibrating screens (shakers) into an open top tank, which is also a fluid separator tank. Finer particles of rock cuttings are then extracted from the drilling mud by a centrifuge and the drilling mud is circulated back down the well.	
Waste Prevention and Minimisation	The ability to prevent or minimise rock cuttings recover is limited given that the formation needs to be removed to allow the casing to be installed. The selection of the drilling bit will be such that it minimises hole size required to install each string of casing which in turn keeps the waste recover to a minimum. The rock cuttings tank is a fluid separator tank (perforated false floor), which allows drilling mud coating the rock cuttings to percolate down through the false floor where it is collected and pumped back into the closed loop mud system.	
Waste Treatment and Disposal	Rock cuttings will be transferred from the rock cuttings tank to a sealed road bulker by a hydraulic grab arm fitted to the rock cuttings tank and transported offsite via licenced haulier to a permitted composting facility where it is blended into compost after compost has been sanitised.	
Waste Remaining in the Formation	None. Extractive process only.	
Monitoring	The Operator provides competent supervision to ensure the operation is carried out in accordance with an approved drilling programme. An inspection of the rock cuttings tanks shall be carried out prior to being used and will be subject to visual weekly inspections and annual thickness checks.	

Table 8: Salt Saturated and KCl Rock Cuttings (Lateral Well)

Chloride Containing Drilling Muds and Waste (Exploratory Well)		
Waste Classification, Quantity and Storage	**Classification**	Non Hazardous
	EWC Code	01 05 08
	Estimated Quantity	457m^3 (based on TD with 8 ½" hole) per well
	Onsite Storage	Minimum 95m^3 Open Top Active Tank System on Rig. 1 x 31m^3 Open Top Tank (Drill Cuttings) and 1 x 20m^3 Open Top Tank (Centrifuge)
	Storage Duration	Maximum 7 Days
	Odour Potential	No Odour Anticipated
Operation / Activity	Drilling muds are used to aid in the drilling process by lubricating the drill head, 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 natural gas or formation pressure. Drilling muds are used in a closed loop system, within which the rock cuttings are circulated to surface and removed by vibrating screens (shakers). Finer particles of rock cuttings are then extracted from the drilling mud by a centrifuge and the drilling mud is circulated back down the well.	
Waste Prevention and Minimisation	Drilling mud waste is minimised by continually reusing the mud in a closed loop system and sustained by way filtering out rock cuttings and finer particles of rock. The rock cuttings tank is a fluid separator tank (perforated false floor), which allows drilling mud coating the rock cuttings to percolate down through the false floor where it is collected and pumped back into the closed loop mud system. Whenever the drilling mud weight exceeds the prescribed mud weight, due to finer particles of rock cuttings in the mud, the drilling mud needs to be diluted. Dilution may require the removal of a prescribed volume of active drilling mud and diluting the remaining volume with new drilling mud. Periodically, the drilling mud system will be completely changed, which will depend on the formation being drilled.	
Waste Treatment and Disposal	Drilling muds are used in a closed loop system and become a waste when no longer required for use in the operation. In such an event the drilling mud will be transferred from the active mud system on the drilling rig to a vacuum tanker for removal offsite via licenced haulier to a permitted composting facility where it is blended into compost after compost has been sanitised.	
Waste Remaining in the Formation	None. Any drilling muds remaining within the formation exist as a filter cake on borehole wall and forms part of the well construction. It is not considered a waste.	
Monitoring	The Operator provides competent supervision to ensure the operation is carried out in accordance with an approved drilling programme. An inspection of the mud tank system, including transfer lines, hoses etc. shall be carried out prior to being used and will be subject to visual weekly inspections and annual thickness checks.	

Table 9: Chloride Containing Drilling Muds and Waste

Chloride Containing Drilling Muds and Waste (Lateral Well)		
Waste Classification, Quantity and Storage	**Classification**	Non Hazardous
	EWC Code	01 05 08
	Estimated Quantity	1,113m^3 (based on 2km lateral well)
	Onsite Storage	Minimum 95m^3 Open Top Active Tank System on Rig. 1 x 31m^3 Open Top Tank (Drill Cuttings) and 1 x 20m^3 Open Top Tank (Centrifuge)
	Storage Duration	Maximum 7 Days
	Odour Potential	No Odour Anticipated
Operation / Activity	Drilling muds are used to aid in the drilling process by lubricating the drill head, 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 natural gas or formation pressure. Drilling muds are used in a closed loop system, within which the rock cuttings are circulated to surface and removed by vibrating screens (shakers). Finer particles of rock cuttings are then extracted from the drilling mud by a centrifuge and the drilling mud is circulated back down the well.	
Waste Prevention and Minimisation	Drilling mud waste is minimised by continually reusing the mud in a closed loop system and sustained by way filtering out rock cuttings and finer particles of rock. The rock cuttings tank is a fluid separator tank (perforated false floor), which allows drilling mud coating the rock cuttings to percolate down through the false floor where it is collected and pumped back into the closed loop mud system. Whenever the drilling mud weight exceeds the prescribed mud weight, due to finer particles of rock cuttings in the mud, the drilling mud needs to be diluted. Dilution may require the removal of a prescribed volume of active drilling mud and diluting the remaining volume with new drilling mud. Periodically, the drilling mud system will be completely changed, which will depend on the formation being drilled.	
Waste Treatment and Disposal	Drilling muds are used in a closed loop system and become a waste when no longer required for use in the operation. In such an event the drilling mud will be transferred from the active mud system on the drilling rig to a vacuum tanker for removal offsite via licenced haulier to a permitted composting facility where it is blended into compost after compost has been sanitised.	
Waste Remaining in the Formation	None. Any drilling muds remaining within the formation exist as a filter cake on borehole wall and forms part of the well construction. It is not considered a waste.	
Monitoring	The Operator provides competent supervision to ensure the operation is carried out in accordance with an approved drilling programme. An inspection of the mud tank system, including transfer lines, hoses etc. shall be carried out prior to being used and will be subject to visual weekly inspections and annual thickness checks.	

Table 10: Chloride Containing Drilling Muds and Waste (Lateral Well)

Oil Based Rock Cuttings		
Waste Classification, Quantity and Storage	**Classification**	Hazardous
	EWC Code	01 05 05*
	Estimated Quantity	457 m^3 (based on TD with 8 ½" hole) per well
	Onsite Storage	Minimum 95 m^3 Open Top Active Tank System on Rig. 1 x 31 m^3 Open Top Tank (Drill Cuttings) and 1 x 20 m^3 Open Top Tank (Centrifuge)
	Storage Duration	Maximum 7 Days
	Odour Potential	No Odour Anticipated
Operation / Activity	Drilling muds are used in a closed loop system, within which the rock cuttings are circulated to surface and removed by vibrating screens (shakers) into an open top tank, which is also a fluid separator tank. Finer particles of rock cuttings are then extracted from the drilling mud by a centrifuge and the drilling mud is circulated back down the well.	
Waste Prevention and Minimisation	The ability to prevent or minimise rock cuttings recover is limited given that the formation needs to be removed to allow the casing to be installed. The selection of the drilling bit will be such that it minimises hole size required to install each string of casing which in turn keeps the waste recover to a minimum. The rock cuttings tank is a fluid separator tank (perforated false floor), which allows drilling mud coating the rock cuttings to percolate down through the false floor where it is collected and pumped back into the closed loop mud system.	
Waste Treatment and Disposal	Rock cuttings will be transferred from the rock cuttings tank to a sealed road bulker by a hydraulic grab arm fitted to the rock cuttings tank and transported offsite via licenced haulier to a permitted composting facility where it is blended into compost after compost has been sanitised.	
Waste Remaining in the Formation	None. Extractive process only.	
Monitoring	The Operator provides competent supervision to ensure the operation is carried out in accordance with an approved drilling programme. An inspection of the rock cuttings tanks shall be carried out prior to being used and will be subject to visual weekly inspections and annual thickness checks.	

Table 11: Oil Based Muds and Waste

Oil Based Muds and Waste		
Waste Classification, Quantity and Storage	**Classification**	Hazardous
	EWC Code	01 05 05*
	Estimated Quantity	267 m^3 - (based on 2km lateral well)
	Onsite Storage	1 x 31 m^3 Open Top Fluid Separator Tank (Drill Cuttings) and 1 x 20 m^3 Open Top Tank (Centrifuge)
	Storage Duration	Maximum 7 Days
	Odour Potential	No Odour Anticipated
Operation / Activity	Drilling muds are used to aid in the drilling process by lubricating the drill head, 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 natural gas or formation pressure. Drilling muds are used in a closed loop system, within which the rock cuttings are circulated to surface and removed by vibrating screens (shakers). Finer particles of rock cuttings are then extracted from the drilling mud by a centrifuge and the drilling mud is circulated back down the well.	
Waste Prevention and Minimisation	Drilling mud waste is minimised by continually reusing the mud in a closed loop system and sustained by way filtering out rock cuttings and finer particles of rock. The rock cuttings tank is a fluid separator tank (perforated false floor), which allows drilling mud coating the rock cuttings to percolate down through the false floor where it is collected and pumped back into the closed loop mud system. Whenever the drilling mud weight exceeds the prescribed mud weight, due to finer particles of rock cuttings in the mud, the drilling mud needs to be diluted. Dilution may require the removal of a prescribed volume of active drilling mud and diluting the remaining volume with new drilling mud. Periodically, the drilling mud system will be completely changed, which will depend on the formation being drilled.	
Waste 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.	
Waste Remaining in the Formation	None, all mud shall be circulated out.	
Monitoring	The Operator provides competent supervision to ensure the operation is carried out in accordance with an approved drilling programme. An inspection of the mud tank system, including transfer lines, hoses etc. shall be carried out prior to being used and will be subject to visual weekly inspections and annual thickness checks.	

Table 12: Oil Based Muds and Waste

Spent Acid		
Waste Classification, Quantity and Storage	**Classification**	Non Hazardous
	EWC Code	16 10 02
	Estimated Quantity	1 m^3 per 1m interval.
	Onsite Storage	IBC Containers or Tank (Bunded)
	Storage Duration	Maximum 7 Days
	Odour Potential	Refer to Odour Management Plan
Operation / Activity	Acid is used to wash and clean out natural fractures within carbonate formations, which may be blocked as a result of the initial drilling operations. In addition, acid is squeezed into the natural fractures of the carbonate formation under pressure, increasing the near wellbore permeability. The reaction of the acid with the calcite produces salt and is unavoidable, which is classified as non-hazardous. The spent acid and salt will be reversed circulated out of the wellbore into containers 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.	
Waste Prevention and Minimisation	The acid will be used in stages to ensure its use is minimised. The reaction of the acid with the calcite produces salt. This reaction, and in turn the waste generated, is unavoidable. Careful planning will be taking prior to any acid wash or squeeze being undertaking to ensure the 'Operator' minimises the amount of acid used, which in turn reduces the amount of waste generated by the operation.	
Waste Treatment and Disposal	The salt will be reverse circulated out of the wellbore into a number of $1m^3$ IBC containers 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.	
Waste Remaining in the Formation	None. The reaction of the acid with the calcite produces salt, which is classified as non-hazardous. The salt will be reverse circulated out of the formation and collected at surface.	
Monitoring	The 'Operator' provides competent supervisors to oversee the operation ensuring the correct volumes of acid are used. The containers will be inspected prior to use to ensure they are suitable for holding salt.	

Table 13: Spent Acid

Spent Acid		
Waste Classification, Quantity and Storage	**Classification**	Non-Hazardous
	EWC Code	01 05 08
	Estimated Quantity	15 m^3 per Alkali Wash and Squeeze
	Onsite Storage	None – Incineration by Ground Flare
	Storage Duration	Cylindrical Tanks
	Odour Potential	No Odour Anticipated
Operation / Activity	The purpose of an alkali wash is to clean the well after drilling and results in improved permeability. The fine particles and drilling muds may block, or bind, the natural pore spaces in the rock. An alkali wash is used to clean the well out following drilling in order to return the natural porosity and permeability of the damaged formation. The proposed dilution of Dissolvine Alkali is 25%. An "alkali squeeze" is a term that is generally used when the intention is for the alkali to remain local to the well in the perforated geological formation. An alkali squeeze results in the alkali being squeezed in to the rock formation and dissolving the rock. The chemical reaction between the formation and acid can be represented by the following formula: Ca/MgCO3 (Calcium/Magnisium Carbonate) + Dissolvine = Calcium Salt + Magnesium Salt + Carbonate Ion Once the alkali has reacted with the formation it will form a waste stream known as 'Spent Alkali' which, following the completion of the squeeze, will be recovered (circulated) back to surface.	
Waste Prevention and Minimisation	The alkali will be used in stages to ensure its use is minimised. The reaction of the alkali with the calcite produces Salts. This reaction, and in turn the waste generated, is unavoidable. Careful planning will be taken prior to any alkali wash or squeeze being undertaking to ensure the 'Operator' minimises the amount of alkali used, which in turn reduces the amount of waste generated by the operation.	
Waste Treatment and Disposal	The salts will be circulated out of the wellbore into a storage tank and stored onsite for subsequent removal via a licensed 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. Should it be identified that not all of the alkali is spent, it will be neutralised at surface using soda ash, before being removed from site.	
Waste Remaining in the Formation	None. All alkali is spent or otherwise is expected to return to surface.	
Monitoring	An inspection of the fluid tanks that contain the spent alkali shall be carried out prior to being used and will be subject to visual inspections and annual thickness checks.	

Table 14: Spent Alkali

Well Suspension Brine		
Waste Classification, Quantity and Storage	**Classification**	Non Hazardous
	EWC Code	01 05 08 or 01 05 06* (if Solvent Entrained)
	Estimated Quantity	116m^3 per well
	Onsite Storage	1 x 60m^3 Horizontal Cylindrical Closed Tank
	Storage Duration	Maximum 7 Days
	Odour Potential	Refer to Odour Management Plan
Operation / Activity	The West Newton B well will be subject to a period of suspension using suspension brine and mechanical plugs. The brine is measured at 988g/ltr and is used to fill the wellbore. Following suspension any further operations will require the suspension brine to be circulated out of the well to an onsite storage tank via temporary surface pipework.	
Waste Prevention and Minimisation	The suspension brine will be stored onsite for subsequent reuse as a suspension brine for the West Newton B well at a later date when the well will need to be suspended again.	
Waste Treatment and Disposal	Once the suspension fluid has fully served its purpose at the wellsite, the suspension brine will be removed from site 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.	
Waste Remaining in the Formation	None. Suspension brine is circulated out prior to well intervention and/or flow testing.	
Monitoring	An inspection of the fluid tanks that contain the suspension fluid shall be carried out prior to being used and will be subject to visual weekly inspections and annual thickness checks.	

Table 15: Well Suspension Brine

Well Suspension Brine		
Waste Classification, Quantity and Storage	**Classification**	Hazardous
	EWC Code	01 05 05*
	Estimated Quantity	116 m^3 - (based on 2km lateral well)
	Onsite Storage	1 x 31 m^3 Open Top Fluid Separator Tank (Drill Cuttings) and 1 x 20 m^3 Open Top Tank (Centrifuge)
	Storage Duration	Maximum 7 Days
	Odour Potential	No Odour Anticipated
Operation / Activity	The West Newton B well will be subject to a period of suspension using suspension brine and mechanical plugs. The oil is used to fill the wellbore. Following suspension any further operations will require the suspension fluid to be circulated out of the well to an onsite storage tank via temporary surface pipework.	
Waste Prevention and Minimisation	The suspension fluid will be stored onsite for subsequent reuse as a suspension fluid for the West Newton B well at a later date when the well will need to be suspended again.	
Waste Treatment and Disposal	Once the suspension fluid has fully served its purpose at the wellsite, it will be removed from site 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.	
Waste Remaining in the Formation	None. Suspension fluid is circulated out prior to well intervention and/or flow testing.	
Monitoring	An inspection of the fluid tanks that contain the suspension fluid shall be carried out prior to being used and will be subject to visual weekly inspections and annual thickness checks.	

Table 16: Well Suspension Oil

Carbon Dioxide		
Waste Classification, Quantity and Storage	**Classification**	Not Classified
	EWC Code	16 05 05
	Estimated Quantity	Circa 2 m^3 and 3 m^3 per 10 m interval being treated
	Onsite Storage	None – Vented to Atmosphere
	Storage Duration	Not Applicable
	Odour Potential	No Odour Anticipated
Operation / Activity	Liquid Carbon Dioxide is injected into the well to assist in the removal of all wellbore fluids and near wellbore debris sustained during the drilling operation, thus restoring near wellbore permeability.	
Waste Prevention and Minimisation	The use of liquid Carbon Dioxide can be classified as a closed loop system due to the Carbon Dioxide having been first taken from the atmosphere during its manufacture process where it is cooled to a liquid state before being injected into the well. The temperature of the formation changes the state of the Carbon Dioxide from a liquid to a gas, which is then returned to surface and vented back into the atmosphere.	
Waste Treatment and Disposal	Carbon Dioxide that has been extracted from the atmosphere will be vented back into the atmosphere via the ground flare without any treatment being necessary.	
Waste Remaining in the Formation	None. Liquid Carbon Dioxide injected into the well to assist in the removal of wellbore fluids and near wellbore debris will flow to surface in a gaseous state.	
Monitoring	The volumes of Carbon Dioxide will be monitored both in and out of the well.	

Table 17: Carbon Dioxide

Nitrogen		
Waste Classification, Quantity and Storage	**Classification**	Inert
	EWC Code	01 05 99
	Estimated Quantity	Not Known at this Time
	Onsite Storage	None – Vented to Atmosphere
	Storage Duration	Not Applicable
	Odour Potential	No Odour Anticipated
Operation / Activity	Nitrogen is injected into the well to aid the initial lifting of wellbore fluids, thus reducing the hydrostatic pressure and allowing petroleum to flow to surface.	
Waste Prevention and Minimisation	The use of nitrogen can be classified as a closed loop system due to the nitrogen having been first taken from the atmosphere during its manufacture process and then returned to surface and vented back into the atmosphere. The quantities of Nitrogen required are small and a detailed measurement cannot be provided at this stage.	
Waste Treatment and Disposal	As an inert gas, nitrogen that has been extracted from the atmosphere will be vented back into the atmosphere via the ground flare without any treatment being necessary.	
Waste Remaining in the Formation	None. nitrogen injected into the well to aid the initial lifting of wellbore fluids will flow to surface.	
Monitoring	The volumes of nitrogen will be monitored both in and out of the well.	

Table 18: Nitrogen

Formation Water		
Waste Classification, Quantity and Storage	**Classification**	Non Hazardous
	EWC Code	16 10 02
	Estimated Quantity	16 m^3 per test
	Onsite Storage	4 x 60 m^3 Horizontal Cylindrical Closed Tank
	Storage Duration	Up to 3 Months to Allow for Radionuclide Analysis
	Odour Potential	Refer to Odour Management Plan
Operation / Activity	During flow testing operations there is a possibility of formation water being produced together with petroleum. Formation water is separated from the petroleum on surface using temporary fluid separation equipment and transferred via temporary pipework to cylindrical storage tanks located onsite for offsite removal. The formation water has the potential to contain low levels of NORM. Samples of formation water will be sent to a laboratory holding the appropriate accreditations for radionuclides analysis by gamma spectrum.	
Waste Prevention and Minimisation	The ability to prevent or minimise recovery of formation water is extremely limited. Given that the operation is exploratory, no consideration has been given at this stage for reinjection of produced formation water. Formation water cannot be reused onsite due to unknown components within the formation water and high salinity. Therefore, formation water is considered a waste, and will be tested at a laboratory and its components determined.	
Waste Treatment and Disposal	Depending on the outcome of radionuclides 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 BAT.	
Waste Remaining in the Formation	None. Formation water naturally occurs within the formation and is only considered as a waste when produced from the well.	
Monitoring	A contamination monitoring programme will be devised and include the wellhead temporary separator equipment and storage tanks. Consignment of formation water will be screened externally for contamination prior to leaving site. An inspection of the fluid tanks that contain the formation water shall be carried out prior to being used and will be subject to visual weekly inspections and annual thickness checks.	

Table 19: Formation Water

Natural Gas		
Waste Classification, Quantity and Storage	**Classification**	Hazardous
	EWC Code	16 05 04
	Estimated Quantity	13,082 Tonnes
	Onsite Storage	None – Incineration by Ground Flare
	Storage Duration	Not Applicable
	Odour Potential	Refer to Odour Management Plan
Operation / Activity	During WCU / EWT operations there is a likelihood of natural gas being produced from the formation and flowed at different rates to understand the characteristics of the formation and determine whether or not the reservoir is capable of producing commercial quantities of natural gas. A period of flowing the natural gas is followed by a period of shutting in the well to monitor pressure build up. At the point of incineration natural gas is considered a waste.	
Waste Prevention and Minimisation	The ability to prevent or minimise natural gas is extremely limited during this operation as it is required to determine the condition and state of the reservoir. Given that the operation is exploratory, no consideration has been given at this stage to capture the gas for sale and transportation for reuse as a fuel or other means of generating energy. Due to the unknown composition, quantity and pressure of any natural gas encountered during the West Newton B exploratory operations, the generation of electricity by means of a gas-powered generator and connection to the national grid is not considered feasible for such a temporary operation. Due to the infrastructure required to suitably store natural gas onsite in a liquid state for subsequent offsite transfer to a liquid natural gas receiving facility it is not feasible for such a temporary operation.	
Waste Treatment and Disposal	Natural gas is separated from produced fluids at surface and diverted via temporary pipework to a ground flare located onsite for incineration. The ground flare will be fitted with a pilot and an electrical ignition system. The flare will also be continuously propane fed to allow for a continuous flame. The incineration of natural gas is subject to a separate air modelling and dispersion report included within the WGMP.	
Waste 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 WCU / EWT operations the flare will be supervised during periods of flaring activity to ensure its effectiveness to incinerate the natural gas.	

Table 20: Natural Gas

7.12 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.

7.13 Management of Non-Extractive Waste

During the West Newton B exploratory operations there will be a number of non-extractive waste stream generated 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.

7.14 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.

7.15 Management of Naturally Occurring Radioactive Material

A standard rules permit to accumulate and dispose of NORM from the wellsite has been acquired.

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

8. RISK POSED TO THE ENVIRONMENT AND HUMAN HEALTH

The wellsite has been designed with consideration for both environmental and human impacts. All permitted activities will take place within the contained area of the wellsite.

The wellsite has been designed and built to ensure complete containment of any spillages in the unlikely event they occur onsite. An enclosed perimeter containment ditch has been excavated and installed around the perimeter of the wellsite, with all storage tanks being installed within contained bunded areas.

Following the excavation of the perimeter containment ditch, the wellsite has been overlaid with an impermeable membrane to provide wellsite integrity and ensure that any surface run off liquids, either rain water or spillages, flow to the perimeter containment ditch.

During operations, all hazardous substances will be stored within the wellsite, ensuring that in the unlikely event of a spillage, hazardous substances will be contained within the wellsite, preventing the migration or percolation of hazardous substances offsite. No hazardous substances shall be stored outside of the active area of the wellsite.

The structure of the Environmental Risk Assessment follows the Environment Agency guidance using a source – pathway – receptor model and includes:

- Identifying the risk from the site;
- Assessing risks and checking they are acceptable;
- Justifying appropriate measures to control the risk (if needed); and
- Presenting the risk assessment.

The Environmental Risk Assessment has included the following items, which have been reviewed for applicability within the proposed operations.

- Accidents & Incidents;
- Air Emissions;
- Dust;
- Fugitive Emissions;
- Noise;
- Odour;
- Releases to Water;
- Global Warming Potential; and
- Waste.

The Environmental Risk Assessment is based on a qualitative assessment and details the activities and events that may lead to environmental impact on one or more receptors.

9. MEASURES TO MINIMISE ENVIRONMENTAL IMPACT

Measures to minimise the environmental impact of the operation have been incorporated as part of the initial site selection process, site design and construction through to subsequent exploration operations. The measures to mitigate long term environmental impact are:

- Site located suitable distance from residential properties;
- Site located away from any statutory designated areas;
- Baseline monitoring of ecology, noise, water;
- Hydrogeological risk assessment;
- Site design to include impermeable membrane and containment ditches;
- Wellbore lifecycle design to protect groundwater;
- Hierarchy of waste management;
- Operating procedures and inductions;
- Waste handling, storage and disposal regime;
- Continuous Training and development;
- Environmental monitoring; and
- Restoration and aftercare.

9.1 Chemicals used at Surface

The following chemicals will be used at surface during the West newton B well test operations:

- Methanol;
- Monoethylene Glycol; and
- Hydrogen Sulphide scavenger
- Soda Ash or other acid neutraliser.

Methanol is used to disperse hydrate build-up within well test pipelines and equipment during well test operations.

Monoethylene Glycol is used as a preventative measure against the build-up of hydrates within surface equipment. Monoethylene Glycol is used during well test operations to prevent the build-up of hydrates within well test pipelines and equipment.

Hydrates are solid compounds containing water molecules generally formed with the following three components:

- Water;
- Temperature;
- Pressure.

For clarity, Methanol and Monoethylene Glycol are used as described above within surface well test equipment and will not be used within the wellbore.

10. WELLSITE MANAGEMENT

10.1 Foul Water and Sewage

During the site construction and site restoration phase, temporary welfare facilities will be provided by an independent welfare cabin which provides kitchen and washroom facilities. Foul water will be emptied on a weekly basis or when required.

During the exploratory activities following site construction offices and accommodation units will have base tanks installed. The tanks will be emptied on a weekly basis or when required.

Sewage will be collected periodically throughout the exploratory operation when the wellsite is manned and removed by licenced waste carrier to an Environment Agency permitted waste water treatment works for subsequent treatment and/or disposal. For clarity, no discharge of foul water or sewerage will be made from the site.

The criteria for determining whether waste generated at the wellsite will be recycled or disposed of will be determined by the receiving waste treatment facility upon receipt of the waste at the treatment facility. The waste will be tested by the waste treatment facility, the results of which will determine the treatment and/or disposal method to be used. Such treatment and/or disposal method will be in accordance with the waste treatment facility's environmental permits.

10.2 Releases to Groundwater

The potential for a release to groundwater exists both at surface and within the subsurface. The potential for releases gas been assessed in the form of an Environmental Risk Assessment which was approved by the Environment Agency under EPR2016.

To summarise, the potential for surface releases are mostly reduced due to the installation of a HDPE liner across the wellsite, capturing any spillages, and storing then in the form of containment ditches. The containment ditch is the subject of regular inspection, proportionate to site activities. For example, should the site be active, the inspection shall take place daily, where the site is inactive the frequency will be much less. The collected rainwater (containing any potential spillages) is subject to a sampling and analysis regime subject to disposal. The disposal methods are as follows:

- During periods of activity within the active area of the wellsite, all water contained within the perimeter containment ditches will be removed via road tanker and disposed at an Environment Agency licenced waste facility.
- During periods of inactivity within the active area of the wellsite, water contained within the perimeter containment ditch will be tested to confirm it is suitable for discharge via the Class 1 SPEL oil-water separator to an adjacent land drain, in accordance with the approved Surface Water Management Plan.
- If the results of the test identify that the surface run-off water is not suitable for discharge, the water will be removed via road tanker and disposed at an Environment Agency licenced waste facility.

For clarity, the interceptor is locked off to prevent release of collected rain water to the nearby water course. Surface water discharge can only take place in the presence of a designated person of the 'Operator'.

With regards to subsurface release as part of active well operations, drilling muds and other fluids used will be strictly monitored to ensure an accurate understanding of fluid volumes lost, gained or, in the case of cement, placed in the subsurface. During drilling operations, the volumes of fluids pumped, together with the volumes of fluid within the tanks will be continually monitored by a geological logging company (mud loggers). Such monitoring can identify loss of drilling muds to the formation. In the event that subsurface fluid losses occur, lost circulation material is provided onsite to stem the losses.

Subsurface releases are mitigated by adopting the best practice approach to wellsite construction and wellbore construction. Dilute acid and/or alkali will be introduced to the formation at levels considered de-minimis and will not constitute a ground water activity.

All fluids introduced to the formation(s) shall be recovered and will not remain within the formation (subsurface).

10.3 Releases to Air

An Air Quality Impact Assessment was undertaken to assess the impact of emissions on air quality and provided in support of the original environmental permit application.

A scheme of air quality monitoring was agreed with the Environment Agency prior to the commence of the permitted activities and implemented prior to the well being constructed. The scheme was implemented during well construction and will be conducted for future well operations.

10.4 Noise

Planning permission for the West Newton B wellsite required the submission of a Noise Impact Assessment. Noise monitoring was undertaken during fourth quarter of 2014 at the nearest residential locations. The Noise Impact Assessment concludes that noise levels associated with the operation (including all operations associated with extractive waste) are relatively low.

10.5 Release of Odorous Emissions

Extractive wastes generated are not ordinarily malodorous, nor are any of the associated processes that will be performed. Measures will be taken to minimise all fugitive emissions which may cause odours. The potential of odour release has been assessed within the approved Odour Management Plan.

10.6 Natural Gas or Oil

In the event of any unexpected release of natural gas or oil releases, the Environment Agency will be notified in accordance with the environmental permit requirements. Details of the quantities of unexpected releases will be recorded by the Operator along with the measures taken to manage them and made available to the Environment Agency on request.

10.7 Security

Security of the wellsite will be provided in the form of a security fence and lockable access gates. The positioning of, both permanent and temporary equipment, will be within the confines of the security fence.

During operations it may be necessary to have manned security. Manned security will control access and egress to the wellsite and will play a key role in the control of personnel in the event of an emergency situation, in accordance with the Site Health and Safety Document, a requirement of BSOR1995.

10.8 Complaints

In the event that a complaint is received from stakeholders, including neighbours, the complaint shall be recorded and investigated in accordance with the ‘Operators’ complaints process.

Complaints relating to the environment will be reported to the Environment Agency within the required timescales, as determined by the severity and environmental impact of the incident initiating the complaint and/or permit conditions. In some cases, permit conditions will require notification to the Environment Agency within 24 hours or without delay for a potentially polluting incident.

Following notification, measures to prevent reoccurrence will be agreed with the Environment Agency, together with a programme for implementation. Implementation of the actions will be monitored and the Environment Agency informed.

10.9 Containment within the Wellbore

Well control equipment is deployed on the well in accordance with API RP53 [REF.14] 'Recommended Practice for Blowout Prevention Equipment Systems for Drilling Wells'. Primary well control is achieved by the hydrostatic weight of the fluid column in the wellbore. Blowout prevention equipment is considered secondary well control in the event that the primary well control is compromised and is subject to a schedule of certification and testing, together with a requirement for those operating the equipment to be certified competent.

10.10 Fire Response

Whilst a fire is associated more so with the health and safety of the personnel onsite, a fire does have the potential to lead to an environmental incident. It is imperative, therefore, that any potential for a fire and subsequent emergency response is identified and included in the operational planning. The Site Safety Document, which is a requirement under Regulation 7 of BSOR1995, specifies the arrangements for identification and mitigation in the event of a fire, including consultation with the local Fire & Rescue Service.

Containment of any firefighting fluid is provided by the impermeable membrane incorporated into the design of the wellsite. In the event that such requirements were to be necessary, continued monitoring of the containment ditch shall be implemented to ensure it does not exceed its containment capacity.

Additional water is available onsite and should be used to keep the areas adjacent to the fire cool to avoid any damage being sustained to the impermeable membrane.

10.11 Incident Reporting and Investigation

All incidents, no matter how minor, are reported in accordance with the 'Operators' Incident Accident Reporting and Investigation Standard. The standard provides for the investigation of all incidents to ensure lessons are captured and actions implemented to avoid reoccurrence.

In addition, the standard provides for the notification to the relevant Regulatory Authority in the event of an incident which extends beyond the containment of the wellsite.

Environmental incidents will be reported to the Environment Agency within the required timescales, as determined by the severity and environmental impact of the incident and/or permit conditions. In some cases, permit conditions may require notification the Environment Agency within 24 hours or without delay for a potentially polluting incident.

Following notification, measures to prevent reoccurrence will be agreed with the Environment Agency, together with a programme for implementation. Implementation of the actions will be monitored and the Environment Agency informed.

11. ALTERATIONS TO THE PLAN

Any required changes or deviations from this plan are to be referred to the HSE & Planning Manager or to the site HSE Advisor in the first instance. No changes to or deviations from this plan are to be implemented until the required changes or deviations have been reviewed and approved by the 'Operator' and the relevant approvals obtained in writing from the Environment Agency for any changes to the plans and operating techniques approved under the environmental permit to be issued.

Within the environmental permit there is a requirement on the Operator to review the Waste Management Plan every five years and amend where necessary. The review date shall take place five years from the date of permit issue. Reviews and amendments will also be required in the event of a substantial change(s) to the operations taking place onsite.

In some cases, changes to operations may require the environmental permit to be varied in order to accommodate such changes. In this instance an application will be made to the Environment Agency to vary the existing permit or apply for a new permit.

12. PLAN FOR CLOSURE

Following the cessation of operations, a decision may be made to close the site resulting in subsequent wellbore abandonment and wellsite restoration.

12.1 Well Abandonment

If a decision is made to restore the wellsite, the boreholes will be abandoned in accordance with Oil & Gas UK Guidelines for the abandonment of wells, which requires all distinct permeable zones penetrated by the wellbore to be isolated from each other and from surface by a minimum of one permanent barrier. If any permeable zone penetrated by the wellbore 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.

In addition to the Oil & Gas UK guidelines for the suspension and abandonment of wells, the well abandonment(s) will be undertaken in accordance with both BSOR1995 and DCR1996.

Prior to any abandonment a full wellbore abandonment programme will be submitted to the HSE and the appointed Independent Well Examiner for review and examination. The wellbore abandonment programme does not form part of the well testing programme.

12.2 Wellsite Restoration

All extractive waste brought to surface will be stored temporarily on site as detailed within Section 7.11 of this Waste Management Plan. No extractive waste brought to surface or non-extractive waste generated at surface shall remain onsite following completion of the operations.

The purpose of the site restoration is to ensure that the wellsite is returned to its former use, in a condition that is as close as reasonably practically possible to its original condition, prior to wellsite construction.

The wellsite will be restored following the abandonment of the boreholes and removal of surface equipment. Full details of the proposed wellsite restoration will be included within the Site Condition Report, which will be submitted as part of an application to surrender the environmental permit.

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. 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

7. Environment Agency. (2021). *Waste Classification [Guidance on the classification and assessment of waste.* 1st Edition v1.2 GB]
   Available at:
   https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1021051/Waste_classification_technical_guidance_WM3.pdf

8. The Waste (England and Wales) Regulations 2011
   Available at: https://www.legislation.gov.uk/uksi/2011/988/contents/made

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

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

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

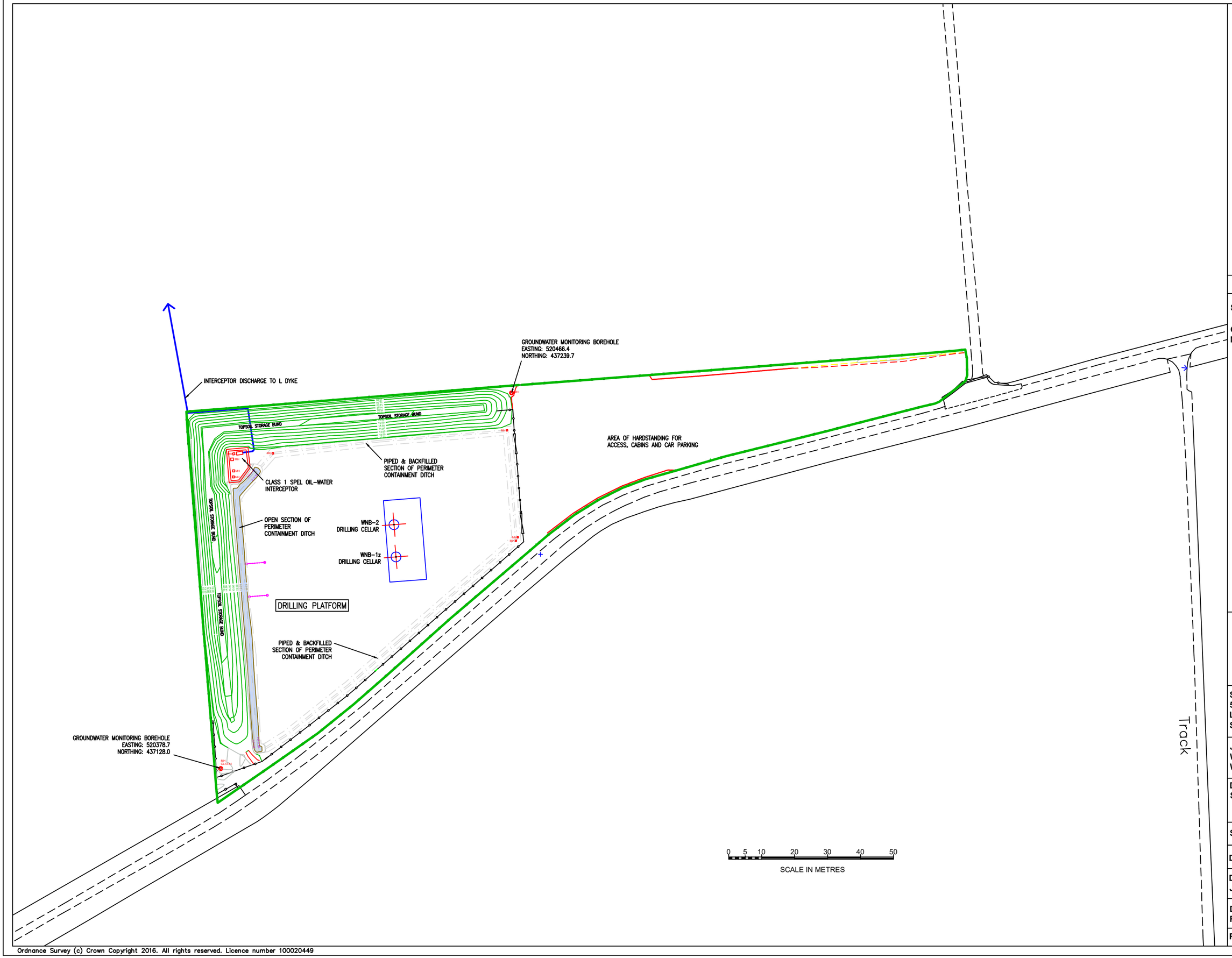
12. Water Resources Act 1991
    Available at: https://www.legislation.gov.uk/ukpga/1991/57/contents

13. Environment Agency. (2018). *Use of acid at oil and gas exploration and productions sites.*
    Available at: https://consult.environment-agency.gov.uk/onshore-oil-and-gas/onshore-oil-and-gas-regulation-information-page/supporting_documents/Acidisation%20FAQs%20January%202018.pdf

Page Left Blank Intentionally

APPENDIX 1 - REGULATED FACILITY BOUNDARY PLAN

Page Left Blank Intentionally



Key:

Site Boundary

Groundwater Monitoring Borehole

Rathlin Energy

Suite 1, 7th Floor
50 Broadway
London
SW1H 0BL

Job Title:
West Newton B Appraisal Wellsite

Drawing Title:
Site Layout Plan (General)

Scale: 1:1,000 (Printed A3)

Date: 17th March 2023

Drawn By:
Jonathan Foster

Drawing No:
RE-EPRA-WNB-SP-004-02

Rev: 1

APPENDIX 2 - CHEMICAL INVENTORY AND WELLBORE SCHEMATIC

Page Left Blank Intentionally

West Newton B Indicative Well Montage

Actual casing depths will vary. This schematic details the minimum and maximum depth each casing string may be set to. This schematic should be used in conjunction with the Chemical Inventory.

CF - Completion Fluid
LCM - Loss Circulation Material
OBM - Oil Based Mud
SS - Salt Saturated Mud
WBM - Water Based Mud

Age	Formation name	Depth (m) TVDSS		Mud system Conclusions	Casing Size	Cement Top	Mud Type: Air	Water Based Mud	Salt Saturated Mud	Oil Based Mud	Completion Fluid
Ground Level		12			Conductor	Cement to surface	X	X			
Qu	Boulder clay			Drill with air / auger or WBM system			X	X			
Upper Cretaceous	Chalk	-30		Drill with WBM with adequate filtercake & allow for use of non-hazardous LCM	Surface	Cement to surface	X	X			
	Carstone Fm	-491		Use WBM / SS system	Intermediate	Cement to >100m within surface casing		X	X		
Jurassic	Lias Group	-495			Production	Cement to >100m within Intermediate casing or top of liner.		X	X		
		-612									
Upper Triassic	Mercia Mudstone			Use OBM system or reduce contact time with drilling mud to as low as possible				X	X		
Lower Triassic	Sherwood Sandstone	-918		OBM preferential for combatting differential sticking. OBM not to be used in geological zones with sufficient porosity & permeability under WMP3. Therefore use WBM / SS mud and design drilling programme accordingly		Producing formation may be left uncemented		X	X		
		-1492									
Upper Permian (Zechstein)	Roxby Fm	-1537		Use OBM system or reduce time formation open to WBM system				X	X	X	
	Sherburn AN	-1543						X	X	X	
	Carnalitic Marl	-1572							X	X	
	Boulby Halite	-1584		Use SS or OBM system					X	X	
	Brotherton Fm			Allow for LCM					X	X	X
	Fordon Evap	-1640		Use SS or OBM system					X	X	
		-1690									
	Kirkham Abbey Formation	-1765		Use higher weight mud system, OBM					X	X	X
	Hayton Anhydrite	-1905							X	X	
	Cadeby Fm	-1944		Allow for LCM					X	X	X
	Marl Slate	-1946		Use OBM or reduce contact time					X	X	
Lower Permian	Rotliegendes	-1968		Allow for LCM					X	X	
Upper Carboniferous	Coal Measures								X	X	
	TD	-2010									

Set Conductor in consolidated Chalk

Set Surface casing between base Chalk & top SS

Set Intermediate Casing between base SS & Brotherton

Set Production Casing / Liner @ TD

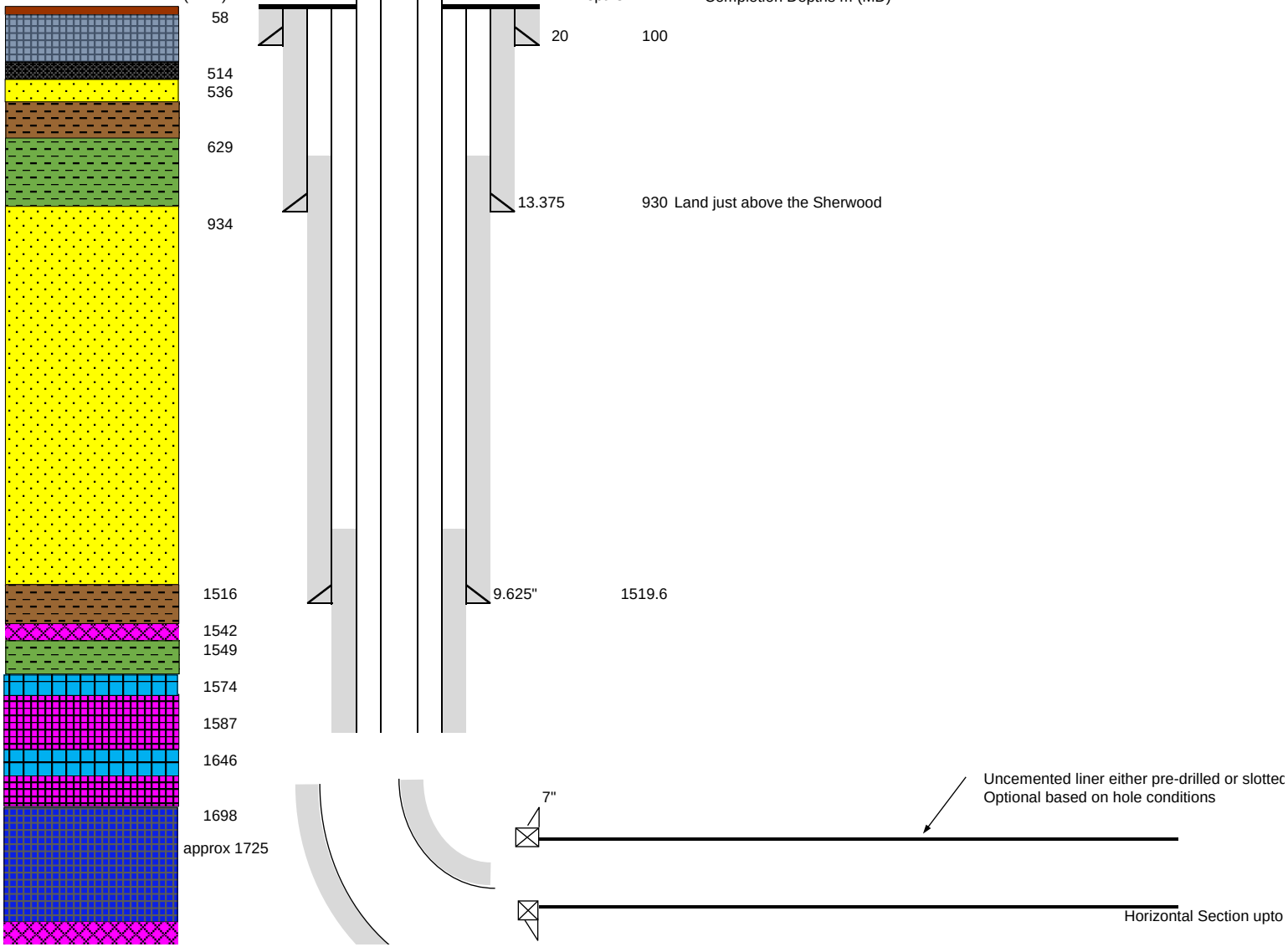
Indicative Well Schematic with a Geological Sidetrack

DEPTH MD (m)	DEPTH TVD (m)	Inc Deg	DOWNHOLE SCHEMATIC	DEPTH MD (m)	DEPTH TVD (m)	Inc Deg	LITHOLOGY
81	81	0					Boulder Clay
							Chalk
562	562	0					Marl Carstone
							Lias Group
							Mercia Mudstone
				974	974	5	
				980	980	5	
			q				Sherwood Sandstone
				1323.5	1311	25	
1560	1505	40		**1538.8**	1494.7	23.9	Roxby
1567	1512	40					Sherburn Anhydrite
							Carnallitic Marl
							Brotherton
							Fordon Evaporite
							Fordon Anhydrite
			Abandoned in line with OEUK Guidelines				Kirkham Abbey
							Hayton Anhydrite
							Cadeby
							Marl Slate
							Rotligendes
				1991	1912	25	
				2111	2025.8	23.7	Coal Measures
				2114	2028.8	23.7	

Rathlin Energy

Indicative Horizontal Wellbore Diagram

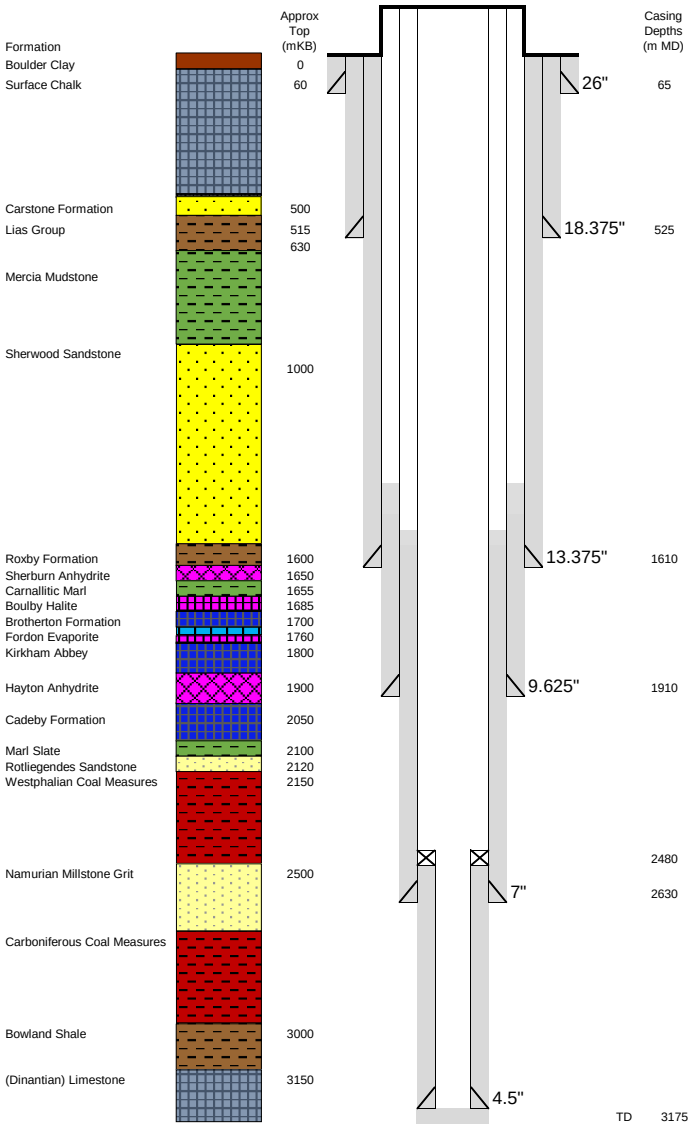
WELL NAME:	West Newton HZ
WELL LOCATION:	



Rathlin Energy

Wellbore Diagram
Constructed Well

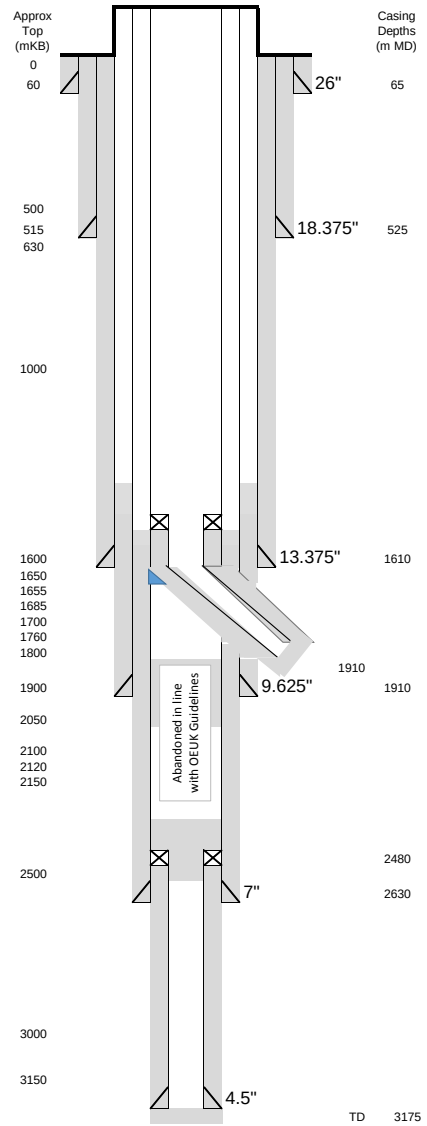
WELL NAME: West Newton A1
WELL LOCATION: West Newton A



Rathlin Energy

Wellbore Diagram
Constructed Well with
Permian Sidetrack

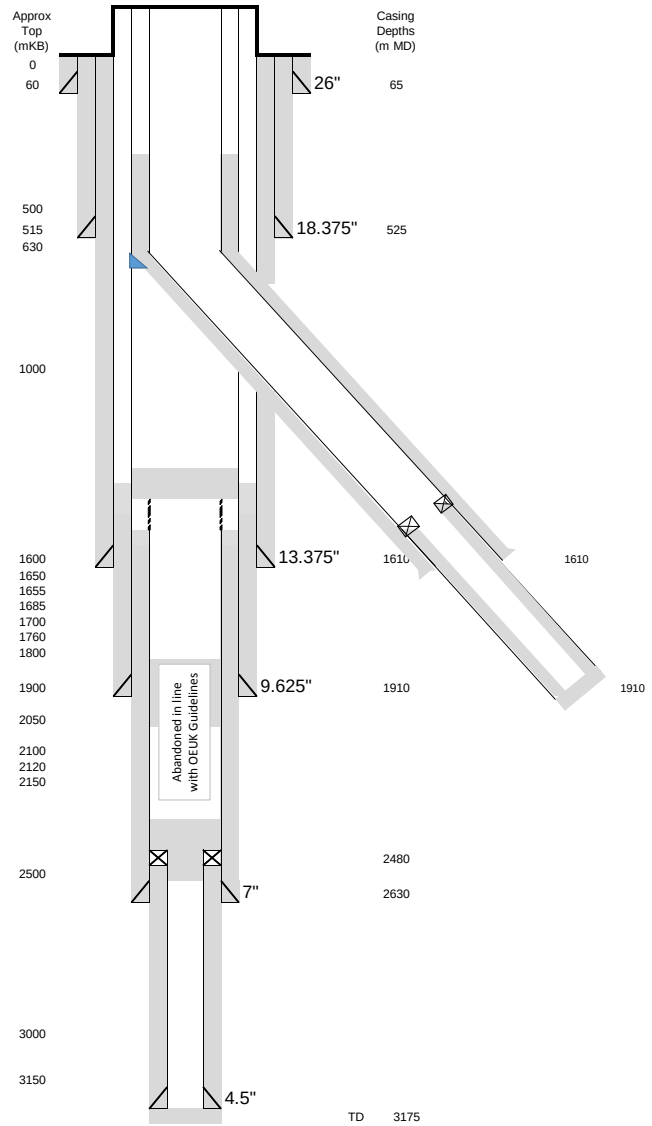
WELL NAME: West Newton A1z
Sidetrack Details: Lower well abandoned as per UKOG guidelines. Whipstock set above 4.5" liner, drilled out & cased in 4.5" liner



Rathlin Energy

Wellbore Diagram
Constructed Well with
Permian Sidetrack

WELL NAME: West Newton A1z
Sidetrack Details: 7" casing cut and pulled and lower wellbore abandoned in accordance with UKOG guidelines. Whipstock set & drilled out of 13-3/8" in Sherwood Sandstone. 7" casing set as per previous casing depth, prior to Permian. Permian



Product Name	UN No	Transport Class	Hazardous Chemical Composition (SDS Section 3)	Weight (%) If Classified	CAS Number	Product Hazard Statement	Results of PBT Assessment	Comments
Water Based Mud System (Includes Additives for Salt Saturated WBM)								
Calcium Chloride	N/A	N/A	Calcium Chloride	60-100	10043-52-4	H319	Not classified as PBT/vPvB by current EU criteria	Weighting agent
Calcium Chloride Brine	N/A	N/A	Calcium Chloride	30-60	10043-52-4	H319	Not classified as PBT/vPvB by current EU criteria	Completion Brine
Caustic Soda	1823	8	Sodium Hydroxide	60-100	1310-73-2	H290 H314	Not classified as PBT/vPvB by current EU criteria	pH modifier
Citric Acid	N/A	N/A	Citric Acid, Monohydrate	100	5949-29-1	H319	Not classified as PBT/vPvB by current EU criteria	pH modifier
Conqor 404NS	N/A	N/A	Salts of Phosphate esters in water	60-100	-	Not Classified	-	pH modifier
Defoam Plus NS	N/A	N/A	No Hazardous Materials	-	-	Not Classified	Not classified as PBT/vPvB by current EU criteria	De-Foamer
Drilling Starch	N/A	N/A	Cold Water Soluble Modified Potato Starch	-	9005-84-9	Not Classified	Not classified as PBT/vPvB by current EU criteria	Fluid Loss Mitigation
Duo-Vis*	N/A	N/A	Glyoxal	<1	107-22-2	Not Classified	Not classified as PBT/vPvB by current EU criteria	Viscosifier - Not to be used in Aquifers.
Dynared (All Grades)	N/A	N/A	No Hazardous Materials	-	-	Not Classified	Not classified as PBT/vPvB by current EU criteria	Loss Circulation Material
Form-A-Blok	N/A	N/A	Wollastonite (Ca(SiO3))	30-60	13983-17-0	Not Classified	Not classified as PBT/vPvB by current EU criteria	Loss Circulation Material
			Cellulose	10-30	9004-34-6	Not Classified		
			Kaolin	5-10	1332-58-7	Not Classified		
			Polyvinyl Alcohol	5-10	9002-89-5	Not Classified		
G-Seal Plus	N/A	N/A	Graphite (Natural)	5-10	7782-42-5	Not Classified	Not classified as PBT/vPvB by current EU criteria	Loss Circulation Material
			Crystalline Silica (Impurity)	<1	14808-60-7	H373		
Kwik-Seal NS Regular	N/A	N/A	Nut Shells	-	-	Not Classified	Not classified as PBT/vPvB by current EU criteria	Loss Circulation Material
			Wood Fibres, Cellulose	-	-	Not Classified		
			Synthetic Fibre	-	-	Not Classified		
			Synthetic Flakes	-	-	Not Classified		
			Wood, Wood Fibres, Ground Hulls or Shells	-	-	Not Classified		
			Mica	-	12001-26-2	Not Classified		
Lime	N/A	N/A	Calcium Hydroxide	60-100	1305-62-0	H315, H318, H335	Not classified as PBT/vPvB by current EU criteria.	pH modifier
MB-5111	N/A	N/A	(Ethylenedioxy)dimethanol	60-100	3586-55-8	H302 H315 H318	Not classified as PBT/vPvB by current EU criteria	Preservative
M-I Gel (Bentonite)	N/A	N/A	Bentonite	60-100	1302-78-9	Not Classified	Not classified as PBT/vPvB by current EU criteria	Viscosifier
			Crystalline Silica (Impurity)	1-5	14808-60-7	H373		
M-I Pac (All Grades)	N/A	N/A	No Hazardous Materials - Poly Anionic Cellulose	60-100	9004-32-4	Not Classified	Not classified as PBT/vPvB by current EU criteria	Fluid Loss Mitigation & Viscosifier
M-I Wate (All Grades)	N/A	N/A	Crystalline Silica (Impurity)	1-5	14808-60-7	H373	Not classified as PBT/vPvB by current EU criteria	Wieghting Agent
Nuosept 78	2810	6.1	2,2',2"-(Hexahydro-1,3, 5-triazine-1,3,5-triyl) Triethanol	78	4719-04-4	H302, H317, H319, H330	Not classified as PBT/vPvB by current EU criteria	Preservative
Nut Shells	N/A	N/A	Crystalline Silica (Impurity)	<1	14808-60-7	H373	Not classified as PBT/vPvB by current EU criteria	Loss Circulation Material
PDV Salt	N/A	N/A	Sodium Chloride	100	007647-14-5	Not Classified	Not classified as PBT/vPvB by current EU criteria	Drilling/Completion Fluid Additive
Polypac(All Grades)	N/A	N/A	Polyanionic Cellulose	60-100	-	Not Classified	Not classified as PBT/vPvB by current EU criteria.	Fluid Loss Mitigation & Viscosifier
Potassium Chloride	N/A	N/A	Potassium Chloride	60-100	7447-40-7	Not Classified	Not classified as PBT/vPvB by current EU criteria.	Drilling/Completion Fluid Additive
Potassium Chloride Brine	N/A	N/A	Potassium Chloride	5-30	7447-40-7	Not Classified	Not classified as PBT/vPvB by current EU criteria	Drilling/Completion Fluid Additive
Pure Bore	N/A	N/A	Non classified proprietary polysaccharide.	-	-	Not Classified	Not classified as PBT/vPvB by current EU criteria	Biodegradable Drilling Fluid
Safe Carb (All Grades)	N/A	N/A	Calcium Carbonate	60-100	-	Not Classified	Not classified as PBT/vPvB by current EU criteria	Lost Circulation Material. Weighting agent. Bridging Material
			Crystalline Silica (Impurity)	<1	14808-60-7	H373		
Safe-Cide	2810	6.1	2,2',2"-(Hexahydro-1,3, 5-triazine-1,3,5-triyl) Triethanol	60-100	4719-04-4	H302 H317 H319 H330	Not classified as PBT/vPvB by current EU criteria.	Biocide
			Tetrasodium Ethylenediaminetetraacetiv	1-5	64-02-8	H302 H318		
			2-aminoethanol	1-5	141-43-5	H302 H312 H314 H332		
Safe Cor*	N/A	N/A	Ethanol, 2,2-oxybis-, Reaction Products with Ammonia, Morpholine Derivatives Residues	30-60	68909-77-3	H319 H412	Not classified as PBT/vPvB by current EU criteria	Corrosion inhibitor
Safe Cor* EN	N/A	N/A	Formaldehyde, reaction products with ethanolamine	10-30	85186-27-2	H302 H315 H317 H319	Not classified as PBT/vPvB by current EU criteria	Corrosion inhibitor
Safe Scav* CA	N/A	N/A	No Hazardous Materials - Sodium Salt of Unsaturated Carbonyl Hexose	-	-	Not Classified	Not classified as PBT/vPvB by current EU criteria	Oxygen Scavenger
Safe Scav* HSN	2810	6.1	Hexahydro-1,3,5-tris(2-hydroxyethyl)-sym-triazine	30-60	4719-04-4	H302 H317 H319 H330 H372	Not classified as PBT/vPvB by current EU criteria	Hydrogen Sulphide Scavenger
			Ethanolamine (Impurity)	<2	141-43-5	H302 H312 H314 H332		
			Formaldehyde (Impurity)	<1	50-00-0	H301 H311 H314 H317 H331 H335 H341 H350		
Safe Scav NA	N/A	N/A	Ammonium Bisulphate	30-60	10192-30-0	H319	Not classified as PBT/vPvB by current EU criteria	Oxygen Scavenger
			Sulphur Dioxide	<1	7446-09-5	H280 H314 H331		
SAPP	N/A	N/A	Disodium Dihydrogen Diphosphate	60-100	7758-16-9	H319	Not classified as PBT/vPvB by current EU criteria	SAPP dispersant. Thinner.
SI-414N	N/A	N/A	Sodium Allysulfonate Copolymer	60-100	68715-83-3	H290 H302	Not classified as PBT/vPvB by current EU criteria	Scale Inhibitor
Soda Ash	N/A	N/A	Sodium Carbonate	60-100	497-19-8	H319	Not classified as PBT/vPvB by current EU criteria	pH Modifier
Sodium Bicarbonate	N/A	N/A	Sodium Bicarbonate	60-100	144-55-8	Not Classified	Not classified as PBT/vPvB by current EU criteria	Drilling/Completion Fluid Additive
Sodium Chloride	N/A	N/A	Sodium Chloride	60-100	7647-14-5	Not Classified	Not classified as PBT/vPvB by current EU criteria	Drilling/Completion Fluid Additive
Sodium Chloride Brine	N/A	N/A	Sodium Chloride	30-60	7647-14-5	Not Classified	Not classified as PBT/vPvB by current EU criteria	Weighting agent. Completion brine
Sugar	N/A	N/A	Sucrose	60-100	57-50-1	Not Classified	Not classified as PBT/vPvB by current EU criteria	Additives
			Crystalline Silica (Impurity)	<1	14808-60-7	H373		

* Duovis will not be used within the Upper Cretaceous Formation which includes the Boulder Clay, Chalk and Carstone Formation. Duovis will be used within the deeper sections of the wellbore at depths below 495m TVDSS.

Product Name	UN No	Transport Class	Hazardous Chemical Composition (SDS Section 3)	Weight (%) If Classified	CAS Number	Product Hazard Statement	Results of PBT Assessment	Comments
Oil Based Mud System								
Barite	N/A	N/A	Barium Sulphate	>93.5	7727-43-7	Not Classified	Not classified as PBT/vPvB by current EU criteria	Weighting agent
			Calcium Carbonate	1.5-2	471-34-1			
Calcium Chloride	N/A	N/A	Calcium Chloride	60-100	10043-52-4	H319	Not classified as PBT/vPvB by current EU criteria	Weighting agent
Caustic Soda	1823	8	Sodium Hydroxide	60-100	1310-73-2	H290 H314	Not classified as PBT/vPvB by current EU criteria	pH modifier
Citric Acid	N/A	N/A	Citric Acid, Monohydrate	100	5949-29-1	H319	Not classified as PBT/vPvB by current EU criteria	pH modifier
Conqor 404NS	N/A	N/A	Salts of Phosphate Esters in Water	60-100	-	Not Classified	Not classified as PBT/vPvB by current EU criteria	Corrosion Inhibitor
Defoam Plus NS	N/A	N/A	No Hazardous Materials	-	-	Not Classified	Not classified as PBT/vPvB by current EU criteria	De-Foamer
Drilling Starch	N/A	N/A	Cold Water Soluble Modified Potato Starch	-	9005-84-9	Not Classified	Not classified as PBT/vPvB by current EU criteria	Fluid Loss Mitigation
Duo-Vis	N/A	N/A	Glyoxal	<1	107-22-2	Not Classified	Not classified as PBT/vPvB by current EU criteria	Viscosifier
Dynared (All Grades)	N/A	N/A	No Hazardous Materials	-	-	Not Classified	Not classified as PBT/vPvB by current EU criteria	Loss Circulation Material
Form-A-Blok	N/A	N/A	Wollastonite (Ca(SiO3))	30-60	13983-17-0	Not Classified	Not classified as PBT/vPvB by current EU criteria	Loss Circulation Material
			Cellulose	10-30	9004-34-6			
			Kaolin	5-10	1332-58-7			
			Polyvinyl Alcohol	5-10	9002-89-5			
G-Seal Plus	N/A	N/A	Graphite (Natural)	5-10	7782-42-5	Not Classified	Not classified as PBT/vPvB by current EU criteria	Loss Circulation Material
			Crystalline Silica (Impurity)	<1	14808-60-7			
Kwik-Seal NS Fine & Regular	N/A	N/A	Wood, Wood Fibres, Ground Hulls or Shells	-	-	Not Classified	Not classified as PBT/vPvB by current EU criteria	Loss Circulation Material
			Mica	-	12001-26-2			
Lime	N/A	N/A	Calcium Hydroxide	60-100	1305-62-0	H315, H318, H335	Not classified as PBT/vPvB by current EU criteria.	pH modifier
LT OBM EDC 95-11	N/A	N/A	Distillates (petroleum), hydrotreated middle (Hydrocarbons, C15-C20, nalkanes,	100	64742-46-7	H304	Not classified as PBT/vPvB by current EU criteria	Base Oil
MB-5111	N/A	N/A	(Ethylenedioxy)dimethanol	60-100	3586-55-8	H302 H315 H318	Not classified as PBT/vPvB by current EU criteria	Preservative
M-I Gel	N/A	N/A	Bentonite	60-100	1302-78-9	Not Classified	Not classified as PBT/vPvB by current EU criteria	Viscosifier
			Crystalline Silica (Impurity)	1-5	14808-60-7			
M-I Pac (All Grades)	N/A	N/A	No Hazardous Materials	-	-	Not Classified	Not classified as PBT/vPvB by current EU criteria	Fluid Loss Mitigation & Viscosifier
M-I Wate (All Grades)	N/A	N/A	Crystalline Silica (Impurity)	1-5	14808-60-7	Not Classified	Not classified as PBT/vPvB by current EU criteria	Wieghting Agent
Nuosept 78	2810	6.1	2,2',2"-(Hexahydro-1,3, 5-triazine-1,3,5-triyl) Triethanol	78	4719-04-4	H302, H317, H319, H330	Not classified as PBT/vPvB by current EU criteria	Preservative
Nut Shells	N/A	N/A	Crystalline Silica (Impurity)	<1	14808-60-7	Not Classified	Not classified as PBT/vPvB by current EU criteria	Loss Circulation Material
Potassium Chloride (KCl)	N/A	N/A	Potassium Chloride	60-100	7447-40-7	Not Classified	Not classified as PBT/vPvB by current EU criteria.	Drilling/Completion Fluid Additive
Safe Carb (All Grades)	N/A	N/A	Calcium Carbonate	60-100	-	Not Classified	Not classified as PBT/vPvB by current EU criteria	Lost Circulation Material. Weighting agent. Bridging Material
			Crystalline Silica (Impurity)	<1	14808-60-7			
Safe-Cide	2810	6.1	2,2',2"-(Hexahydro-1,3, 5-triazine-1,3,5-triyl) Triethanol	60-100	4719-04-4	H302 H315 H317 H318 H330 H372	Not classified as PBT/vPvB by current EU criteria.	Biocide
			Tetrasodium Ethylenediaminetetraacetiv	1-5	64-02-8			
			2-aminoethanol	1-5	141-43-5			
Safe Cor*	N/A	N/A	Ethanol, 2,2-oxybis-, Reaction Products with Ammonia,	30-60	68909-77-3	H319, H412	Not classified as PBT/vPvB by current EU criteria	Corrosion inhibitor
Safe Scav* CA	N/A	N/A	No Hazardous Materials	-	-	Not Classified	Not classified as PBT/vPvB by current EU criteria	Oxygen Scavenger
Safe Scav* HSN	2810	6.1	Hexahydro-1,3,5-tris(2-hydroxyethyl)-sym-triazine	30-60	4719-04-4	H302, H317, H319, H330, H372	Not classified as PBT/vPvB by current EU criteria	Hydrogen Sulphide Scavenger
			Ethanolamine (Impurity)	<2	141-43-5			
			Formaldehyde (Impurity)	<1	50-00-0			
Safe Scav NA	N/A	N/A	Ammonium Bisulphate	30-60	10192-30-0	H319 EUH031	Not classified as PBT/vPvB by current EU criteria	Oxygen Scavenger
			Sulphur Dioxide	<1	7446-09-5			
Safe Surf EU	N/A	N/A	2-butoxyethanol	30-60	111-76-2	H302 H312 H315 H318 H332	Not classified as PBT/vPvB by current EU criteria	Cleaning Spacer
			D-Glucopyranose, oligomeric, C8-10 glycosides	5-10	68515-73-1			
Saraline 185V	N/A	N/A	Distillates (Fischer-Tropsch), C8-26 - Branched and Linear	<=100	848301-67-7	H304 EUH066	Not classified as PBT/vPvB by current EU criteria	Base Oil.
SI-414N	N/A	N/A	Sodium Allysulfonate Copolymer	60-100	68715-83-3	Not Classified	Not classified as PBT/vPvB by current EU criteria	Scale Inhibitor
Soda Ash	N/A	N/A	Sodium Carbonate	60-100	497-19-8	H319	Not classified as PBT/vPvB by current EU criteria	pH Modifier
SMS-01	N/A	N/A	2-Butoxy ethanol	50-100	111-76-2	H332, H302, H312, H319, H316	No components within the mixture are identified as a PBT/vPvB substance.	Mutual Solvent
Sodium Bicarbonate	N/A	N/A	Sodium Bicarbonate	60-102	144-55-10	Not Classified	Not classified as PBT/vPvB by current EU criteria	Drilling/Completion Fluid Additive
Sugar	N/A	N/A	Sucrose	60-100	57-50-1	Not Classified	Not classified as PBT/vPvB by current EU criteria	Additives
			Crystalline Silica (Impurity)	<1	14808-60-7			
Truvis	N/A	N/A	Crystalline silica (impurity)	<3	14808-60-7	Not Classified	Not classified as PBT/vPvB by current EU criteria	Viscosifier
Versaclean CBE	N/A	N/A	Fatty acids, tall-oil, reaction products with diethylenetriamine, maleic anhydride, tetraethylenepentamine and triethylenetetramine	60-100	68990-47-6	H315 H317 H336 H412	Not classified as PBT/vPvB by current EU criteria	Emulsifier
			Distillates (petroleum), hydrotreated light	10-30	64742-47-8			
			(2-methoxymethylethoxy)propanol	5-10	34590-94-8			
Versatrol M	N/A	N/A	No Hazardous Componants	-	-	Not Classified	Not classified as PBT/vPvB by current EU criteria	Fluid Loss Mitigation
VG-Supreme	N/A	N/A	Crystalline silica (impurity)	<3	14808-60-7	Not Classified	Not classified as PBT/vPvB by current EU criteria	Viscosifier

Low Toxicity Oil based drilling mud (LTOBDM): Low Toxicity Oil based drilling fluids not be used in shallow aquifer units or in any formation where losses of drilling fluid are expected. In all other circumstances the impact of the use of LTOBM must be determined to be trivial to any groundwater.
The base oil will consist of Group III: low/negligible-aromatic content fluids. This group includes fluids produced by chemical reactions and highly refined mineral oils which contain levels of total aromatics below 0.5% and polycyclic aromatic hydrocarbon (PAH) levels below 0.001%, according to the OGP definition. Additives may include barite, clays, calcium chloride, lignite, lime, brine, emulsifiers and gellants.

Product Name	UN No	Transport Class	Hazardous Chemical Composition (SDS Section 3)	Weight (%) If Classified	CAS Number	Product Hazard Statement	Results of PBT Assessment	Comments
Well Treatment								
Acetic Acid	2790	8	Acetic Acid	60-100	64-19-7	H226 H314	The product is easily biodegradable. The product is not bioaccumulating. **Acute Toxicity - Fish** LC50 96 hours 75 mg/l Lepomis macrochirus (Bluegill) **Acute Toxicity - Aquatic Invertebrates** EC50 95 @ 24h mg/l Daphnia magna **Acute Toxicity - Aquatic Plants**	Acid alternative to HCl or as an admixture with HCl
Butanol	1120	3	n-Butanol	100	71-36-6	H226 H302 H315 H318 H335 H336	Not classified as PBT/vPvB by current EU criteria.	Solvent Treatment
Carbon Dioxide (Liquid)	2187	2	Carbon Dioxide	100	124-38-9	H281	Not classified as PBT/vPvB by current EU criteria	Liquid CO2 Application
Citric Acid	N/A	N/A	Citric Acid Monohydrate	60-100	5949-29-1	H319	This product does not contain any PBT or vPvB substances.	Acid alternative to HCl or as an admixture with HCl
Diesel	1202	3	Diesel	>90	68334-30-5	H 226 H304 H315 H332 H351 H373 H411	Anthracene is not present in this substance at greater than 0.1% (CONCAWE 2010). No other representative hydrocarbon structure were found to meet the PBT/vPvB criteria. This preparation contains no substance considered to be persistent, bioaccumulating nor toxic (PBT).	Filter cake removal
Dissolvine StimWell DDH-P	3267	8	Diethylenetriaminepentaacetic acid, pentapotassium salt	40-50	7216-95-7	H290, H319, H332, H361d, H373	This substance/mixture contains no components considered to be either persistent, bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher.	Chelating Agent / Well Treatment
Formic Acid	1779	8	Formic Acid	>95	64-18-6	H314	Not classified as PBT/vPvB by current EU criteria	Acid Alternative
Hydrochloric Acid	1789	8	Hydrochloric Acid	<15	7647-01-0	H290 H315 H319 H335	Not classified as PBT/vPvB by current EU criteria	Acid Wash / Squeeze
LT OBM EDC 95-11	N/A	N/A	Distillates (petroleum), hydrotreated middle (Hydrocarbons, C15-C20, nalkanes,	100	64742-46-7	H304	Not classified as PBT/vPvB by current EU criteria	Filter cake removal
Methanol	1230	3	Methanol	100	67-56-1	H225 H301 H311 H331 H370	Not classified as PBT/vPvB by current EU criteria	Solvent Treatment
Nitrogen	1977	2	Nitrogen	100	7727-37-9	H281	Not classified as PBT/vPvB by current EU criteria	Nitrogen Lift
Potassium Chloride	N/A	N/A	Potassium Chloride	60-100	7447-40-7	Not Classified	Not classified as PBT/vPvB by current EU criteria.	Drilling/Completion Fluid Additive
Potassium Chloride Brine	N/A	N/A	Potassium Chloride	5-30	7447-40-7	Not Classified	Not classified as PBT/vPvB by current EU criteria.	Drilling/Completion Fluid Additive
PROTEKT 7 Plus	1789	8	Hydrogen Chloride	6.5-7.5	7647-01-0	H302 H314 H318 H371 H402	Not classified as PBT/vPvB by current EU criteria	Acid Wash / Squeeze
			Citric Acid	4-8	77-92-9			
			Acetic Acid	1.5-3	64-19-7			
			Tallowalkylamine Ethoxylates	0.8-1	68213-26-2			
			Formaldehyde reaction products, oleylamine	0.8-1	91728-72-3			
			Prop-2-yn-ol	0.7-1	107-19-7			
			Formaldehyde	0.02-0.05	50-00-0			
			Proprietary antifoam silicone	0.5-1	-			
			Proprietary Dispersants (Protekt 318)	1-2	-			
PROTEKT-14 Acetic Acid	2790	8	Acetic Acid	10-18	64-19-7	H226 H304 H314 H318	Not classified as PBT/vPvB by current EU criteria	Acid Wash / Squeeze
			Water	75-85	7732-18-5			
			1H-Imidazole-1-ethanol, 4,5-dihydro-, 2-nortall-oil alkyl	2-4	61791-39-7			
PROTEKT 15 Plus	1789	8	Hydrogen Chloride	14-16	7647-01-0	H302 H314 H318 H371 H402	Not classified as PBT/vPvB by current EU criteria	Acid Wash / Squeeze
			Citric Acid	7-9	77-92-9			
			Acetic Acid	2-4	64-19-7			
			Tallowalkylamine Ethoxylates	1-3	68213-26-3			
			Formaldehyde reaction products, oleylamine	1-3	91728-72-3			
			Proprietary Antifoam	0.5-1	-			
			Proprietary Dispersants (Protekt 318)	1-2	-			
Protekt 318	N/A	N/A	Lauryl alcohol alkoxylate	10 - 20	68154-97-2	H319	No specific data available. Product is not expected to rapidly degrade. No specific data available. Product is not expected to bioaccumulate in biological tissue. Product has not been tested. Product is not expected to have significant deleterious effects on aquatic organisms, due to the nature of MDI and its interaction with water.	Acid Wash / Squeeze
			Sodium toluene sulphonate	10 - 20	12068-03-0			
			Linear alcohol (c12-13) ethoxylate	10 - 20	160901-19-9			
			Citric acid	1 - 3	77-29-9			
			D,Limonene type(turpene)	1 - 3				
SMS-01	N/A	N/A	2-Butoxy ethanol	50-100	111-76-2	H332, H302, H312, H319, H316	No components within the mixture are identified as a PBT/vPvB substance.	Mutual Solvent
Sobos Gold 08	N/A	N/A	Tetrapotassium pyrophosphate (tkpp)	1-5	7320-34-5	H318	Not classified as PBT/vPvB by current EU criteria	Cleaning additive (degreaser) at surface for the rig and casing.
			Alkylpolyglucoside	5-10	132778-08-06			
Xylene	1307	3	Xylene	60-100	1330-20-7	H226 H304 H312 H315 H319 H335 H336 H360 H373	Not classified as PBT/vPvB by current EU criteria.	Solvent Treatment
			Ethyl benzene	10-30	100-41-4			
			Toluene	0.1-1	108-88-3			