

RISK ASSESSMENT & METHOD STATEMENT (V1.0)

Horizontal Directional Drilling (HDD)

1336-HDD-RAMS-1.0

River Usk Crossing

Newport Docks

DNOC

October 2021



PETER MC CORMACK & SONS LIMITED
DIRECTIONAL DRILLING & UTILITY CONTRACTORS

Safety First

" Peter McCormack and Sons and its senior management team are committed to ensuring that works are carried out safely and that everyone goes home at the end of the day without injury or incident. This document is central to that. Everyone onsite has a responsibility to adhere to the requirements of this document and to protect their own, their colleagues and public safety".



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Ref: 1336-HDD-RAMS-1.0 River Usk Crossing			
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Risk Assessment

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201019-01-04-15-00-00-00 -Marine License Application v3

1336-HDD-1-000-1 Indicative Site Layout

DNOC River Usk Programme

Emergency Spill Response Plan

HDD Frac-Out Emergency Plan

COSHH

Declaration

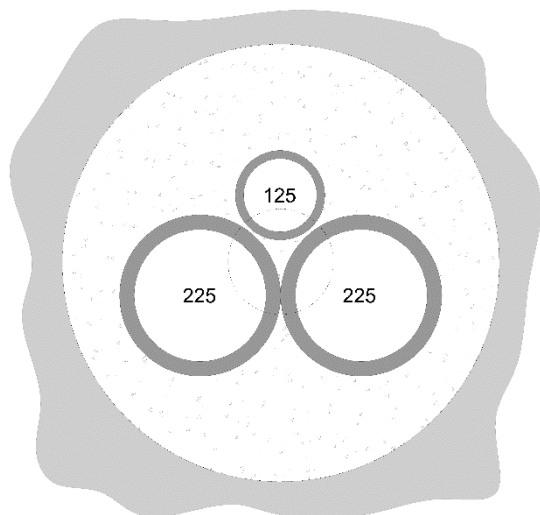
Introduction

1.0 Introduction

The technique of Horizontal Directional Drilling (HDD) was developed specifically to avoid conflict with surface features, and as one of the family of civil engineering techniques known as “Trenchless Technology”, is used to install utility ducts without impact to roads, railways, rivers, canals, and existing utilities etc. In addition, the integrity of cable ducts installed at depth, in solid geology, is considerably enhanced precluding the requirement to re-excavate at regular intervals for repair and restoration.

McCormack Drilling has been commissioned by **DNOC** to install 2no. x 225mm & 1no. x 125mm SDR11 PE black electric cable ducts by means of Horizontal Directional Drilling (HDD) under the River Usk, from land owned and maintained by Associated British Ports (ABP) to a point near The Lodge in Coronation Park – owned by Newport City Council. The works form part of a new cable route which **DNOC** will be installing as part of the Newport Docks Generation project. The new service is required to connect the new (under construction) Waste to Energy Plant for CoGen Ltd to the substation off Traston Road.

A Marine Licence application is required and is being applied for by **DNOC**.



The aim is to execute the works in ways that mitigate the risks and impact on the following, but not limited to: -

- **local community**
- **existing infrastructure & utilities**
- **River Usk and its environs**

Figure 1 – Proposed duct arrangement.

HDD Summary

HDD#	Name	Type	Length	Entry/exit pit size
HDD 1	River Usk Crossing	RVX	360m	3.0m x 3.0m x 1.2m

Figure 2 – Summary of HDD's.

These RAMS apply to all HDD operations to be undertaken. RAMS to be submitted by 3rd parties/other contractors for review by **DNOC** (i.e. Trakway).



All works to adhere to and be carried out with reference to the following reference documents, but not limited to: -

- HDD design drawings
- HDD Scope of Works
- MMO Licence requirements
- ABP (Associated British Ports) requirements
- ENATS 12-24 Technical Specification Issue 3 2014 – Technical Specification for Plastic Ducts for Buried Electric Cables
- HDD Frac-Out Emergency Plan
- Emergency Spill Response Plan
- GPP5 Guidance for Pollution Control (Works & maintenance near water)
- PPG6 Pollution Prevention Guidelines (Working at construction and demolition sites)
- The Construction (Design and Management) Regulations 2015
- HSG 47
- New Roads & Street Works Act 1991
- Traffic Signs Manual (TSM) Chapter 8
- DCA Technical Guidelines
- NJUG
- Construction Phase Plan
- Construction Drawings/Plans
- Relevant DNO Specifications
- Preliminary Ecological Report

All McCormack Drilling personnel to receive a full **DNOC** site induction prior to the commencement of any works.

Drawings (as amended)

- 201019-01-04-15-00-00-00 -Marine License Application v3
- 1336-HDD-1-000-1 Indicative Site Layout
- *Full design pending completion of site specific BH's*

Site Safety Plan

Personal and site safety is always our first consideration on any HDD operation, regardless of importance or scale. This document is aimed at controlling the risks with HDD and establishing safety procedures for, but not limited to the following: -

- | | |
|---------------------------------------|---|
| - Rig Operation | - Noise |
| - Pilot Bore Tracking | - Hand & Power Tools |
| - Utility & Infrastructure Clearances | - Traffic Control |
| - Electrical Strike Protection | - Communications |
| - Rotating Drill Pipe | - Fall Protection |
| - Drilling Fluid System | - Security of Site & Isolation of Hazards |
| - Working on Product Side (Exit) | - Material Handling & Manual Lifting |
| - Handling Loose Drill Pipe | - Highway infrastructure |
| - Making/Breaking Tool Joints | - River Usk |
| - Vehicle Operation | |
| - Trench Shoring & Slopping | |
| - Mobile Equipment Operation | |



2.0 Works Location

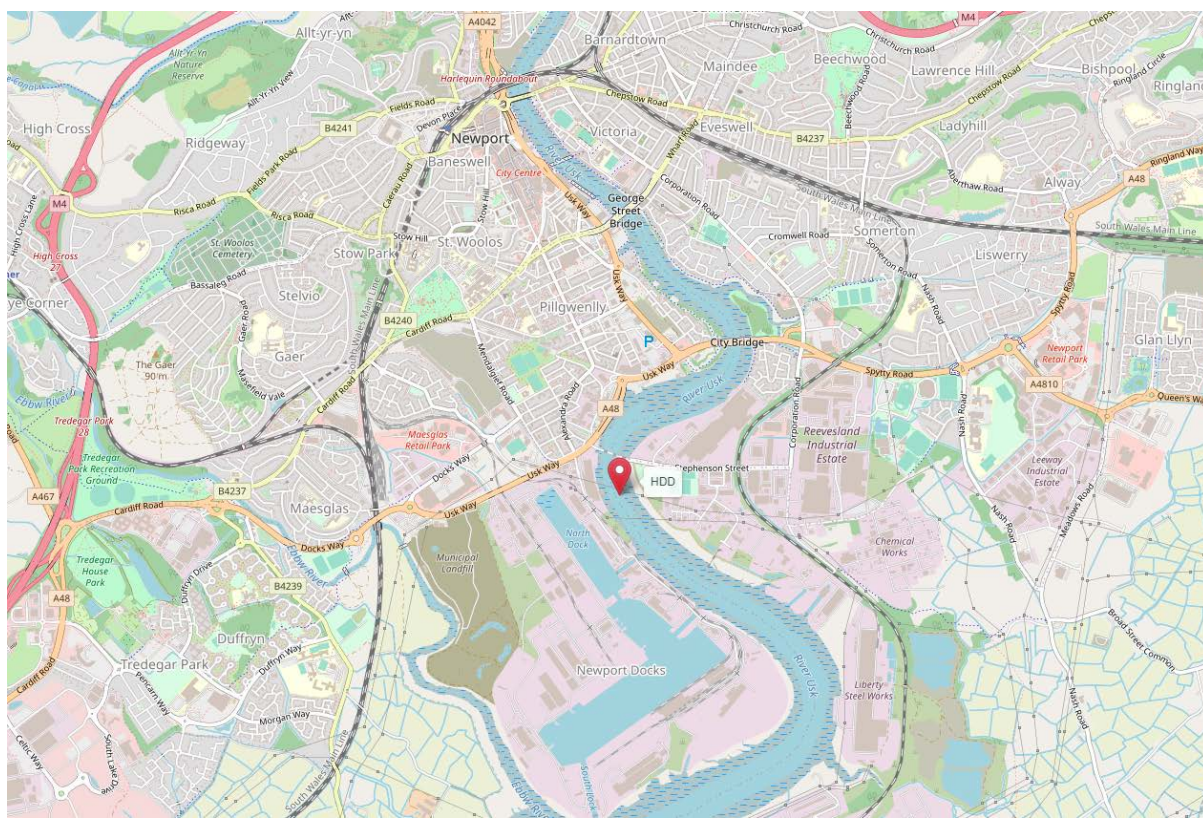


Figure 3 – Overview of HDD 1 in relation to Newport area

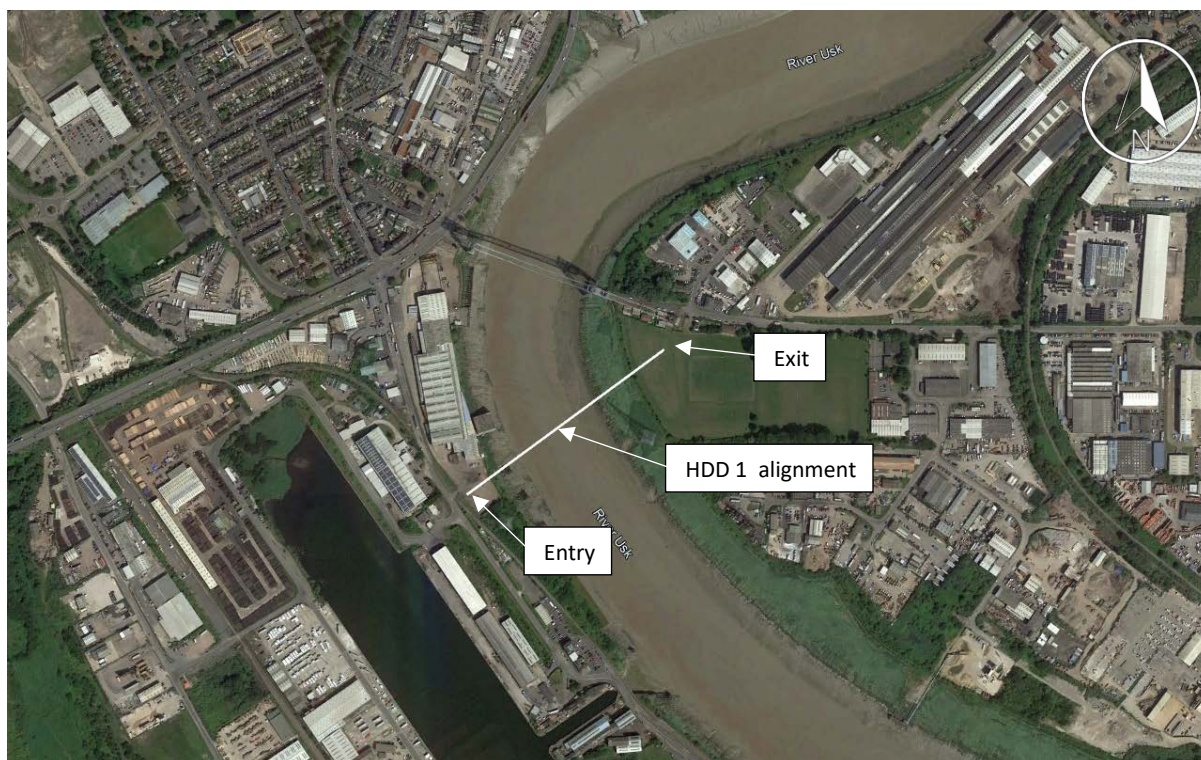


Figure 4– HDD 1 crossing aerial image.



3.0 Geotechnical Information

Geology (From BGS)

The following is an overview of the geology at HDD 1: -

Superficial deposits: Tidal Flat Deposits - Clay and silt. Sedimentary superficial deposit formed between 11.8 thousand years ago and the present during the Quaternary period.

Bedrock geology: Mercia Mudstone Group - Mudstone. Sedimentary bedrock formed between 252.2 and 201.3 million years ago during the Triassic period.

Site-specific Investigation

Site-specific ground investigation will be undertaken by **DNOC** with 2no. x 30m BH's planned.

- BH results to be summarised and included here once available

Summary

An assessment has been made of the anticipated geology for HDD 1 and is based on the geological conditions present in the closest historic BH's and will be confirmed once site-specific BH's are available. The following HDD tooling is proposed: -

HDD#	Down Hole Assembly (DHA)	Hole Opening	Remarks
HDD 1	Mud motor (TBC)	TBC	Pending SI

Figure 5– HDD proposed tooling based on anticipated geology.

A mud motor is a Progressive Cavity Positive Displacement pump (PCPD) placed in the drill string to provide power to the bit while drilling by using the drilling mud to create eccentric motion in the power section of the motor. The mud motor uses different rotor and stator configurations to provide greater horsepower for the desired drilling operation, as the eccentric motion in the power section is transferred as concentric power to the drill bit. The rotation rate of the bit is proportional to the volumetric flow rate of drilling mud through the motor and normal rotation rates are from 60 rpm, to over 150 rpm.

Method Statement



Method Statement

4.0 Emergency Arrangements & Utility Strike Procedures

All site operatives to be inducted by **DNOC**, during which details of emergency arrangements will be outlined. Any incidents on site which affect the health, safety, quality of the service and welfare of employees, visitors, sub-contractors, or members of the public should be reported immediately. If a hazardous situation is suspected, stop work until an evaluation is made and appropriate corrective action is taken.

In the event of any emergency, the following actions will be taken. All operations to cease immediately and shut down all plant so as not to present any further risk to persons present (*make area, equipment & activity safe*).

If first aid is required, a person trained in first aid should carry this out. **DNOC** / Drilling Supervisor / Manager/ Director to be informed as above and take control of the emergency or appoint a responsible person to take immediate control. Area to be made secure and assistance given to emergency services where required. No work will re-commence until authorised by **DNOC**. In event of emergency all Permits and work instructions are suspended. Safe and approved re starting of operations must be approved by PC.

Prevention of COVID-19

Call your GP to be assessed for a test if you have: -

1. A fever.
2. A cough - this can be any kind of cough, not just dry.
3. Shortness of breath.
4. Breathing difficulties.
5. Lack of taste or smell.

You will need to keep self-isolated while you wait for a test and your household will need to restrict their movements. Test results will be given via text. Notify and maintain contact with management updated on your progress or if we need to take additional action.

In rare cases, infection can lead to death. People most at risk of complications are those with a weakened immune system or a chronic disease and older people.

If you are not feeling well:

If you have: -

6. Been in close contact with someone with symptoms.
7. Are not feeling well.
8. You need to self-isolate to prevent other getting sick.

Self-isolate means to stay at home and not attend work. Keep away from others at home as much as you can. Call the doctor if your symptoms get worse. Cover your coughs and sneezes using a tissue and clean your hands afterwards. Do not share a toilet with others. You need to self-isolate if you have symptoms of COVID-19.

Only stop self-isolation when both of these apply to you:

9. You have had no fever for 5 days.
10. It has been 10 days since you first developed symptoms.

If you do have symptoms of coronavirus, phone your GP or local emergency department (ED) without delay. Do not go to the hospital or your doctor contact them by phone.

All personnel who attend a site must wear a face covering. This includes all external and internal areas of the site, offices, meeting rooms and welfare areas.



Personnel are only exempt wearing a face covering when:

11. eating or drinking.
12. at their desk or at meetings where a social distance of 2m is present.
13. in the confines of a cab, when operating plant with prior approval from site management.
14. an existing medical condition prevents it.

Proper hand washing, respiratory hygiene and social distancing remain the most important methods of preventing the spread of the coronavirus. The wearing of face coverings supplements these other precautions.

Response to Electrical Strike

Our rigs are equipped with the ZAPALERT™ alarm system. If the drill makes contact with a power line and becomes electrically charged, the ZAPALERT alarm system will sound a loud, audible signal. The alarm will continue until contact with the electrical line is disconnected.

- If you are on the machine, stay on it.
- Remain calm.
- Reverse the direction of advance to break contact with the electrical line.
- If you are not on the machine, do not touch any part of the machine as it may be highly charged.
- Notify public safety authorities to secure the area.
- Notify the electric utility company immediately.
- When the proper utility authorities verify that the power has been disconnected and the work area is safe, you may get off the machine.

Other workers in the immediate area of the machine should not move. The voltage difference between the equipment and the ground, or between a person's feet may be sufficient to cause injury or death. Do not touch the machine, hoses, drill pipe, water system, mud mixing system or anything connected to the drill as these items may be highly charged. The ZAPALERT alarm may be activated if you break a communication line. However, until you are sure, you must consider the alarm to be an electrical strike. Follow the above procedures and wait for verification from the proper utility authorities.

Response to a Gas Strike

If a gas line strike occurs, evacuate the area immediately. Turn off all engines. Extinguish all flame and sparks immediately. Do not attempt to reverse the bore to break contact as further movement may cause a spark. Contact emergency services and the gas utility company immediately.

Response to a Fibre Optic Strike

If a fibre-optic strike occurs, stop drilling immediately. Do not look into the cut ends of the cable. This can cause severe eye damage. Notify the utility owner.

Response to a Communications Line Strike

If a communications line strike occurs, stop drilling immediately and notify the utility company.

Response to a Sanitary/Storm Sewer and Water Strike

If a water or sewer line strike occurs, stop drilling immediately. Warn all bystanders that a strike has occurred and that they should stay away. Obtain medical attention for personnel who have come into contact with sewage. Notify the utility owner immediately.

**Response to Hydrofracture (Frac-out) – Refer to Frac-out Emergency Plan in Appendix**

If a frac-out occurs, drilling operation to be suspended temporarily and assessment of location and severity to be carried out. DNOC Site Manager to be notified as-soon-as possible. It should be contained as quickly as possible by any one of the measures listed below where applicable: -

- 50 Hessian Sandbags – use to contain sediment, deployed at source around the frac-out location and then this is removed after drying via excavator and dumper or vacuum tanker.
- Straw bales (for watercourse)
- 1 x roll of Polyethylene (to help seal any bund)
- Tractor & vacuum bowser (if frac-out is accessible, extraction of escaped fluid)
- Water Pump – used to extract water containing silt/sediment at source of containment pool-Permit to pump will be issued prior
- Filter Sock – to be attached to end of pump output hose. Where possible utilise vegetation/grass area for additional filtration
- Physical plugging by Loss of Circulation Material (LCM), pumped down borehole to help seal hydrofracture. Products such as Enviro Formfill

5.0 Emergency Contact Numbers

If personnel are unsure about a work instruction, task, or situation, then they should cease what they are doing and seek advice from one of the contacts below.

Name	Company	Contact Number
Caroline McCormack (Director)	McCormack Drilling	Mobile: 07818032739 Office: 02879645902
Fintan McCusker (Technical Manager)	McCormack Drilling	Mobile: 07525668075
Andy Ellis (Project Manager)	McCormack Drilling	Mobile: 07837657167
Martin McCormack (Drill Manager)	McCormack Drilling	Mobile: 07793127111
Scott Williams (Operations Manager)	McCormack Drilling	Mobile: 07740265810
DNOC	DNOC	Office: 01793 861482
Lee Mason (Project Manager)	DNOC	Mobile: 07793815177
Paul Gray (Street Works & Highways))	DNOC	Mobile: 07968124777

Figure 6 – Emergency contact details.

Company/Service	Contact Number	Company/Service	Contact Number
Fire Service / Police / Ambulance	999 or 112	BT/Openreach	0800 023 2023
Welsh Water (Dŵr Cymru)	0800 573553	Virgin	0345 454 1111
Natural Resources Wales	0300 065 3000	Newport City Council	0800 328 4432
National Grid (Electric)	0800 40 4090	Western Power Distribution (WPD)	0800 6783 105 or 105
Wales & West Utilities (24hr)	0800 111 999		

Figure 7 – Emergency contact details for companies/services affected.



6.0 Assembly Points

HDD locations - To site specific requirements/as directed at induction.

7.0 Nearest Accident & Emergency Department



When calling Emergency Services dial 999 or 112

Emergency services will be contacted by dialling 999 or 112 and giving clear instructions and the reason for emergency. Provide details of service required with: Location, incident type, numbers injured (if any), extent of any injuries, details of any existing hazards. Do not end the call first.

Directions from each individual HDD location to the relevant hospital will be displayed at each site and all personnel briefed.

HDD Site Emergency Location Information

HDD 1 – Entry (East Way Road)			
Grid Reference		ST 31685 85856	
Grid x y		331685	185856
Lat / Long	51.567421	-2.9870169	
What3words		socket.tonic.tracks	
HDD 1 Exit (Coronation Park)			
Grid Reference		ST 31997 86081	
Grid x y		331997	186081
Lat / Long	51.569481	-2.9825598	
What3words		zest.jukebox.popped	

Figure 8 – HDD Site Emergency Location Information.

999 <i>Emergency</i>	111 <i>national non-emergency medical number</i>
112 <i>Emergency number. 112 will work on any mobile phone anywhere in the world.</i>	101 <i>non-emergency number for the police</i>



The Grange University Hospital

Telephone: 01633 493100 Address: Llanfrehfa Grange, Caerleon Road, Cwmbran, NP44 8YN

Satellite navigation postcode for hospital **NP20 2UB**

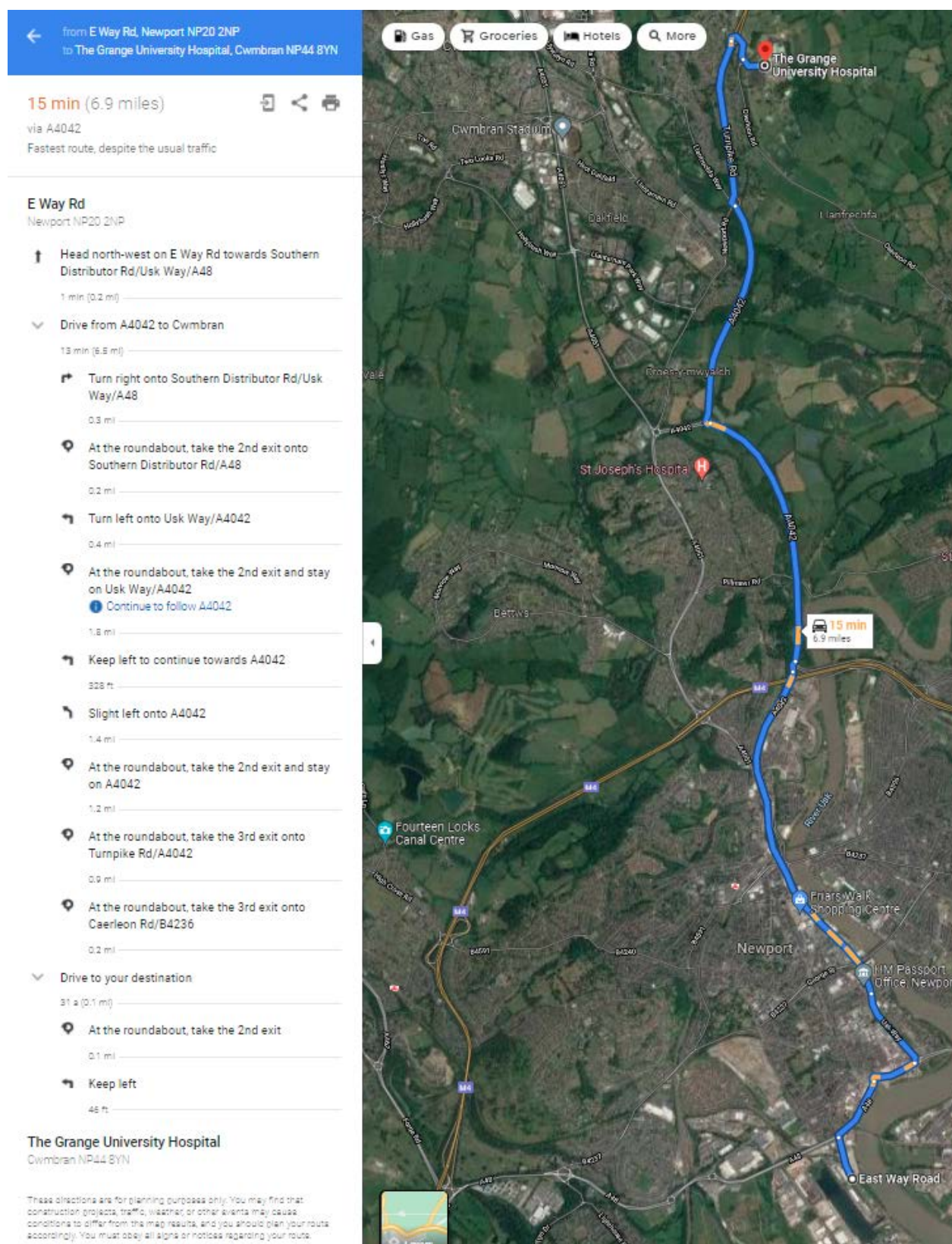


Figure 9 – Emergency Department route details from works



8.0 First Aid, Welfare Facilities & PPE

Toilet and washing facilities will be required at the work site and will be provided by **DNOC** at the main compound. A welfare unit will be provided by McCormacks at the HDD locations. All McCormack drilling vans are equipped with a 10-person First Aid Kit and relevant PPE which are issued freely, regularly checked and maintained by our site supervisor from stocks issued. At least one member of the team will be a First Aid Appointed Person First Aiders will be identified by "First Aid Helmet Stickers".

Personal Protective Equipment (PPE)			
Safety item		Protect against/comment	
	Safety Helmet**	BS EN 397	Impact from objects, plant & machinery
	Overalls**	BS EN 470-1 Flame Retardant	Dermatitis, burns
	High Visibility Clothing**	EN ISO 20471 Class 3	
	Safety Boots**	BS EN 345	Crushing from falling tools, materials, plant movement.
	Safety Glasses**	BS EN 166-F	Ejection of muds and particles. <i>EN166 is low level light protection and where the risk increases so should the level of eye protection.</i>
	Gloves**	BS EN 388 PU Coated Gloves	Dermatitis, leptospirosis cuts & abrasions. <i>Hand protection should reflect the risk and activity</i>
	Hearing Protection	BS EN 352-1 To be available in HDD launch site where required.	Noise of drilling rig & equipment. <i>This should be worn where noise levels reach or exceed the stated thresholds</i>
	Dust Mask	EN149:2001 FFP2 Minimum when handling bentonite	Inhalation of particulates. <i>Operatives wearing respiratory protection should be face fit tested.</i>
High Visibility Clothing		To site specific requirements (additional may be required) ** Denotes mandatory PPE to be worn at ALL TIMES. These are minimum levels of PPE and all such equipment is provided and used relative to the activity and risks including weather	

Figure 10 – PPE.



9.0 HDD Personnel

McCormack Drilling personnel are highly skilled and experienced in the field of HDD and hold all the required training and competency records. Training and qualifications are usually sent via email.

The project team may consist of the following: -

#	Employee Name	Position
1	Steve Rigby 	HDD - Lead Driller
2	Gary Boyle	HDD Operative
3	Reece Boobyer	HDD Operative/Fluid Technician
4	David Lamont	HDD Operative
5	Andy Ellis	Project Manager
6	Kingsley Emerson	Steering Engineer
7	Fintan McCusker	Technical Manager
8	Gabriel Clendinning	HDD Operative/Mechanic
Mon-Sun Dayshift (0700hrs to 1900hrs)		Overtime may be necessary (To be approved)

Figure 11 – Site personnel.

10.0 Precautions & Limitations

Access & egress to be restricted and limited to only those necessary to carry out the works. **Site Specific Risk Assessment** to be carried out every day on site and everyone on site to sign and acknowledge.

Permit to drill to be followed and all reasonably practicable steps to be used to locate any underground services in accordance with **HSG 47** and avoid overhead services in accordance with **GS6**.

No person shall enter an unsupported excavation without prior assessment by a competent person and Temporary Works Design. **TMP** must be followed for construction routes and site access.

11.0 Environmental Issues

Transmission & reception pits to be of sufficient size to hold excess amount of water/drilling fluid to prevent run off during drilling, if necessary, these may be banded or sand bagged.

Spent drilling muds from HDD projects can include a mixed waste of geological formations encountered (drill cuttings), liquid (water), clay (bentonite) plus any additives used, typically soil and stone mixed with bentonite clay. They are usually given the European Waste Catalogue code **EWC 01 05 04 (freshwater drilling muds and wastes)**.

The final quantity of waste is dependent on ground conditions and therefore the Drilling Manager will need to inform the client of the requirements as soon as this is known. All expended drill fluid to be removed from site on completion of the drill by suitable company holding the relevant waste carriers' licence and a copy of the relevant waste transfer documentation made available to **DNOC** including details of certified disposal site information including Waste Management Licence/Permit.

Re-Fuelling

Plant and equipment will be checked for drips and leaks before use and drip trays and spill kits will be available to prevent any subsequent fuel & oil leaks polluting water courses or groundwater. Fuel bowser shall be of a double skin banded type (fuel cube or static tank) and will be positioned on hard standing away from any drains and traffic routes. Spill kit nearby readily available for use if required. Valves and hoses to be checked regularly for signs of wear and leaks. A drip tray will be placed



under the fuelling nozzle to contain any drips/spills during and after fuelling in line with **DNOC** re-fuelling procedure. Any accumulated drips shall be absorbed with pads etc. from the spill kit and bagged up for appropriate disposal. The risk of spilling fuel is greatest during refuelling of plant.

Ecology

Only designated routes are to be used to access the work area as agreed with **DNOC**. **TMP** to be adhered to for construction traffic routes. Works in the vicinity of trees to be carried out in accordance with **NJUG Vol.4** with particular care to be taken of branches when travelling down the access tracks. Ecological (newts, bats, badgers etc.) information to be obtained for each drill location and guidelines/stipulations to be adhered to where necessary. Use Pure Bore/Eco Bore drilling fluid under environmentally sensitive areas if specified.

Noise

Noise and general disturbance levels will be kept to a minimum as far as is reasonably practicable. Work activities to take place during the stipulated working hours where practicable.

Archaeology

Site Team to be made aware of any areas of archaeological significance and associated requirements. Works to be segregated to prevent personnel and machinery/plant interference.

12.0 Plant & Equipment

HDD Rig Specification

American Augers DD440 horizontal directional drill and associated plant to be utilised.

Maximum Thrust/Pullback	Maximum Rotary Torque
440,000 lbs. (200 Tonnes)	60,000 ft-lbs. (81,350 Nm)

Figure 12 – Rig specification.

HDD#	Down Hole Assembly (DHA)	Hole Opening	Remarks
HDD 1	Mud Motor (TBC)	Hole opener & barrel reamer	Pending SI

Figure 13 – Tooling.

Plant	Safety precautions required
American Augers DD440	As per risk assessment
Drill Equipment Trailer	As per risk assessment
Drill Fluid Recycler	As per risk assessment
Drill Fluid Plant & Trailer	As per risk assessment
20 Yard Skip	As per risk assessment
Welfare Unit/Site Office	As per risk assessment
Transit Vans	As per risk assessment
Wireline Guidance System	As per risk assessment
Trimble R10 GPS System	As per risk assessment
Associated Reamers	As per risk assessment
360° Excavators	As per risk assessment

Backhoe Loader (JCB)	As per risk assessment
Radio Communication	As per risk assessment

Figure 14 – Main plant & equipment list.

13.0 Access & Egress

All drilling operations should be supervised by personnel with New-Road and Street Works Act qualifications. Traffic movements to and from site, and between entry and exit points, should be scheduled to minimise impact to the local area. Large loads delivering to the site may and should be aware of local traffic requirements. **DNOC** Traffic Management Plan to be adhered to and access to be agreed.

14.0 Utilities & Infrastructure

The following utility services may be affected by the proposed works: -

- **BT ducts and joint boxes**
- **electric cables**
- **water mains**
- **foul sewers**
- **storm drains**
- **gas mains**
- **cable telecommunications**

Utility drawings to be supplied by **DNOC**. Site to be assessed to the suitability of HDD technique. Prior to any HDD works, & where possible and reasonably practicable, a CAT survey will be undertaken to locate all known existing infrastructure/utilities, parallel runs, and lateral crossings along proposed route of the HDD and obtain depths/position. A risk evaluation will be performed, considering overhead, surface, and subsurface hazards. The site will be examined for indications of possible unmarked utilities. Trial excavations to be undertaken where necessary and carried out in accordance with HSG 47.

After the above measures have been undertaken, a joint survey/walk-over of the proposed HDD route will be undertaken by the site supervisors of **DNOC** and McCormack Drilling team whereby all known crossings/infrastructure locations will be identified and safe separation distances confirmed in relation to proximity of the proposed HDD.

Alternative methods or stakeholder approved means of utility/infrastructure verification may be required; procedures to be agreed by all parties and adhered to where necessary. Permit to Drill and all other relevant pre-start documentation to be issued before commencement of any works.

15.0 Project Preparation

A list of equipment and materials necessary for the proposed HDD has been prepared. Before equipment is dispatched to the job site, it will be serviced, inspected for damage, and repaired as necessary. This includes bits, reamers, swivels, hoses, gauges, etc. Drill pipe will be inspected for damage to the pipe and threads and replaced if necessary. The electrical strike sensing system will be checked to ensure it is in good working condition. Anchoring requirements have been determined. All certification/inspections to be provided to **DNOC** prior to works.

Entry and exit locations to be agreed with **DNOC**. McCormack Drilling will develop a drill profile, considering all physical features such as topography, geotechnical information, existing infrastructure/utilities, and any other relevant information. Parameters such as specific depth targets and pipe bending radii will be considered when developing the HDD bore plan.

A 'Permit to Drill' will be issued and signed by all relevant parties when the drill route has been finalised and agreed. As it is unloaded on-site, the equipment and materials will be checked off against the checklist prepared for the job.

Water Requirements

If required, a metered standpipe and license will be obtained from relevant water supplier in relation to each HDD location. License/permission will be obtained from relevant stakeholder if extraction is from water course, a 20m³ extraction limit per day is permitted by the Natural Resources Wales. Appropriate types and quantities of drilling fluid additives will be on hand, including any special additives or components for dealing with excessive water hardness, high or low pH, or brackish conditions. The pH of the water will be tested using paper strips. Copies of all licenses/permissions to be given to **DNOC**.

16.0 Equipment Set Up, Pre-Start Walkover & Inspection (Mobilisation)

The drill rig will be off-loaded and positioned over the bore centre line at a sufficient distance behind the ground entry point to allow the drill head to level off at the specified depth and location for the near terminal end of the product pipe or cable being installed. This "stand-off" distance is divided into an above-ground portion and a below-ground portion by the ground entry point of the drill string. The above-ground stand-off distance is determined by the entry angle of the drill string, the upper limit of which is defined by bend radius limitations of the product or drill string. A launch pit will be excavated over the entry point using a mechanical excavator to facilitate the containment of drill fluids/solids.



Figure 15 – Surface Coil.

The work areas will be laid out in accordance with **DNOC** specifications and traffic management plans as necessary. Fencing will be installed to restrict access and ensure public and worker safety. The exit areas will be utilised as a pipe staging zone. Prior to drilling, the drilling fluids will be mixed and sufficient quantities will be available to complete the pilot bore, pre- reaming, and reaming passes. The actual quantity of drilling fluids that must be pumped to remove cuttings and maintain a stable open bore will usually exceed the bore volume, sometimes by substantial amounts, depending on ground conditions and other factors.

Surface Coil

ParaTrack 2 is a Surface Wire Tracking System utilising, light gauge wire, and driven by a small hand-held low current power supply. A surface coil will be necessary along the route of the HDD's as part of the operation of the pilot bore guidance system. The steering engineer will undertake a survey of the site in order to establish a wire grid using 10mm² copper cable. A magnetic field, created from current flowing through a coil (wire grid) of known geometry, is modelled in conjunction with away coordinate and compared to probe sensor data, to determine its right and elevation coordinates.

The current is produced by a ParaTrack 2 Guide Wire Power Supply for injecting AC current into the surface wire. The wire grid will be secured with wooden stakes/survey nails and placed where physically safe to do so. The locations of the stakes and wire grid will be recorded with a total station survey or GNSS (GPS). Precautions will be taken (**picture left**) where paths or pedestrians may cross the grid layout; warning signs, walk boards and barriers will be installed where necessary. McCormack supervisor to discuss agreed surface coil layout plan in RAMS with whoever the steering engineer is and undertake a joint walk-over of the site to confirm everybody is cognisant with what is proposed/agreed and aware of any specific restrictions that apply.

Decommissioning – The surface coil and ancillary equipment (wooden stakes & survey nails etc.) will be removed upon



completion of the HDD activities.



Figure 16 – Surface coil secured to road with survey nail & highlighted with spray paint if required.

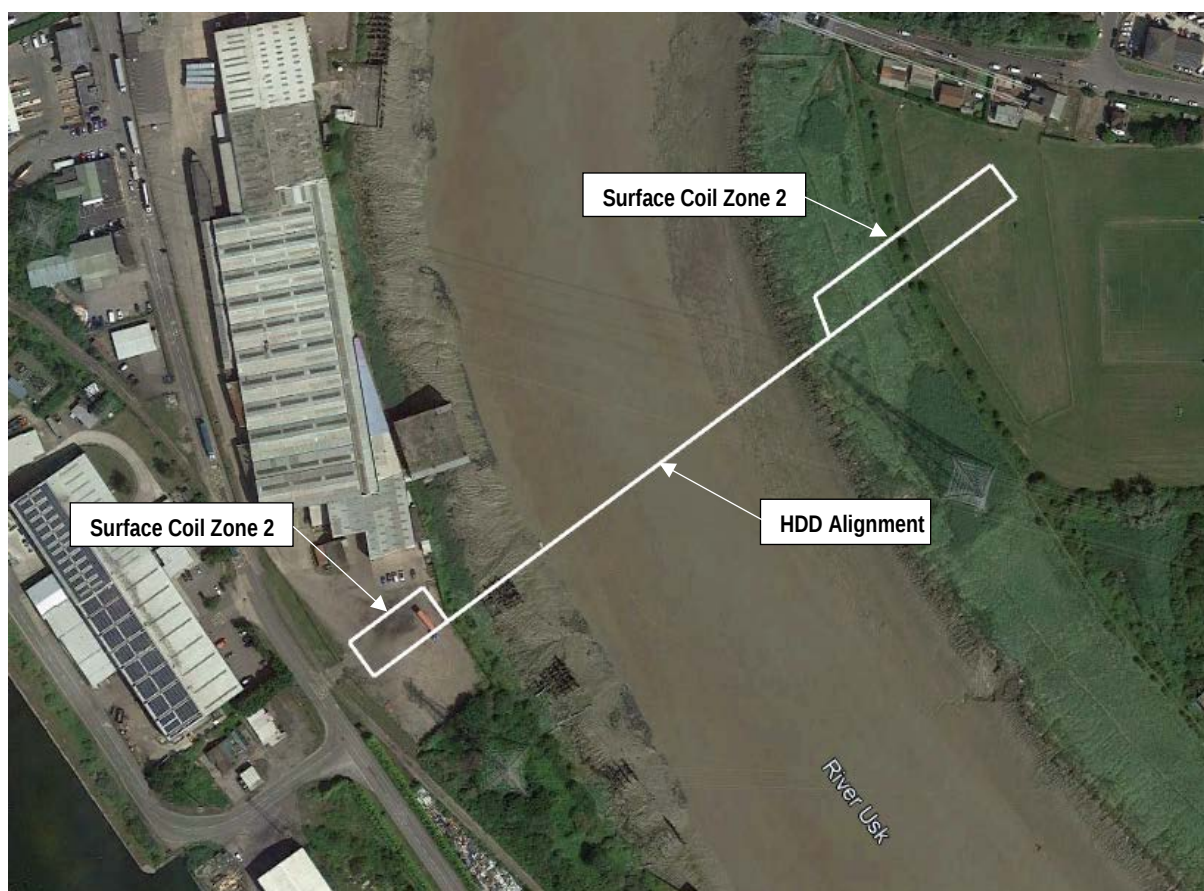


Figure 17 – Indicative surface coil area.



17.0 Pilot Bore & Tracking

HDD#	Down Hole Assembly (DHA)	Remarks
HDD 1	Mud motor (TBC)	Pending SI

Figure 18 – Pilot hole assemblies.

Sequence of Works for HDD

- 1) Conduct daily checks of plant and equipment.
- 2) Review Proposed HDD Profile & Site Layout drawings with entry, exit and points of tangent.
- 3) Undertake walk-over site survey for laying of surface coil.
- 4) Visually inspect location and verify entry point, exit point & alignment coordinates set out with GPS based on approved CAD drawing 3D alignment. The location of the traced pertinent utilities & infrastructure will be checked against the HDD alignment and cross checked with the design.
- 5) Install surface coil and survey location using GPS or total station.
- 6) Connect down hole assembly to rig and 'torque up' to desired settings.
- 7) Test assembly. The ParaTrack-II will be tested before it is placed in the Non-Magnetic Drill Collar (NMDC) by doing a roll test. A 19-point roll test is done to check the ParaTrack-II probe is calibrated to undertake the pilot hole. By doing this roll test the engineer will check Inclination, Azimuth, gTot, bTot & Dip of the ParaTrack-II probe.

HOLD POINT

- 8) Permit to Drill sign-off Client & Drill Manager once items 1 – 7 have been undertaken.
- 9) When the drill rig is properly set up and anchored, and drilling fluids mixed, the pilot bore can be initiated. To make entry of the drill string easier, a small entry pit may be excavated (subject to Permit to Dig being issued). The pit facilitates entry of the bit at the proper angle and helps contain drilling fluids.
- 10) Commence drilling to achieve profile line. At all times throughout the pilot bore the exact x, y and z coordinated position of the Paratrak II probe is known and each reading is plotted on CAD.
- 11) Take a survey reading and log at least every joint length or where required and record.
- 12) The pilot bore will be drilled along the planned alignment from entry to exit.
- 13) The drill head will be tracked by monitoring an electromagnetic signal sent from the transmitter mounted in the drill head via the coil on the surface. The steering engineer determines drill head location and calculated depth, drill head inclination (pitch), and clock orientation of the slanted face (tool face orientation). The drill locator provides the tracking information to the drill rig operator or provides instructions for steering. This real-time data will be checked off against the proposed drawing depths. The objective is to accurately survey the actual location of the drill head as the bore progresses. Appropriate steering inputs can then be made to keep the bore along the designed drill path. Steering corrections should begin promptly when deflections are detected or changes in the bore path's direction are needed. The corrections should be gradual and remain within the allowable bend radius. To avoid over-steering and undulations in the bore path, steering corrections should end just before the correction is completed. It is sometimes necessary to pull the drill head back one or more drill pipe lengths to increase steering response and achieve desired corrections.
- 14) The planned path will have the fewest bends possible. This prolongs drill string life and minimises pullback problems.
- 15) An exit pit will be excavated at the exit point to facilitate containment of drilling fluids and entry of the pipe during pullback operations.
- 16) The drill head may also be retracted when circulation is lost to try to re-establish circulation. During the pilot bore, the surface will be closely monitored for inadvertent drilling fluid returns.
- 17) At the completion of the pilot bore, the assembly will be removed in preparation for reaming/hole opening and an exit pit fluid/solids containment pit will be excavated with a mechanical excavator to design specification. When the hole has



been drilled the assembly is disconnected and stripped down. Excavations are for fluid containment only; no personnel are required to enter any excavations to carry out the works. The drill head will be guided out of the exit excavation with a sling and shackle attached to the excavator. The drill head will be removed at ground level and a reamer will be attached and guided into the exit excavation with the sling and shackle attachment in reverse process of the extraction of the drill head.

- 18) Complete all paperwork and records. As-drilled drawing will be supplied with x, y and z coordinates.

18.0 Reaming/Hole Enlargement

HDD Project design drawings (see Appendix): -

HDD#	Hole Opening	Remarks
HDD 1	Hole opener & barrel reamer	Pending SI

Figure 19 – Hole opening selection.

If the pilot bore is to be enlarged, a reaming/hole opening bit will be attached to the drill pipe and the drill pipe is pressurized to ensure the jets are open. The reamer is then rotated and pulled (or pushed in some cases) back through the pilot bore to enlarge the bore in one or more reaming passes.

The bore will be completed in a number of stages; initially a 170mm pilot hole will be carried out, followed by incremental reaming/hole opening stages. The reaming process is to be carried out in a continuous cycle.

In loose or soft soils, the number of required reaming passes will typically be less than if hard soils or rock are encountered. This is primarily due to torque limitations, cleaning plant capacity, and pump capacity. Reaming may be accomplished by pulling or pushing the reaming tool through the hole. The final bore diameter must be larger than the product diameter to reduce frictional pullback loads and to facilitate flow of the drilling fluids around the product. As a rule of thumb, the final bore diameter should be approximately 1.5 times the diameter of the product pipe.

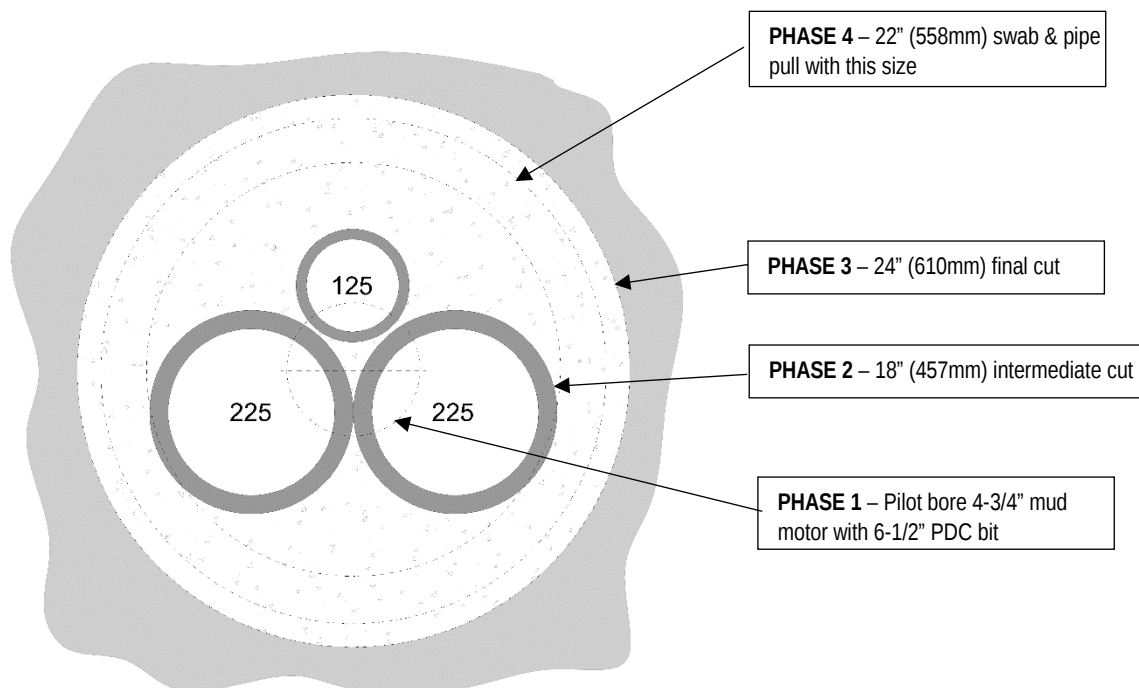


Figure 20 – Reaming phases for HDD's.



19.0 Pipe Preparation

A slip trench should be excavated (refer to specification for excavations) at a suitable angle from the HDD exit pit to enable the least bend radii possible for the duct configuration during pull back operations. The exit areas will be utilised for pipe staging and preparation.

20.0 Pull Back

After fabrication and pre-installation testing have been completed, the product is prepared for pullback. The pull-back operation involves pulling the entire pipeline lengths in one segment back through the drilling mud along the reamed-hole pathway. Proper pipe handling, bending minimization, surface inspection, and fusion welding procedures should be followed. Fuse-on towing heads will be ABF welded onto the end of the ducts. A swivel will be installed between the reamer and the pipe attachment to prevent rotation of the product pipe during pull back. The product must be properly positioned and supported to enter the bore. It may be necessary, where applicable, to support the product on rollers to prevent damage (scratches or gouges) to the product during pipe preparation or pullback. Pull back should be completed without interruption, to reduce risk of becoming stuck in the bore.

21.0 Inadvertent Fluid Returns

Refer to Appendix for: -

- **HDD Frac-Out Emergency Plan**

Geotechnical / Fluid Selection & Pathway Analysis

The main environmental risk regarding a HDD operation is hydro fracture. A hydro fracture or 'frac-out' is the unintentional return of drilling fluids to the surface during HDD. A frac-out occurs when the down hole mud pressure exceeds the overburden pressure (i.e. shallow or loose sections of the bore), or the fluid finds a preferential seepage pathway (such as fault lines and fractures, infrastructure or loose material). These fractures can be natural or induced by over-pressurising the formation. It is relatively common for a frac-out to occur on a HDD project. Most frac-outs, however, are usually minor, within works easements and close to the bore entry or exit.

Generally, frac-out is most likely to occur during the pilot bore or product installation where most of the bore annulus is taken up by pipe. Once punch out at exit point has been achieved, the annular pressure within the bore is relieved. Frac-out during hole opening is therefore much less likely to occur.

Frac-outs are still better avoided as they can have a detrimental effect on the environment, utilise resources, and time in clean-up and reporting. Drilling fluid is comprised primarily of water and approximately 1 to 3% bentonite, a naturally occurring clay mineral, so it is, in most circumstances, a non-toxic, benign fluid (except when suspended within a water body and it can harm ecology). Often, inadvertent fluid returns are more of an eyesore than an environmental catastrophe. Regardless, they can be detrimental to the environment, utilise resources, time in clean-up, reporting, and therefore the risk of inadvertent fluid returns should be reduced through competent design and good practices. Frac-out risk monitoring starts at the planning stage. Our bores have been designed to create as large a radius of curvature as possible within the limits of the site, pipe, and equipment. This design is important in that it will allow the mud returns to flow back to the exit pit and entry pit.

Four main components considered are (i) **Geology**, (ii) **Fluid Design**, (iii) **Hole Opener Selection**, and (iv) **Volume**. These are all synergistic in relation to the prevention of inadvertent returns. McCormack Drilling considers all these aspects at the design stage.

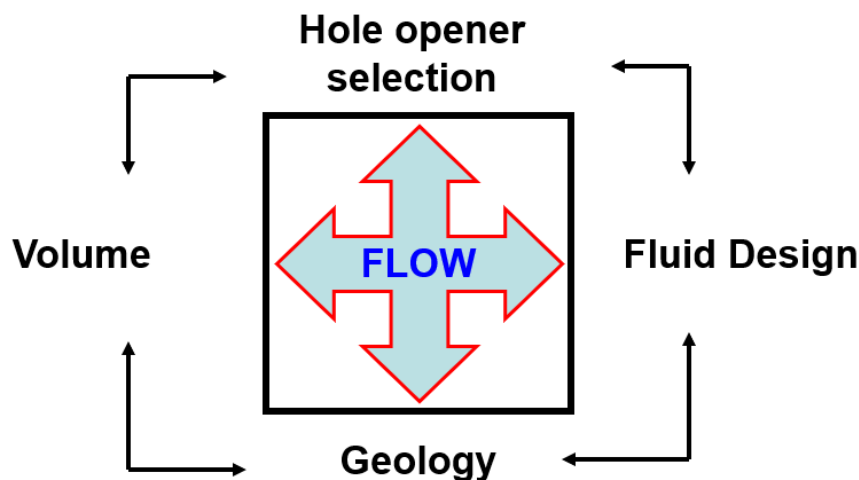


Figure 21 – Drilling processes.

(i) Geology

Refer to various geotechnical information for the HDD.

(ii) Fluid Design

The influence of geology has a major impact on the correct product selection. A fluid system must be designed based on respective geology.

Drilling without the correct bentonite properties will limit the effectiveness of the reamer contributing excessive wear and increase the risk of getting the drill bit stuck. The correct drilling mud will remove cuttings from the borehole because it has the correct viscosity. Viscosity is a fluid's resistance to flow; the greater the resistance, the higher the viscosity. Dependant on ground conditions, it may be necessary to utilise other drilling fluid additives to enhance the performance of the drill fluid.

Key requirements: -

- **Viscosity** Aids transport of drilled cuttings at low annular velocity.
- **Gel Strength** Suspends and supports the drilled cuttings during periods of inactivity.
- **Filter Cake** Controls fluid loss and stabilises the formation.
- **Inhibition** Control clay and shale hydration and prevent bit balling
- **Velocity** Adequate fluid volumes are required to transport the drilled cuttings out of the borehole

Formation	Considerations for Drilling Fluid Design
Clay	- Potential borehole instability
Mudstone	- Potential for excessive torque & drag
	- Suspension & cuttings transport issues
	- Maintenance of flow
	- Adequate pump volumes & cuttings removal
	- Potential for Loss of Returns to Formation
	- Potential for Frac-Out



	- Contingency plans during planning phase is essential - Effective Solids Control	
Drilling Fluid Design – recommended fluid formulation kg/m³		
Product	Tunnel-Gel Plus	27kg/m³
	PAC LV	0.5kg/m³
	Penetrol Dry EU	1.0kg/m³

Figure 22 – Drilling fluid consideration & design.

Soda Ash is an alkalinity agent is a granular powder form of sodium carbonate primarily used to condition and soften make-up water and to raise pH.

Tunnel Gel Max as this is a high yield bentonite designed for use on the larger HDD operations. It has a higher volume of bentonite platelets, promoting rapid viscosity development while maintaining effective borehole stabilization.

PAC-L has been added to enhance the filtration control, maintaining your fluid in the bore through the difficult sands and gravels. PAC-L also has a secondary function of clay inhibition.

Penetrol Dry EU can be added if you find the clay to be of a sticky nature. It will coat anything metallic like your drill pipe, or down hole tooling, preventing bit balling.

(iii) Hole Opener Selection

The hole opening operation is to open the pilot hole to a slightly larger diameter than the product pipe. The percentage oversize depends on many variables including soil types, soil stability, depth, drilling mud etc. Hole openers are essentially a cutting tool, they also mix soil with fluid to form a flowable slurry.

(iv) Fluid Volume

Pump rates & volume will be based on calculations which are derived from the anticipated ground conditions encountered and different stages of the operation. This will be continuously monitored during HDD operations and subject to change.

22.0 As laid Information

Survey to be undertaken for every bore recording depth and any other information deemed relevant for the purposes of future location.

23.0 Demobilisation

After the product is installed, the drill site will be made good to the client's specification. All McCormack Drilling plant shall be removed from site. When the client's representative is satisfied with the demobilisation etc., the 'Job Completion' section of the Permit to Drill should be signed and closed out.

Risk Assessment

Risk Assessment

Safety Measures Implementation	Using all the controls listed above describe clearly how you are going to complete the work: -
	1) Set up site in accordance with CDM regulations & layout drawings (if applicable) 2) Use of trained and competent personnel; certification & competency required 3) On-site supervision & monitoring 4) Permit to Break Ground, Permit to Drill to be followed. Permit issued by Client; to be signed by McCormack Drilling & Client representative 5) Drawings to be approved by Client before commencement of works. 6) All operatives understand, sign & follow RAMS 7) Site Specific Risk Assessment (Daily) or Point of Works Risk Assessment (POWRA) to be completed by McCormack Drilling representative 8) Follow manufacturer's specifications 9) TMP to be followed, site rules to be adhered to and records provided.

Risk Assessed by	Fintan McCusker (Technical Manager)	Risk Reviewed by	Andy Ellis (Project Manager)	Date	04.11.2021
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NOTE: Before commencing this activity ensure that you are familiar with the contents of this risk assessment.

All hazards are categorised by a risk rating score by assessing the severity of a hazard with consideration of how likely it is to occur before any control measures. Control measures are then put in place and the risk is re-assessed to see if the hazard is acceptable. The following table should be used as a guide to identify the likelihood and severity of each hazard:

			Likelihood (L)				
			Very Unlikely	Unlikely	Likely	Very Likely	Definitely
			1	2	3	4	5
Severity (S)	Very Low	1	1	2	3	4	5
	Low / Minor	2	2	4	6	8	10
	Moderate / Significant	3	3	6	9	12	15
	High	4	4	8	12	16	20
	Very High/Catastrophic	5	5	10	15	20	25

Risk Rating	
The risk rating of each hazard must be calculated before and after control measures to see if the hazard is acceptable, further review is required or it is an unacceptable risk and therefore the activity should not proceed. Risk Rating (R) = Likelihood (L) x Severity (S)	
1-5	Low - Acceptable No further control measures required. Monitoring required to ensure that controls in place are properly maintained.
6-10	Medium - Further Review Work shall not be started until the risk has been reduced. Introduce additional control measures.
11-25	High - Unacceptable Risk Work shall not be started until the risk level has been reduced to an acceptable risk level and further control measures implemented. If risk cannot be reduced the activity must not proceed.



#	Hazzard	Persons/item at Risk	Risk	Before Control			Control Measures Required	After Control		
				L	S	R		L	S	R
1	Working adjacent to carriageways	Operatives	Struck by moving traffic	4	5	20	Correct signing lighting and guarding to be in place for all road works and pathways in accordance with <i>Chapter 8: Traffic Signs Manual</i> . Consultation with Local Authority and/or police where traffic routes are to be obstructed or altered. No plant or machinery will be allowed to enter carriageway. Adhere to TMP for access routes and locations. Highways compliant / reflective PPE. Avoid lone working. Walk or drive route every day before works commence and after to check and reinstate TM arrangements as required. All involved should be briefed on the TM arrangements and the importance of them.	1	5	5
2	Mud on carriageway (if required)	Operatives, Public, Vehicles, Cyclists	Skid, slip hazard for road users	4	5	20	Warning signage to be provided on road either side of access to site entrance (CAUTION- Mud on Road). Carriageway to be monitored for cleanliness throughout working hours. Vehicular movements to/from site to be kept to a minimum. Brooms and shovels will be available to clear any debris arising from access/egress from site entrance. Hard standing to be provided consisting of timber bog mats/trackway panels and to be kept clear of mud and debris where possible. Jet wash available on site to clean vehicle wheels.	1	5	5
3	Manual handling of signs and barriers	Operatives	Musculoskeletal injuries	2	4	8	No one person shall lift or move a load greater than 25kg. Materials to be brought to point of use as far as practicable in work vehicle. Assess Load. Substitute human lifting for mechanical lifting.	1	4	4
4	Collision with plant or traffic	Operatives, Public	Impact, crushing	3	5	15	Correct signing lighting and guarding to be in place for all road works and pathways in accordance with <i>Chapter 8: Traffic Signs Manual</i> . Consultation with Local Authority and/or police where traffic routes are to be obstructed or altered. Safe access and egress to site for vehicles, plant and persons should be in place. Site plant and vehicles to utilise flashing beacons. Plant Operatives to be trained and competent. Site Operatives and Supervisor to be trained in accordance with Section 67 of NRSWA. Appropriate Hi-Vis PPE to be worn. Traffic Management to be provided by third party where necessary. Follow TMP. Banksman trained personnel to be utilised where required. Avoid reversing of plant where possible. Safety exclusion zone to be in place. Thumbs Up signalling to be utilised.	1	5	5
5	Driving to and from site	Operatives, public, livestock,	Impact, crushing	2	5	10	Follow TMP. Ensure operatives are aware of the risks of driving on rural roads, adhere to speed limits and respect the needs of local road users and community. Be aware of other road users like pedestrians, horse riders and agricultural vehicles etc. It may be necessary to drive some routes before works start for familiarisation purposes and assessment prior to usage.	1	5	5

#	Hazard	Persons/item at Risk	Risk	Before Control			Control Measures Required	After Control		
				L	S	R		L	S	R
6	Transport of fluids in bowsters/tankers	Operatives, Public	Overtuning, spillage, road traffic accident	2	5	10	Tanker/bowser to be full as far as practicable to minimise load shifting. Travel at speeds appropriate to road, ground, load, and environmental conditions. Ensure tyre pressures are suitable for road, ground, load, and environmental conditions. Visual check on tyre condition to be carried out regularly. Speed limits to be adhered to on public roads and access roads. Adhere to TMP for access routes.	1	5	5
7	Loss of load	Operatives, Public	Overtuning, impact, crushing	2	5	10	Load to be kept as low as possible to the ground. Care must be taken when working on slopes or areas of gradient. Ensure load is secure before lifting, i.e. Pipe coils to have banding in place. Drill rods to be in baskets. No person to walk or stand under a raised load. Certified lifting equipment and exclusion zone around the lifting area.	1	5	5
8	Utilities - underground, overhead lines & infrastructure	Operatives, Public	Injury, damage, disruption to supply	4	5	20	Surface Examination - The works site and the surface along the planned bore should be evaluated for indications of possible underground hazards. Transformer boxes, manholes, surface access furniture, ditch line depressions and signs of recent road or utility repairs may indicate the presence of additional buried utility lines. Refer to HSG 47 Avoiding Danger from Underground Services & GS6 Avoiding Danger from Overhead Power Lines. Ensure all utility plans are present. Proximity distances from identified utilities/infrastructure should be clearly understood. Utility/owner requirements/special conditions incorporated where necessary. Use of CAT locator to mark location of apparatus by trained & competent operative. Trial holes to be undertaken using safe digging techniques. Necessary PPE to be worn. Extreme diligence required in order not to disturb utilities/infrastructure. Consult utility plans and local landowner information for private services. Overhead Hazards - Overhead lines must be avoided if possible. If overhead lines are present, consult with owner for advice on necessary separation and use of demarcation apparatus (goalposts). Overhead lines are of particular concern during mobilisation/demobilisation, loading and unloading heavy equipment and while handling drill pipe. Use banksman when plant is crossing under. Refer to GS6 Avoiding Danger from Overhead Power Lines.	1	5	5
9	Open excavations	Operatives	Falls Plant overturning	4	5	20	Excavations to be closed as-soon-as practicable. Correct signing lighting and guarding to be in place for all excavations. Safe access and egress to site for vehicles, plant and persons should be in place. Stop blocks to be secured for all plant and machinery which need to approach the excavation. Supported	1	5	5



#	Hazzard	Persons/item at Risk	Risk	Before Control			Control Measures Required	After Control		
				L	S	R		L	S	R
							excavations shall be checked daily before any person enters and a record kept. Excavations to be secured. Heras fencing and signage to be checked at the start, duration, and end of each work period.			
10	Excavation Support & Trench Boxes	Operatives, public	Structural stability during excavations, risk of collapse	4	5	20	To maintain the required precautions, a competent person must inspect excavation supports or battering at the start, during and end of each shift. No work should take place until the excavation is safe. Formal inspection to be undertaken once a week and record kept in line with Temporary Works. Follow established ladder safety practices, regulations, temporary works and guidance (HSE – Safe Use of Ladders & Stepladders)	1	5	5
11	Excavator movement / operation	Operatives	Overturning, crushing, impact	4	5	20	Only trained, competent and authorized personnel may operate plant and machinery. When the machine is not in use switch it off and remove keys as this will prevent unauthorised usage. Ensure all round vision is possible on the machine by the way of three-way mirrors one on each side and one at the rear. In tight/enclosed areas use the assistance of banksmen to ensure safe access/egress of the machine and that of personnel. Care must be taken when working on slopes and crossing gradients. Do not lift any items that could overload the machine or lift any items that are unsuitable for the machine to lift. Refer to manufacturer's specification for lifting operations. Ensure all lifting operations are carried out with certified lifting point and equipment. Fire extinguisher and spill kit to accompany excavators. SWL to be indicated on both sides of boom. Banksman to accompany excavator always.	1	5	5
12	Lifting operations	Operatives	Overturning, crushing, impact	4	5	20	No lifting operation to be carried out without a Lifting Plan. Lifting Plan to be issued by trained, experienced, & competent person. Lifting Plan to be reviewed and approved by all relevant parties prior to any lifting operations. Equipment to be used must be able to undertake the proposed lift safely and within the capability of the manufacturer's specification; SWL must be adhered to. Equipment must be tested and certification available for inspection if required. If an excavator is being used for lifting operations, it must be equipped with a blade for extra stability; buckets or other ancillary hitch attachments must also be removed. Persons involved in the lift must be trained, experienced & competent. All lifting operation to be in exclusion zone for lifting and suitably barriered off. If unsure about weights, do NOT undertake the lift and seek guidance.	1	5	5
13	Fall of equipment or materials from height	Operatives	Impact, crushing	2	5	10	Operation to be carried out and supervised by trained and competent persons. Loading / unloading area to be signed and barriered-off. Operation to be carried out on firm stable ground. Lifting equipment and accessories to be checked and test certs available on site. Lifting equipment to have sufficient capacity to carry out the lift. Correct PPE to be worn.	1	5	5

#	Hazard	Persons/item at Risk	Risk	Before Control			Control Measures Required	After Control		
				L	S	R		L	S	R
14	Falls from plant	Operatives	Musculoskeletal injuries	2	5	10	Operatives to use manufacturer's access points only. No persons to ride on plant unless in the seat provided. Door to be closed when in use, shutters to be fitted at end of shift. 'Three points of contact' on entry/exiting plant.	1	5	5
15	Noise from machinery & vehicular traffic	Operatives	Hearing loss, stress	2	5	10	Conduct pre-construction survey and obtain baseline noise levels. Noise from works to be monitored on site when set up is complete and plant is operational. Noise abatement/mitigation measures to be introduced if required – acoustic barriers or strategic placement of plant. Where possible, works will be undertaken at times sympathetic to the local community. All site plant, vehicles, and equipment to be maintained in good working order. Hearing protection to be worn if required. The sound pressure measured according to ISO 11202:1993, ISO 3746:1995, IEC 651:1979 and IEC 804:1985 is 90 dB(A).	1	5	5
16	Use of hand tools	Operatives	Musculoskeletal injuries puncture, impact	2	5	10	Use tools for the job they were intended and in accordance with manufacturer's instructions. Check tools before use to ensure they are in good working order. Broken or damaged tools are not to be used and returned to stores for either disposal or repair. Clean tools after use and return to storage.	1	5	5
17	Contact with hazardous materials	Operatives	Poisoning, dermatitis, burns, respiratory problems	2	5	10	CoSHH assessment to be available to users on site (see COSHH in Appendix in these RAMS), extra information or updates to be delivered at inductions or via toolbox talks (TBT). Users of items considered COSHH to be trained and competent regarding handling, correct PPE, usage, and disposal. Refer to Emergency Spill Response Plan.	1	5	5
18	Failure of hoses or couplings	Operatives	Spillage, ground contamination, water contamination, whip injuries	2	5	10	All hoses and coupling to be inspected before use Damaged or faulty equipment should not be used and should be reported to Drill Manager who will arrange for them to be replaced and or repaired. Whip arrestors should be utilized. Equipment to receive regular maintenance checks.	1	5	5



#	Hazard	Persons/item at Risk	Risk	Before Control			Control Measures Required	After Control		
				L	S	R		L	S	R
19	Manual handling heavy, bulky tools, hoses, and power supplies	Operatives	Musculoskeletal injuries	2	4	8	Individuals to assess object to be lifted or moved with reference to their ability/capacity. <i>Read information on packaging if available. If in doubt seek help or advice on weight of items, lifting capacity and lifting technique.</i> Materials to be brought to point of use as far as practicable in work vehicle or other suitable apparatus. DO NOT undertake lift until clarification is sought.	1	4	4
20	Exhaust fumes	Operatives	Suffocation, choking, nausea	3	5	15	Adequate ventilation to be provided. Engines to be switch off when not in use. Exhausts to be vented away from work areas.	1	5	5
21	Diesel / petrol	Operatives	Spillage, ground contamination, water contamination	2	5	10	COSHH assessment to be available on site. Spillages to be barriered off, banded and cleared as-soon-as practicable. Funnels to be used for refuelling. Drip trays & spill kits to be available on site. Plant nappies to be placed under generators and water pump. Refer to Emergency Spill Plan.	1	5	5
22	Hot Works/ Welding, grinding operations	Operatives	Injury, fire hazard	3	5	15	Trained & competent operatives only wearing welding specific PPE (Fireproof overalls, mask, gloves). Permit to work & specific risk assessment (POWRA) to be undertaken and approved before any hot works are carried out. Welding screen to be used if required. 2no. 9kg dry powder fire extinguisher to be available. Assign another person to 'fire watch'. Remove flammable materials from area and carry out gas atmosphere tests. Generator to be earthed. Do not leave a welder alone in the pit. Ensure adequate ventilation. Have a first aid kit nearby.	1	5	5
23	Electrical equipment	Operatives	Electrocution, injury	3	5	15	Trained and competent operatives only. All electrical equipment to be tested. Equipment to be inspected before use, be fit for purpose, and show evidence of testing. Ensure correctly fused, free of damage, use lowest practicable voltage (110v or less). Ensure RCD when using 230volts. PAT test sticker to be attached to equipment. All other certification to be available for inspection. 230volts to be used only in welfare units/site office. All power tools will be 110volts.	1	5	5
24	Exposure to disease & other potentially harmful substances	Operatives	Ill-health, Weil's disease, tetanus	3	5	15	Cover cuts and abrasions with waterproof plasters and wear gloves. Wash hands before eating and use good hygiene practices. Wash out splashes in eyes with clean water. If experiencing flu-like symptoms with severe headache, seek medical advice. Be aware of the environment you are working in. Farms & agricultural areas may contain poisons or pesticides for spraying etc. Ensure appropriate PPE is worn relevant to task or area.	1	5	5

#	Hazard	Persons/item at Risk	Risk	Before Control			Control Measures Required	After Control		
				L	S	R		L	S	R
							Preventing Lyme disease (Ticks) There is currently no vaccine available to prevent Lyme disease. The best way to prevent the condition is to be aware of the risks when you visit areas where ticks are found and to take sensible precautions. You can reduce the risk of infection by: • keeping to footpaths/trackway and avoiding long grass where possible • wearing appropriate clothing in tick-infested areas (long-sleeved clothing, trousers tucked into your socks and work overalls to be worn) • using insect repellent on exposed skin • inspecting your skin for ticks, particularly at the end of the day, including your head, neck, and skin folds (armpits, groin, and waistband) – remove any ticks you find promptly • making sure ticks are not brought home on your clothes How to remove a tick: - If you find a tick on your or your skin, remove it by gently gripping it as close to the skin as possible, preferably using fine-toothed tweezers. Pull steadily away from the skin without twisting or crushing the tick. Wash your skin with water and soap afterwards and apply an antiseptic cream to the skin around the bite. Do not use a lit cigarette end, a match head, or substances such as alcohol or petroleum jelly to force the tick out. Some veterinary surgeries and pet shops sell inexpensive tick removal devices, which may be useful if you frequently spend time in areas where there are ticks. Horseflies A large, hairy fly whose bite can be extremely painful, the horsefly tends to bite on warm, sunny days, especially the head and upper body. Prevent horsefly bites: The horsefly doesn't spread disease, but as its bite cuts the skin rather than piercing it, horse fly bites are very painful, take longer to heal than other insect bites and can easily become infected, so cover up and use insect repellent.			
25	Animals	Operatives, Public	Injury, disease	2	5	10	Be aware of the environment you are working in. Take care if livestock are present. Check with farmer/owner if unsure. Maintain adequate separation.	1	5	5
26	Working outdoors – weather	Operatives	Land erosion, Ground stability, cold / hypothermia, sun burn	2	5	10	Supervisor to assess each day if works should cease due to adverse weather. Monitor Conditions. Appropriate PPE to be issued and worn. Cold/Rain/Sunshine – Thermal / water protective PPE / UV protection / sunscreen.	1	5	5

#	Hazard	Persons/item at Risk	Risk	Before Control			Control Measures Required	After Control		
				L	S	R		L	S	R
27	Work Site	Operatives	Musculoskeletal injuries, slips, trips and falls	2	5	10	Keep site tidy. Operate a 'don't walk by' policy, if anyone sees a potential hazard, rectify it immediately if safe to do so or inform supervisor. Walkways to be kept clear of obstructions. Use designated storage areas for materials on even ground and do not obstruct emergency routes or access. All employees to be aware of site-specific rules and emergency action plans. Be aware of uneven ground, especially after adverse weather conditions.	1	5	5
28	Security	Operatives, public, plant & equipment	Theft, damage, injury	4	4	16	Location to be assessed for security purposes considering factors such as proximity to schools/children, high crime areas, high value equipment present etc. Evaluation to be undertaken as to whether out of hours security is required. Tower lighting to be provided for low light conditions. Heras fencing to be utilised around excavations and perimeter of the works where practicable to restrict access by third parties. Security operatives to be briefed before starting shift.	1	4	4
29	General Public	Public, especially children	Theft, damage, injury	4	4	16	Working areas secured at all times, entrance gates to be closed after access and egress. Banksman to be utilised for every movement in and out. Security to be provided when personnel are not on site. Perimeter security fencing to be inspected at the start and end of each shift.	1	4	4
30	Damage to Habitat, Flora & Fauna	Local habitats	Disruption and possible damage to plant and animal habitats	2	5	10	Refer to advice contained in site ecology or environmental report if available. Set up exclusion zones where required. Programme works to avoid sensitive seasons for wildlife.	1	5	5
31	Trees	Environment, ecology, habitats,	Damage to trees, habitat	3	3	9	Works in the vicinity of trees to be carried out in accordance with NJUG Vol.4 with particular care to be taken of branches when travelling down the access tracks. All mature trees, treelines and hedgerows to be retained. Refer to the Wildlife & Countryside Act 1981 regarding birds. Refer to BS 5837:2012. Refer to advice contained in site ecology or environmental report if available.	1	3	3
32	Re-fuelling	Environment, operatives	Pollution	4	5	20	Plant and equipment will be checked for drips and leaks before use and drip trays and spill kits will be available to prevent any subsequent fuel & oil leaks polluting water courses or groundwater. Fuel bowser shall be of a double skin bunded type (fuel cube or static tank) and will be positioned on hard standing away from any drains and traffic routes. Spill kit nearby readily available for use if required. Valves and hoses to be checked regularly for signs of wear and leaks. A drip tray will be placed under the fuelling nozzle to contain any drips/spills during and after fuelling in line with Client re-fuelling procedure. Any accumulated drips shall be absorbed with pads from the spill kit and bagged up for appropriate disposal. The risk of spilling fuel is greatest during refuelling of plant. A permit to refuel	1	5	5

#	Hazard	Persons/item at Risk	Risk	Before Control			Control Measures Required	After Control		
				L	S	R		L	S	R
							system will be employed throughout the project to ensure that appropriately trained personnel and equipment are used. COSHH information on site. Refer to Emergency Spill Plan.			
33	Plant Movement	Environment	Land damage	2	5	10	Where works are to be carried out in verge / grass areas, trackway to be installed if required to protect the surface. Turfs to be removed and stored for reuse if possible.	1	5	5
34	Watercourses	Environment	Pollution, threat to ecology	4	5	20	Site to be surveyed and assessed for the presence of watercourses and drainage pathways in relation to the proposed works. Mitigation measures and controls to be in place. A bund may be required around excavations if deemed necessary. Sandbags/tractor & bowser - to be readily available for deployment if required and where necessary. Refer to Appendix for: - Emergency Spill Response Plan	1	5	5
35	Working adjacent to rivers/watercourses	Operatives	Potential drowning	3	5	15	It may be necessary to carry out works near rivers or small watercourses to carry out tasks such as surveying, pilot bore tracking, hydrofracture monitoring and implementing hydrofracture contingencies. Great care must be observed when working in such areas. Where practical, orange barrier fencing should be erected 5m from the edge of the watercourses with 'Danger Deep Water' signage. Minimum 2no. personnel to be present when undertaking works close to watercourses; all personnel to be briefed on rescue procedures. Suitable rescue floatation device with rope attachment to be located close by to ensure swift deployment if necessary. If someone falls into the watercourse, the floatation device should be thrown as-close-as possible to their location so they can take hold and subsequently be drawn back with the rope attachment to bank/solid ground. Where the watercourses are small and walkable (ankle-deep), deployment of sandbags and straw bales can be undertaken physically by operatives as part of the Frac-Out Emergency Plan contingency procedure.	1	5	5
36	Radio Communication	Operatives	Injury to operatives and damage	5	5	25	Communication via two-way radio to be maintained between drill operator and exit site operator. Clear verbal instructions of proposed action to be issued by both parties and acknowledged before taking place. No one is to approach or attempt to work on live drill string until authorised. Emergency Plan in operation. Emergency alarm on-site will be 5no. blasts from air horn at launch site, the exit site team will be notified via radio by the drill operator. All plant to be shut down where possible and personnel to make their way to the site-specific Assembly Point. The same applies in reverse for the exit site to the launch site.	1	5	5

#	Hazard	Persons/item at Risk	Risk	Before Control			Control Measures Required	After Control		
				L	S	R		L	S	R
37	Needles, sharps and drugs paraphernalia	Operatives	Injury, disease	4	5	20	Check working area for needles/sharps and drugs paraphernalia. When working in urban areas the risk of coming into contact with sharps is generally higher than working in rural areas. Wear gloves and take extra care in suspect areas, inform Site Supervisor if you see any needles, sharps and drugs paraphernalia. DO NOT ATTEMPT TO TOUCH, REMOVE OR DISPOSE. In the event of accidental contact with a sharp, squeeze the area around the wound to encourage bleeding. Wash with clean water and dress the wound then seek immediate medical assistance and report the incident to Site Supervisor.	1	5	5
38	Transporting Precautions	Operatives, public	Loss of load,	4	5	20	- Inspect all tractor unit & trailers being used to transport the machine, including but not limited to checking the brakes, tyres, tyre pressure and lights. - Remove or properly secure loose items so they cannot fall off during transport.	1	5	5
39	HDD Rig / Machinery	Operatives, public	Injury, damage	4	5	20	Trained & competent operatives only. Adhere to manufacturer's specification relating to plant operation and maintenance. Wear PPE as directed. Isolate machinery before carrying out maintenance. Ensure all guards are in place whilst operating machine. Do not interfere with any safety precaution devices. Stand clear of moving parts. Do not wear loose clothing or jewellery. Do not use defective machinery. During HDD operation ensure drill is isolated prior to working on drill string. Do not allow anyone to stand near or touch drill whilst in operation. - It is the responsibility of the operator to read, understand, and follow the Operator's Manual and other information provided and use the correct operating procedure. Machines should be operated only by qualified operators and trained helpers. <i>Ensure machinery is serviced and in good working order.</i> - Ensure that all underground utilities have been located before drilling begins and avoid them by using proper drilling techniques. - Assess the situation using common sense and the benefit of experience and proceed if and only if the work can be safely performed. - Understand and obey all applicable local codes and regulations. - Point out each of the safety signs on the machine and ensure that the crew understand them. - Make sure all personnel stay in their prescribed areas. - Ensure that all personnel and objects stay away from rotating or moving parts. - Ensure machinery is adequately fenced off from public. - Never leave the operator's station while the engine is running. - Do not operate the machine while under the influence of alcohol or drugs. - Ensure all safety devices are in place and in working order. - Visually verify all personnel and objects are clear of the machine before start-up. - Turn off the machine at the first sign of malfunction or hazardous condition.	1	5	5



#	Hazard	Persons/item at Risk	Risk	Before Control			Control Measures Required	After Control		
				L	S	R		L	S	R
40	Drilling Precautions	Operatives, Public	Injury, damage	4	5	20	Danger Zones – Safe Distances A danger zone is any zone inside or near the machine where health, safety and security risks exist. All personnel on the jobsite should be advised of these zones, the hazards they may encounter and the safety precautions which are required or recommended. Danger zones to be fenced off and signed where necessary. Hazardous Area: All areas from which a person could touch parts of the machine when it is operating or when maintenance is being performed. Wear appropriate protective equipment. Electrically Charged Safe Distance: 1m perimeter of rig. Personnel in this zone during drilling operations are at risk in the event an electric line is struck. All other personnel must stay out of this zone during drilling or backreaming or any time when an electric line could be struck. Area to be demarcated and fenced off. Identify and avoid potential pinch points on the drill rig and support equipment. Maintain safe clearances between the bore and all utilities. Minimum clearance must take into consideration the final reamed diameter and the bend radius of the pilot bore. Stay away from the rotating drill string at all times. Do not operate the drill when personnel are working on or near the drill string. Do not operate the drill without positive communication with the drill locator or exit side personnel. Operate within the drill pipe manufacturer's specified maximum torque and thrust/pullback capacity of the drill pipe. Do not use drilling machine torque to make or break tool joints outside the machine's wrenches. Do not breakout tool joints with pipe wrenches. Use remote breakout wrenches safety.	1	5	5
41	ZapAlert electrical strike alarm	Operatives, Public	Electrocution	4	5	20	System to be tested prior to HDD operation to manufacturer's specification. Personnel are at risk of serious injury or death if an electric line is struck during drilling. Serious injury or death could occur. All crew members should know the ZAPALERT audible alarm signals and the proper procedures to follow if the drill becomes electrically charged. ZAPALERT is an electric sensing device used on equipment which has a high likelihood of striking an underground energized power line. When drill pipe comes in direct contact with a power line, it becomes charged to the same voltage as the power line. An audible and visual alarm is triggered. Crew members should follow procedures described in "Response to Electrical Strike" in the Method Statement. - Electrical earth ground stake to be located adjacent to drill rig, area to be free of existing utilities/obstructions – use CAT scan and hand-dig trial hole if required. Refer to HSA Cable Avoidance for the installation of the ground stake. - Make sure the ZAPALERT™ system is properly grounded.	1	5	5



#	Hazzard	Persons/item at Risk	Risk	Before Control			Control Measures Required	After Control		
				L	S	R		L	S	R
							- The ZAPALERT ground stake must be installed for the unit to work properly - Once the ground stake has been installed securely, push the test button - Do not operate the machine until ZAPALERT testing is complete and all issues have been satisfactorily resolved. The ZAPALERT alarm may be activated if you break a communication line. However, until you are sure, you must consider the alarm to be an electrical strike. When utility authorities have verified that the drill and associated equipment are no longer energized, retest the ZAPALERT system and set it up properly before resuming drilling operations.			
42	Guidance system & drill head monitoring	Operatives	Damage to infrastructure / utilities, death & serious injury	5	5	25	Guidance systems are electronic devices that enable the bore to be directionally steered on a planned curved path. The guidance devices are installed in the down hole tooling string. They provide drill head location information that the operator uses to steer and make directional changes in the bore. Before beginning the bore, ensure that the guidance system has fresh batteries and has been tested and properly calibrated. Check the location of the drill head frequently to ensure that the bore remains on course. Take care not to exceed the bend radius of the pipe as this will cause damage or breakage. As each drill rod is drilled into the ground the Steering Engineer shall take a reading at least every 6.1 metres or wherever practicable, and inform the drill operator of the location, pitch and roll of the drill head. The operator can then use this information to maintain the pre-planned path of the bore. The accuracy of the drilling is verified by comparing the data of the actual location of the drill bit against the planned drill profile. If there is a difference between the actual and planned location of the drill bit, the operator can correct the actual profile by pulling back to a correct position of the planned profile and begin re-drilling. All steering equipment to be certificated and calibrated prior to commencement. When crossing existing underground utilities, expose the utility at the crossing location and monitor it during crossing. A power line that was safely passed during drilling may be struck on reaming or pull- back. The drill locator should take great care when operating the guidance system, considering topography, undergrowth, roads, and other obstacles which may hinder access.	1	5	5
43	Drill Pipe Handling	Operatives	Injury, crushing	4	5	20	The American Augers DD440T - Drill pipes are contained on a trailer which will be located close to the drill rig. A 9.6m drill rod weighs circa 300kg. Use proper lifting equipment, trained and competent HDD operatives to conduct the operation. Do not stand directly under drill rod during lifting operations. Drill rods should be transported on suitable trailers and strapped down at either end to prevent movement with chains or ratchet straps. <i>Lifting areas to be in an exclusion zone.</i>	1	5	5



#	Hazzard	Persons/item at Risk	Risk	Before Control			Control Measures Required	After Control		
				L	S	R		L	S	R
							Exit Site - During pre-reaming, drill rods may be added to the drill string. Drill rods should be emptied at a suitable location close to the terminal end of the drill string. Individual drill pipes should be lifted mechanically using proper certified apparatus. All appropriate PPE to be worn, especially gloves whilst handling drill pipes. Adhere to radio communication protocol before adding drill pipe to the drill string. Refer to Lifting Plans.			
44	End of Pilot Bore Drilling / Safety Tongs	Operatives	Musculoskeletal injuries	4	5	20	Trained and competent HDD operatives only. 'ALL STOP' procedure to be followed before attachment to drill string, seek permission from drill operator adhering to radio protocol. Maintain verbal contact with personnel at the exit point. Verify that everyone is clear of the exiting pipe. Steer the drill head UP to exit. Plan the exit point so that steer angle is within the minimum pipe bend radius capacity. Assistance can be provided with a mechanical excavator/cranage if required where the drill head is lifted. Verify that everyone is clear of the exiting assembly, the drill head will then be guided out of the exit excavation with the sling and shackle attached to the excavator. If using break-out tongs - always ensure tongs are suitably retained with locking pins to the hydraulic ram to mitigate the risk of separation during operation. Do not break out tool joints with pipe wrenches. Do not work on drill equipment unless all parties are fully conversant of the activity which is about to take place.	1	5	5
45	Reaming/hole opening (forward/back) & pullback	Operatives	Musculoskeletal injuries, entanglement	5	5	25	Unexpected movement or rotation of the drill string can cause death or serious injury. After the completion of the pilot bore, a reamer is used to enlarge the hole so product (cable, tubing, etc) can be pulled back through the hole. The product pipe is isolated from rotation with a swivel and follows the reamer through the bore. Turn off the engine, remove the key. Install the selected reamer using appropriate tools. Install a pullback swivel behind the reamer using appropriate tools. The swivel eliminates twisting the product being pulled back. Some backreamers have the swivel built into them. If you are pre-reaming, install a pulling eye behind the swivel so the drill pipe can be pulled in. This technique prevents the hole from being free of drill pipe throughout the pre-reaming process. Pulling eyes are also used to pull small diameter product (cable, pipe, etc.) into a pilot hole, if product is 2 inches (50 mm) or smaller. Install a product coupler and attach the product to the coupler. Ensure that all exit-side personnel are standing a safe distance from the reamer. Turn on the engine. Activate the mud system to ensure that the reamer jets are open. Slowly pull the reamer back to the pilot hole. Rotate the drill pipe and reamer CLOCKWISE. Slowly pull the reamer into the hole. Advance at a slow rate to ensure the drilling fluid and cuttings mix into a slurry that will flow. Remove each section of pipe from the drill string as it is pulled back. Follow the procedures below. Use a pipe wiper to clean the pipe as it is retracted. Adhere to radio communication protocol throughout.	1	5	5



#	Hazard	Persons/item at Risk	Risk	Before Control			Control Measures Required	After Control		
				L	S	R		L	S	R
46	Ejected muds and debris	Operatives Public	Eye damage, slips	4	5	20	Drilling entry and exit locations to be assessed and where possible safe working zone to be established where there is the potential for ejection of materials during the HDD process. Where this is not practicable then panels should be erected to prevent material being ejected from the work area in to passing traffic, roads, etc. Impact resistant glasses to be worn by operatives. Daily pre-start visual inspection of the pit and surrounding area where the reamer will be travelling, looking for potential debris/objects etc. which could be struck by the rotating tool. When the reamer is passing through exit and entry pit areas, excavator with bucket attachment to be placed over excavations to cover and contain any potential projectiles. Maintain radio communication protocol between exit and entry teams as per risk assessment. No rotation of the reamer is permitted until it is centralized and entirely buried within the existing bore.	1	5	5
47	Drill Fluid Additives (Bentonite)	Operatives Public	Inhalation of particles/dust	4	5	20	Inhalation hazard, dust from drilling fluid additives such as bentonite may irritate the respiratory system or lungs. Prolonged exposure may damage the respiratory system. Use respiratory protection (minimum FFP3 standard) and dust resistant safety goggles. Ensure work area has adequate ventilation. Follow instructions on Material Safety Data sheets and product packaging when working with chemicals. Refer to COSHH.	1	5	5
48	Release of Drilling Fluid	Aquatic environment	Adverse effect on aquatic life	3	3	9	Ensure design is adequate and fit for purpose. Fluid output to be in line with design and calculations. Refer to Frac-out Emergency Plan. Shut down fluid pump as soon as possible upon exit being confirmed.	1	3	5
49	Failure of Drilling Equipment Downhole	Equipment/ project failure	Failure of the bore, time delay	4	5	20	Ensure all equipment is fit for purpose and inspected prior to use in line with manufacturer's specification. Use trained and competent personnel. Monitoring and recording of drilling forces to ensure they are within the tolerances. Ensure sand content is kept to absolute minimum to reduce abrasive wear.	1	5	5
50	Excessive Cuttings	Equipment/ project failure	Equipment getting stuck	3	5	15	Use trained and competent personnel. Monitoring the volume of cuttings removed from the HDD against volume drilled. Drill Operator to monitor pressures and watch for anomalies.	1	5	5

#	Hazard	Persons/item at Risk	Risk	Before Control			Control Measures Required	After Control		
				L	S	R		L	S	R
51	Pipe Stuck During Pullback	Equipment/ project failure	Failure of the bore, time delay	3	4	12	Ensure reamed hole is adequately cleaned to enable installation of product pipe. Monitor installation pressures and forces. Adhere to safe pull limit of product pipe.	1	4	4
52	Pipe Damage During Pullback	Equipment/ project failure	Failure of the bore, time delay	3	4	12	Design to avoid unsuitable ground conditions if possible. Ensure duct is robust, of a suitable SDR/thickness and quality to withstand potential forces. Cleaning run satisfactorily completed before pullback. Monitoring of forces during pullback operations.	1	4	4
53	Inadvertent Returns of Drill Fluid (Frac-Out)	Environment, infrastructure, ecology	Pollution, threat to ecology, disruption. Failure of the bore, time delay	4	4	16	Assessment of ground and design with sufficient depth below surface for expected conditions. Monitoring of drilling fluid returns and volumes to warn of inadequate hole cleaning. Drilling fluid to be of sufficient viscosity and properties for the ground being drilled and cutting size generated. As a contingency, have Lost Circulation Materials available on site to seal any breakout. Grouting if required. Pilot hole stopped in competent ground before exit point and only advanced to exit when reaming to that point is completed. Ensure compliance with best drilling practice at all times. All personnel will be fully briefed on the HDD Frac-Out Emergency Plan, what is expected of them and where the emergency response stations are located. Refer to Appendix for: - HDD Frac-Out Emergency Plan	1	4	4
54	Unthreading of Downhole Equipment	Equipment/ project failure	Failure of the bore, time delay	4	5	20	Competent personnel to be utilised. Drilling technique to maintain consistent torque and avoid over-spinning. Use of cradles to assist in aligning drill rods.	1	5	5
55	Adverse Ground Conditions at Exit	Equipment/ project failure	Loose material, gravel, cobbles at exit causing failure of the bore & time delay	4	5	20	Ground investigation/survey to establish suitability of exit area. Clearing of debris from exit point. Extra swabbing/cleaning of exit point.	1	5	5
56	Adverse Ground Conditions at Entry	Equipment/ project failure	Collapse of soft ground in superficial deposits at entry	4	5	20	Excavate loose material if shallow enough and possible to do so subject to approval. HDD design to drill in optimum ground conditions if possible. Provide casings down to a suitable stratum. Ensure drill fluid design is suitable for the ground conditions encountered.	1	5	5
57	Anchor/Thrust Block Construction	Operatives	Musculoskeletal injuries / burns from concrete	3	4	12	Refer to Code of Practice – Avoiding Damage From Underground Services. Consult drawings, CAT scan and survey area before any excavation works. Excavate thrust block to dimensions specified by HDD engineer. Minimize time between excavation and concrete pour to mitigate against potential	1	4	4



#	Hazard	Persons/item at Risk	Risk	Before Control			Control Measures Required	After Control		
				L	S	R		L	S	R
							collapse of side walls and ensure excavation is signed and guarded. Concrete truck to maintain safe distance as possible from excavation, extra chutes to be utilised if necessary. Once concrete has been poured level with ground, track HDD rig into position (use template if no rig is present) and place front deck on concrete and bed into grooves. Insert steel RSJ or C channel into holes as required to complete set up. WET CEMENTITIOUS PRODUCTS such as concrete, mortar and screed MAY CAUSE SERIOUS BURNS in contact with eyes or skin. You MUST wear the appropriate protective clothing at all times. Contact with wet concrete may cause irritation, dermatitis or severe alkali burns. There is serious risk of damage to the eyes. Wear suitable waterproof protective clothing, gloves and eye / face protection. In case of contact with eyes, rinse immediately with plenty of clean water and seek medical advice. After contact with skin, wash immediately with plenty of clean water. Keep out of reach of children and animals. Contains chromium (VI), may cause allergic reaction.			
58	COVID 19	Operatives, Suppliers, Delivery personnel, Visitors to site.	Spread of disease	3	5	15	There are 2 main routes by which people can spread COVID-19: Infection can be spread to people who are nearby (within 2 metres) or possibly could be inhaled into the lungs. Respiratory secretions produced when an infected person coughs or sneezes containing the virus are most likely to be the main means of transmission. Infection is also possible by touching a surface, object or the hand of an infected person that has been contaminated with respiratory secretions and then touching their own mouth, nose, or eyes (such as touching door knob or shaking hands then touching own face) Operatives - Non-essential personnel are NOT allowed on site. - All personnel must read, sign and comply with this COVID-19 Risk Assessment. - Segregated working groups will be implemented where possible on sites. - Wash hands or use sanitiser after signing in/out of the site (sign in pen will be used by everyone). Where possible, gateman should sign everyone in and out. - Clean and disinfect frequently touched objects and surfaces. - Stagger breaks and keep 2m away from other people as much as possible. - When you cough or sneeze, cover your mouth and nose with a tissue, or your sleeve (not your hands) if you don't have a tissue, and throw the tissue away immediately. Then wash your hands or use a hand sanitising gel. - Wash your hands more often than usual, for 20 seconds using soap and hot water, particularly after coughing, sneezing and blowing your nose, or after being in public areas where people are doing so. Use hand sanitiser if all you have access to. - Stay 2m away from people who are unwell. - Do not touch your eyes, nose or mouth if your hands are not clean. - If disposable cups are being used, please ensure you dispose of them appropriately.	1	5	5



#	Hazard	Persons/item at Risk	Risk	Before Control			Control Measures Required	After Control		
				L	S	R		L	S	R
							- Ensure smoking area is away from designated walkways. Employees are advised of the following simple measures to protect against the spreading of the virus, which includes the following. - Employees to maintain the recommended "social distancing". - Stagger meal breaks to assist with social distancing. - Wash hand regularly. - Practice good respiratory hygiene by covering your mouth and nose with a tissue of your sleeve when you cough or sneeze. - Dispose of used tissues into a bin and wash your hands immediately after use. - Clean and disinfect frequently touched objects and surfaces. - Avoid touching eyes, nose or mouth.			
59	Contaminated ground	Environment, personnel, public	Spread of pollution, potential health risk to humans	4	5	20	Personnel to cease works and notify Site Supervisor if contaminated ground is encountered or suspected. Make affected area safe by securing the perimeter to restrict access by personnel, public, or animals. Specialist may be required to attend site to assess suspected contamination. No works to recommence until instructed by the Client and/or based upon recommendations by specialist.	1	5	5
60	River Usk	River, ecosystem, habitats	Hydro-fracture, pollution	4	5	20	Mitigation pre-works on-site stage - Previous experience of similar projects and design by competent contractor's design team. Ground investigation & analysis. Frac-out analysis and calculations. Background history check of the site. Analysis of potential pathways for fluid escape. Refer to geotechnical and ecological survey reports and any recommendations. If required, consultation with EA hydrogeology team at design stage regarding details of specific layering of deposits. Onsite- Undertake works utilising best drilling practice. No refuelling to take place within 30m of watercourses. All personnel will be fully briefed on the HDD Frac-Out Emergency Plan, what is expected of them and where the emergency response stations are located. Refer to Appendix for: - HDD Frac-Out Emergency Plan & Emergency Spill Response Plan	1	5	5

Appendix

201019-01-04-15-00-00-00 -Marine License Application v3

1336-HDD-1-000-1 Indicative Site Layout

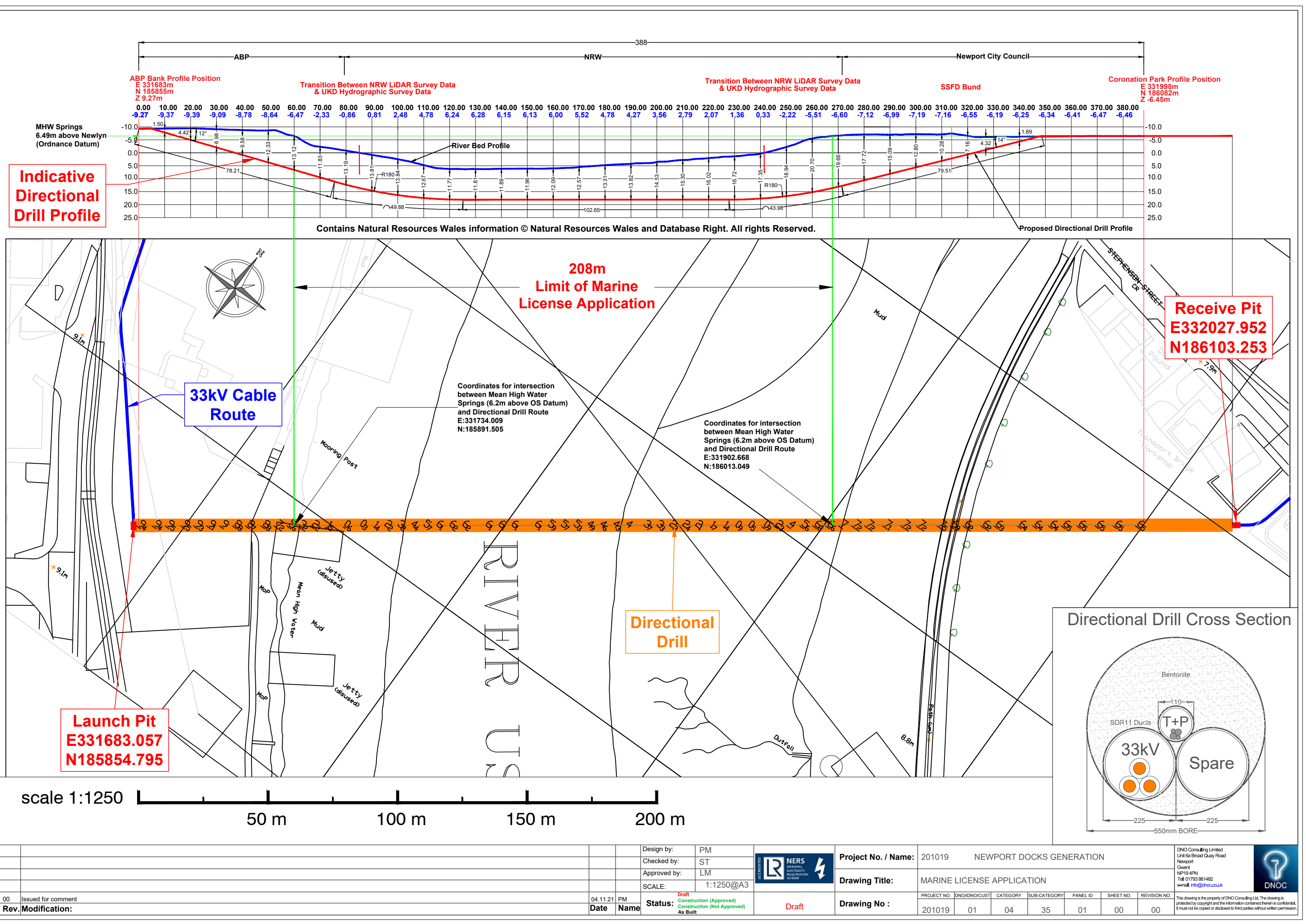
DNOC River Use Programme

Emergency Spill Response Plan

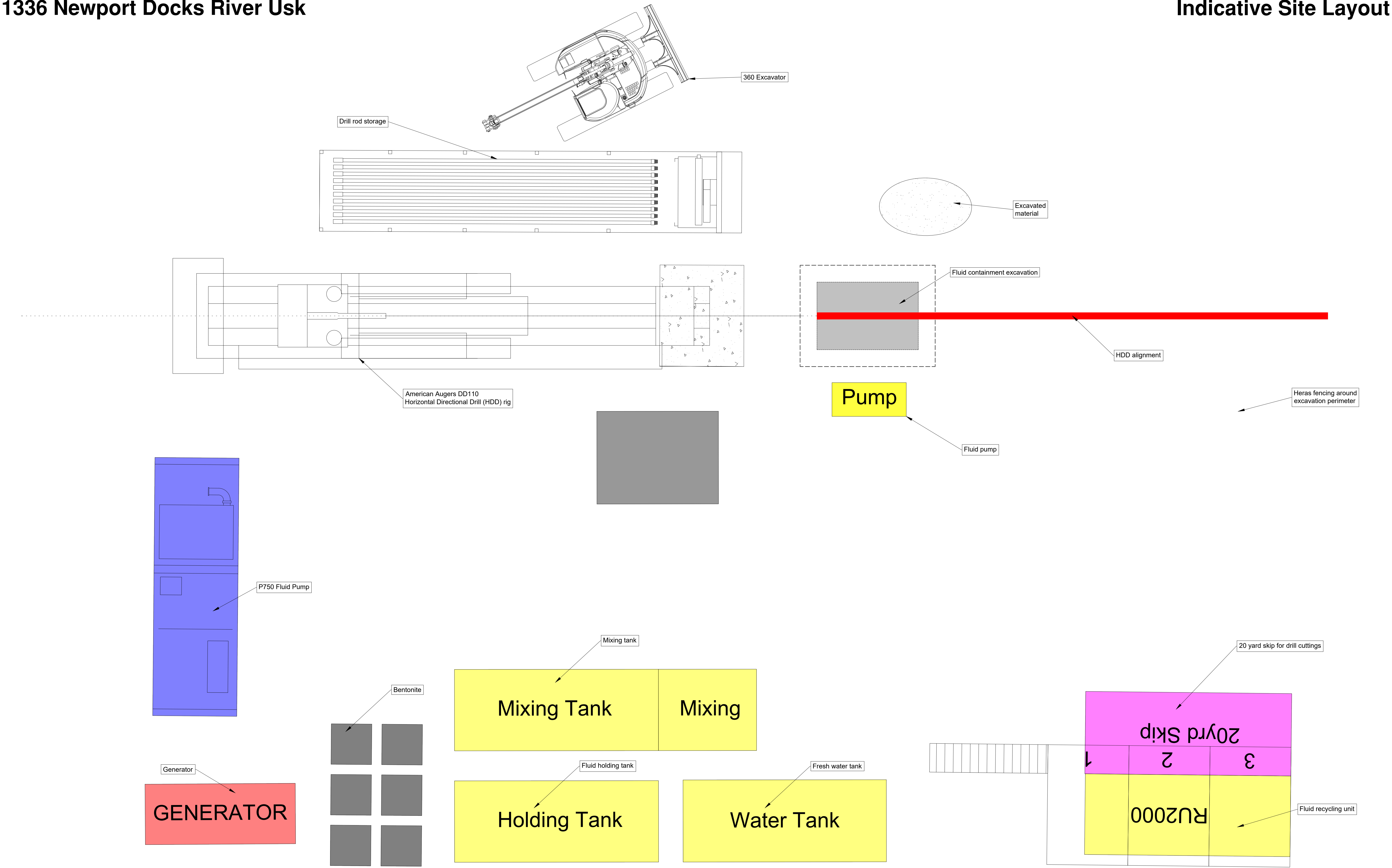
HDD Frac-Out Emergency Plan

COSHH

Declaration



00 Issued for comment		04.11.21 PM	PM	Design by:	PM	PROJECT NO. / Name: 201019 NEWPORT DOCKS GENERATION Drawing Title: MARINE LICENSE APPLICATION Drawing No : 201019 01 04 35 01 00 00	DNO Consulting Limited Unit 6a Broad Quay Road Newport Gwent NP19 4PN Tel: 01793 861482 e-mail: info@dnoc.co.uk DNOC
Rev. Modification:		Date	Name	Status:	As Built		
				Checked by:	ST		
				Approved by:	LM		
				SCALE:	1:1250@A3		



Legends/Notes:

- Entry/Exit Excavation
- Borehole - Project Specific
- Borehole - Historic record
- Trial hole/VacEx Location
- Trakway / Hardstand / Bog Mat
- HDD 1A

Utilities

- Electrical HV
- Electrical LV
- Clean Water
- Telecom
- Gas
- Storm
- Foul Sewer
- Removed
- Abandoned

- Proposed HDD set-up locations are preliminary pending further investigation on-site to determine the location of existing utilities and infrastructure; HDD set-up may be moved accordingly to suit as a result
- All excavations to be carried out with reference to HSG 47 'Avoiding danger from underground services'
- All relevant permissions to be in place prior to commencement of HDD works
- Utility locations to be confirmed
- Site layout to be confirmed at detailed design stage

Rev	Description	Drawn	Approved	Date
000-1	First issue - preliminary	FMC	AE	27.10.2021

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PURPOSE OF ISSUE - PRELIMINARY UNLESS INDICATED

TENDER ☐ APPROVAL ☒ CONSTRUCTION ☐ AS-BUILT ☐ REVISED ☐

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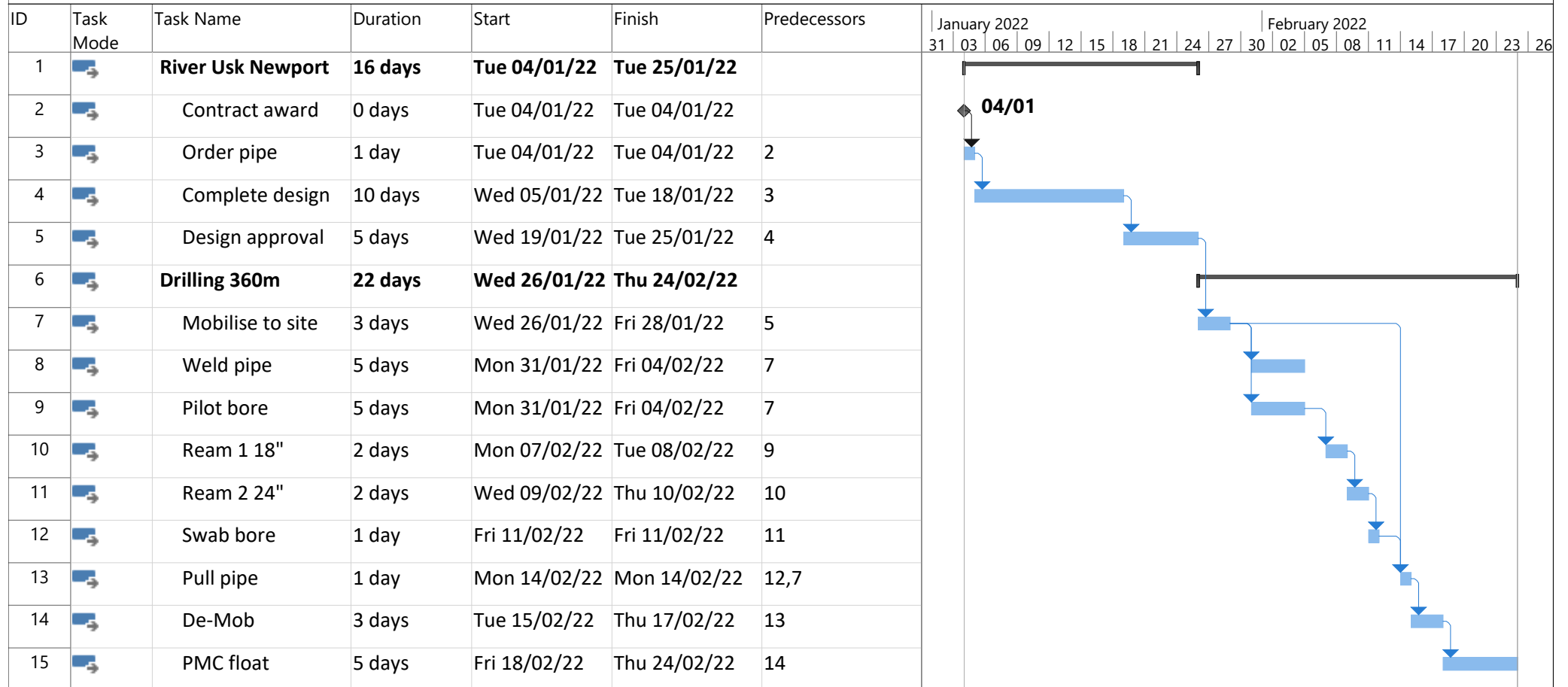
Project/Contract
Dukes Ride

Location
Dukes Ride

Drawn F. McCusker	Checked AE	Approved AE
Date 27.10.2021	Scale 1:50	Size A1

Drawing reference
HDD-1-000-1

DNOC River Usk Newport Docks 360m Directional drill



Project: 1415 DNOC River Usk P
Date: Thu 04/11/21

Task		Inactive Summary		External Tasks	
Split		Manual Task		External Milestone	
Milestone		Duration-only		Deadline	
Summary		Manual Summary Rollup		Progress	
Project Summary		Manual Summary		Manual Progress	
Inactive Task		Start-only			
Inactive Milestone		Finish-only			



Emergency Spill Response Plan

All personnel to be briefed and fully conversant with this **Emergency Spill Response** prior to works commencing. There are four stages to the management of a spill which will be implemented as follows: -

1) Prevention 2) Containment 3) Notify 4) Clean-up

1 Prevention

Many spillages can be prevented. It is important that everyone on site knows how to control a spill to minimise its impact and what preventative measures are in place on their project.

- ✓ Spill kits will be available next to all plant on site
- ✓ *practice annual spill response drills to ensure knowledge of plans and how to use clean-up equipment*

2 Containment

- ✓ if a spill occurs **stop work immediately**
- ✓ if spillage is flammable, extinguish all possible ignition sources
- ✓ If SAFE, stop the source of the spill and raise the alarm to alert people working in the vicinity of any potential dangers. Inform Project Manager immediately.
- ✓ If SAFE, contain the spillage – using the absorbent spill material provided. Do not spread or flush away the spill. Cover or bund off any vulnerable areas where appropriate
- ✓ protect sensitive areas (eg watercourses or surface water drains), and use drain covers or use earth/sand to construct a bund



3 Notify

Notify the Project Manager or the Site Manager and HSQE Manager so that used absorbent material can be disposed of using a specialist contractor. In the event of a significant spill contact the

4 Clean-up

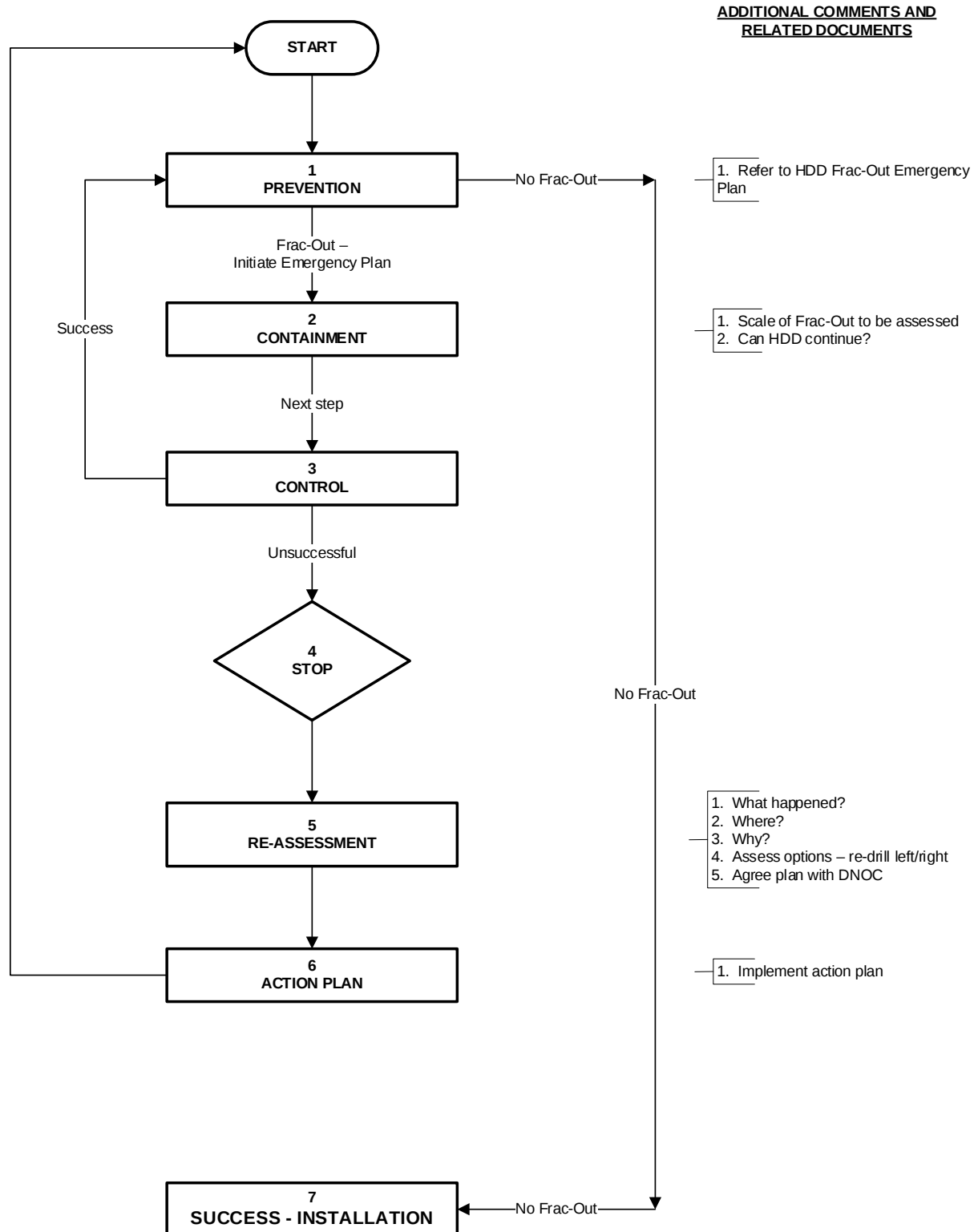
- ✓ Clean-up the spill. Use absorbent granules/pads to mop up spills. Large pools of oil or spills that cannot be absorbed should be removed by gulper
- ✓ Ensure to have the correct spill clean-up equipment, eg oil booms, chemical absorbent mats
- ✓ Dispose of all contaminated materials (soil/absorbent materials) correctly – those containing substances such as oil, diesel or paint will be hazardous waste
- ✓ ensure any contaminated water is taken to an appropriately licensed disposal site
- ✓ notify your supervisor of actions taken.



1.0 Frac-Out Management Process Map

HDD Frac-Out Management Process Map (V1.0)

To be read in conjunction with Frac-Out Emergency Plan





HDD Frac-Out Emergency Plan

All HDD personnel to be briefed and fully conversant with this **Frac-Out Emergency Plan** prior to works commencing. There are seven stages (refer to Frac-Out Management Plan Process Map) to the management of a frac-out at the HDD's which will be implemented as follows: -

1	2	3	4	5	6	7
PREVENTION	CONTAINMENT	CONTROL	STOP	RE-ASSESSMENT	ACTION PLAN	SUCCESS

Methods for Mitigating Hydro-Fracture (Frac-out)

1 Prevention

Frac-out occurs when annular fluid pressures exceed formation fracture pressures. Annular fluid pressures are minimised by constant monitoring of the drilling fluid parameters.

- The Fluids Technician will monitor and record drill fluid density, viscosity, and solids content on a regular basis, **(half-hourly)**, to ensure that the fluid does not increase in viscosity, requiring additional pressure to maintain mobility.
- The Driller will monitor the drill fluid pressures, volumes, viscosities, and densities of mud being pumped through the bore. Any increases in pump pressure will be investigated immediately to prevent the risk of pressure build up within the annulus. Refer to: - **IMS 069 Reaming/Hole Opening Record & IMS 070 Pilot Hole Drill Record**
- The Fluids Technician will monitor active fluid tank volumes and account for any unexpected changes (The drill fluid is designed to allow water loss in porous formations to build filter cake).
- The bore hole will be reamed on a regular basis to keep the annulus clear. Rates of Penetration and circulated cuttings volumes will be monitored to ensure that drilled cuttings are being flushed from the bore and are not building up creating pressure restrictions. Also, as a rough guide, a volumetric check of the cuttings stockpiled on site can be equated against the complete hole volume.
- Calculations of the anticipated down hole fluid pressures will be undertaken at design stage. These pre-determined calculations will be the parameters for the Pressure-While-Drilling module during the pilot bore.
- Annular fluid velocity will be kept below critical velocity to prevent eddying and subsequent erosion caused by turbulent flow.
- When drilling clay-based formations, inhibitors may be used to prevent the absorption of water and subsequent swelling of the formations.
- A **Frac-Watch** programme will be operated always whilst circulating, particularly when drilling past potential pathways
- The **Frac-Watch** programme will ensure that the ground surface above the drilling path will be inspected throughout the HDD process. Spotters will be responsible for the monitoring (numbers dependant on drill length and location topography etc.)

HDD drilling fluid returns to be monitored. Risk of hydro-fracture to be mitigated through monitoring and HDD fluid selection. Methods of monitoring include: -

Operational (This will be undertaken throughout HDD process)

- Full briefing of personnel prior to HDD operation (**Emergency Plan**)*
- Personnel will be assigned to specific tasks and be fully conversant with procedures in the **Emergency Plan***
- Follow best drilling practices (HDD Design)*
- Monitor, record, & control mud weights*
- Maintain effective fluid properties*
- Monitor & record pressures on HDD rig*



- **Frac-Watch** - Visual monitoring of returns at both launch and reception pits
- **Frac-Watch** – Half-hourly drone surveillance of the route (especially inaccessible areas)
- **Frac-Watch** - Spotters to be deployed
- **Frac-Watch** - Spotters to have two-way radios, along with launch and reception teams (close monitoring and direct communication ensures swift reaction)
- **Frac-Watch** – Driller to inform spotters of progress of drill so that they know location of drill head/reamer (i.e. Joint 1, 2, 3.etc.)

2 Containment

Contingencies are in place to deal with potential frac-outs when drilling operations commence. If a frac-out occurs, drilling operation to be suspended temporarily and assessment of location and severity to be carried out.

- a. The rig and pumps will immediately be shut off
- b. The drilling assembly will be pulled off bottom to reduce annular pressures
- c. Once shut down procedure is complete, the frac-out will be contained by all site personnel as-quickly-as possible by any one of the measures listed below where applicable.

Physical (This will be undertaken if a frac-out occurs)

The following is to be stored at the **Entry Site, Exit Site**, intermediate locations for rapid deployment (locations to be approved).

- 200 Hessian Sandbags – use to contain sediment, deploy at source. Frac-out may occur some distance from the bore path. Sandbags will be available to control drill fluid at surface
- Straw bales
- 1 x roll of Polyethylene
- Tractor & bowser
- Pumps
- Jet washer

- d. **DNOC** Site Manager to be notified as-soon-as possible by McCormack Drilling Project Manager.

Name	Company	Contact Number
Lee Mason (Project Manager)	DNOC	Mobile: 07702135353
Steve Rigby (Lead Driller)	McCormack Drilling	Mobile: 07890269844

3 Control

The freshwater based, bentonite suspension, drill fluid systems utilised are, essentially, low viscosity grouts. In most cases, the fracture pathways will quickly seal up. Frac-out is likely to indicate that the bore hole requires reaming to reduce the pressure required to return drill fluid to surface.

Once the frac-out has been contained a swab-trip may be sufficient to prevent further frac-out and re-establishment of fluid returns. Lost Circulation Material (LCM) drill fluid additives will be available to seal fractures in the formation (requires 24-hours to work).

After an assessment has been conducted following a frac-out the following control measures should be implemented as follows: -

- a) **Re-Circulation Attempt (This will be undertaken if a frac-out occurs)**



- The pilot bore or reaming operation will be retracted away from the frac-out to try and re-establish fluid returns. This may require the complete extraction of the drill string and a re-drill if necessary.

b) Mechanical (This will be undertaken if a frac-out occurs)

This will be carried out via fluid mixing system and pumped down drill string to frac-out.

- Physical plugging by Loss of Circulation Material (LCM), Enviro Formfill to be utilised as-soon-as possible to manufacturer's specification.

4 Stop Procedure (If sections 1, 2, & 3 are unsuccessful)

If any of the measures outlined in sections **1, 2, & 3** are unsuccessful then drilling operation will be suspended – proceed to next step.

5 Re-Assessment

All information regarding HDD attempt to be evaluated as follows: -

- What happened?
- Where did it happen?
- Cause(s), why did it occur?
- Assess findings and formulate options – re-drill left, or right?
- Agree solution/plan with Kier/UKPN/Highways England

6 Action Plan

Agreed solution/plan to be implemented as-soon-as possible.

7 Success - Installation

COSHH Assessment Sheet

Petroleum Fuels

Activity	Used as a fuel for mobile and static plant. Used as a fuel for ignition of engines.		
Hazard	May cause skin rash, dermatitis and nausea from fumes.		
Highly Flammable 		Environmental  May cause long term affects in the aquatic environment (Marine pollutant).	
Precautions & Control Measures	Eye protection  Protection from splashes	Skin Protection  Protection from possible skin problems	Protective Clothing  Wear overalls or similar when handling diesel
Storage	In accordance with the Petroleum Consolidation Act and the Highly Flammable Liquids and Liquefied Petroleum Gases Regulations. Keep in well-ventilated area in closed flammable liquid storage. Store away from sources of heat and ignition.		
Handling	Avoid spillage, skin & eye contact. Use in well ventilated areas. Use non sparking tools. Use funnel for filling. Use proprietary storage i.e. 20 ltr Jerry Can.		
Spillage & Cleaning	Treat any spillage as having some fire risk and ensure all sources of ignition are removed. May damage tar macadam and other surfaces making surface very slippery. Do not wash into drainage system. Contain and recover using suitable absorbent (e.g. vermiculite, sand etc).		
First Aid 	Inhalation	Remove to fresh air away from source. Seek medical advice if discomfort continues.	
	Eye Contact	Wash out thoroughly with water. Get medical advice if irritation continues.	
	Skin Contact	Wash skin with soap and water as soon as practicable after contact. Change heavily contaminated clothing and laundry before reuse.	
	Ingestion	Unlikely in normal use. Wash mouth out with water if oral contamination occurs. DO NOT induce vomiting because of the danger of aspiration. Seek medical advice.	
Fire Fighting 	Fire Fighting: Use CO2 , dry chemicals, sand. DO NOT use water. Treat any spillage as having some fire risk and ensure all sources of ignition are removed. Avoid contact with water. Contact the fire brigade		
			



COSHH Assessment Sheet

Diesel Fuel/Gas Oil

Activity	Used as a fuel for mobile and static plant. Used as a fuel for ignition of engines.		
Hazard	Under normal conditions of storage and use these products afford little opportunity for a health hazard and present a low risk in normal ambient temperatures. However, prolonged skin contact may cause dermatitis and pose a possible long-term cancer risk.		
Environmental		Irritant	
 May cause long term affects in the aquatic environment (Marine pollutant).		 Wash with soap and water.	
Precautions & Control Measures	Eye protection	Skin Protection	Protective Clothing
	 Protection from splashes	 Protection from possible skin problems	 Wear overalls or similar when handling diesel
Storage	Storage in suitably designed storage tanks and in storage areas away from sources of heat and ignition. Drums and other containers should be stored in well ventilated areas preferably under cover away from sources of heat and ignition.		
Handling	Avoid spillage, skin & eye contact. Use in well ventilated areas. Use non sparking tools		
Spillage & Cleaning	Treat any spillage as having some fire risk and ensure all sources of ignition are removed. May damage tar macadam and other surfaces making surface very slippery. Do not wash into drainage system. Contain and recover using suitable absorbent (e.g. vermiculite, sand etc).		
First Aid	Inhalation	If inhalation of fumes irritates the nose or throat or causes coughing remove to fresh air. Get medical advice. If necessary administer artificial respiration (mouth to mouth).	
	Eye Contact	Wash out thoroughly with water. Get medical advice if irritation continues.	
	Skin Contact	Wash skin with soap and water as soon as practicable after contact. Change heavily contaminated clothing and launder before reuse.	
	Ingestion	Unlikely in normal use. Wash mouth out with water if oral contamination occurs. DO NOT induce vomiting because of the danger of aspiration.	
Fire Fighting	Fire Fighting: Use CO2 , dry chemicals, sand. DO NOT use water.		
	Water fog or spray to cool fire-exposed surfaces (e.g. containers) and to protect personnel. Cut off 'fuel' if possible. Either allow to burn out under controlled conditions, or use foam or day chemical powder to extinguish the fire. Contact the fire brigade		



COSHH Assessment Sheet

Hydraulic Oil

Activity	Used in plant and machinery as a lubricant for hydraulic systems		
Hazard	Not classified as hazardous under current UK Health & Safety/Environmental legislation. It is of low oral and dermal toxicity and under normal conditions of use should present no health hazards. However, in common with most mineral oils, prolonged and repeated skin contact may cause dermatitis.		
Environmental	May cause long term affects in the aquatic environment.		
			
Precautions & Control Measures	Eye protection  Protection from splashes	Skin Protection  Protection from possible skin problems	Protective Clothing  Wear overalls or similar when handling
Storage	Keep containers tightly closed. Store in well vented area. Avoid sources of ignition.		
Handling	Avoid spillage, skin and eye contact.		
Spillage & Cleaning	Clean up spills promptly. Provide granules to absorb spills. Do not wash into drainage system. May damage tarmacadam and other surfaces.		
First Aid	Inhalation	Low volatility makes inhalation unlikely at ambient temperatures.	
	Eye Contact	Flush eyes immediately with water for 5 minutes. Seek medical advice if adverse eye effects follow.	
	Skin Contact	Unlikely to cause harm on brief or occasional contact. Wash skin immediately with soap and water. Do not use solvents or thinners. Remove heavily contaminated clothing and launder before reuse. Seek medical advice if irritation develops.	
	Ingestion	Do not induce vomiting because of the dangers of aspiration. Wash mouth out with water. Seek medical advice if adverse effects follow.	
Fire Fighting	Fire Fighting: Use CO2 , dry chemicals, sand.		
	DO NOT use water.		
	Treat any spillage as having some fire risk and ensure all sources of ignition are removed.		





Soda Ash

Alkalinity Agent

Description Soda Ash alkalinity agent is a granular powder form of sodium carbonate primarily used to condition and soften make-up water and to raise pH.

Applications/Functions

- Treat out calcium hardness in make-up water
- Raise pH

Advantages

- Can eliminate calcium ions by converting to insoluble carbonate
- Can maximize the performance of bentonite and polymer products

Typical Properties	• Appearance	Variable-colored powder (white to gray)
	• pH of 5% solution	11.5
	• Bulk density, lb/ft ³	57-65

Recommended Treatment

- Hardness and pH levels of make-up water should be checked prior to addition of Soda Ash.
- When treating make-up water, pH ranges should be maintained between 8.5 – 9.5
- Addition of Soda Ash should always be done prior to addition of bentonite or polymer to the fluid system.
- Soda Ash alkalinity agent should not be added at the same time as other drilling fluid components.

General Treatment:

- 1-2 pounds of Soda Ash alkalinity agent per 100 gallons of make-up water or 1.2-2.4 kilograms per cubic meter of make-up water.
 - Use as required to remove calcium ions but do not add in excess as overtreatment can lead to detrimental effects and reduced performance of the drilling fluid components and/or system.
 - Mix slowly through a jet mixer or sift slowly into the vortex of a high-speed stirrer.
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Packaging	Soda Ash is packaged in 50-lb (22.7 kg) or 100-lb (45.4 kg) multiwall paper bags.
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Availability	Soda Ash can be purchased through any Baroid Industrial Drilling Products Retailer. To locate the Baroid IDP retailer nearest you contact the Customer Service Department in Houston or your area IDP Sales Representative.
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Baroid Industrial Drilling Products
Product Service Line, Halliburton
3000 N. Sam Houston Pkwy. E.
Houston, TX 77032

Customer Service	(800) 735-6075 Toll Free	(281) 871-4612
Technical Service	(877) 379-7412 Toll Free	(281) 871-4613



TUNNEL-GEL® MAX

Viscosifier

Description TUNNEL-GEL® MAX is a specially formulated, high-yield bentonite designed for use in tunneling and large diameter HDD operations. TUNNEL-GEL MAX promotes rapid viscosity development while maintaining effective borehole stabilization and enhanced filtration control in most water-based drilling fluids.

Applications/Functions *The use of TUNNEL-GEL MAX viscosifier promotes or assists the following:*

- Viscosifies water-based drilling fluids
- Reduces filtration by forming a thin filter cake with low permeability, resulting in borehole stabilization
- Improves hole-cleaning capability of drilling fluids

Advantages

- Can provide lubricity
- Can mix easily and quickly reaches maximum viscosity
- Can be effectively used in a wide range of concentrations
- Can be effective in a variety of drilling applications.
- Provides the option of using a variety of additives

Typical Properties

- | | |
|--------------------|------------------------------|
| • Appearance | Tan Powder |
| • Specific Density | 2400 kg/m ³ ± 10% |
| • pH (3% solution) | 8.9 |

Recommended Treatment

Using a Venturi hopper, or a colloidal mixer, add TUNNEL-GEL MAX viscosifier, slowly and uniformly to the entire circulating system or mix tank.

Approximate Amounts of TUNNEL-GEL MAX viscosifier Added to Freshwater, kg/m ³	
Normal Drilling Conditions	30-40
Unconsolidated Formations	40-45

Additional Information

Note: For optimum yield and performance, pre-treat make-up water with 0.5 – 1.0 kg/m³ of soda ash.

Packaging TUNNEL-GEL[®] MAX viscosifier is packaged in 25-kg (55.1-lb) , 1000 kg (2204-lb) bags, and it is also available in bulk.

Availability TUNNEL-GEL MAX viscosifier is a regionally sourced product and may not be available through all Baroid Industrial Drilling Products Retailers. To locate the appropriate Baroid IDP retailer nearest you contact CEBO Holland.

CEBO Holland, BV

Authorized Retailer, Baroid IDP

Westerduinweg 4

NL-1976 BV Ijmuiden

Customer Service: +31 (0)255-46262



Cebo Holland

Product Data Sheet



Description & Properties

PAC LV is a premium anionic modified cellulose and is used to improve the fluid loss control in KCL based drilling fluids without increasing the viscosity. PAC LV is an off-white free flowing powder.

PAC LV in KCl / NaCl solution according to API / ISO 13500 test

<u>Parameter</u>	<u>Test method / In accordance with</u>	<u>Requirement</u>	<u>Typical property</u>
Apparent viscosity	API / ISO 13500 section 17.5	40 mPa.s	
Fluid Loss, 24 hrs	API / ISO 13500 section 17.4	Max. 16 ml	

Typical properties

Bulk density	Min. 700 kg/m ³
Starch content	None
Moisture	Max. 8%
Degree of substitution	Min. 1
pH (1% water solution)	7 - 10
Solubility	Readily soluble in saline drilling fluids
Suspensibility	Excellent without lumping

Recommended use:

Shelf life 24 months if stored inside and under dry and cool conditions.

PAC LV is available in 25 kg bags.

In so far as we can ascertain the above-stated information is correct. However, we are unable to provide any guarantees with regard to the results that you will achieve with this. This specification is provided on the condition that you determine yourself to what degree it is suitable for your purposes.

Date : 25.03.2019
Document number : 108202GB

Contact us for more information

Cebo Holland BV

Westerduinweg 1
NL-1976 BV IJmuiden
The Netherlands

info@cebo.com
www.cebo.com
Tel. +31(0)255-546262





PENETROL® DRY EU

Surfactant

Description PENETROL® DRY EU surfactant is used to assist in counteracting the sticking tendencies of encountered clay or shale during drilling operations.

Applications/Functions *The use of PENETROL DRY EU surfactant aids or promotes the following:*

- Reduces and/or minimizes bit balling
- Improves drilling efficiency by preferentially coating the bottom-hole assembly and drill string
- Minimizes potential for accretion and agglomeration of cuttings

Advantages

- Free-flowing granular product
- Easy to mix and readily dispersible
- Effective at low concentrations
- Minimal to no foaming produced during high shear mixing or surface agitation
- Compatible with other Baroid drilling fluid additives
- Low aquatic toxicity

Typical Properties

▪ Appearance	White granules
▪ Bulk Density, lb/ft ³ , kg/m ³	40 - 45, 641 - 721
▪ pH (1.0% Aqueous Solution)	6.5

Recommended Treatment

Approximate Amounts of PENETROL DRY EU Surfactant Added to Water Based Fluids, kg/m³

0.6 – 3.6

*1 bbl = 42 U.S. gallons or 0.16 m³

- It is recommended that Soda Ash (sodium carbonate) be added to the make-up water prior to the addition of PENETROL DRY EU surfactant for reduction of excess calcium and pH adjustment.
- Introduction of PENETROL DRY EU surfactant requires the user to incorporate the material into the drilling fluid system using a venturi hopper or directly into the vortex of a high-speed stirrer and follow standard order of addition. PENETROL DRY EU should be incorporated only after bentonite and/or polymers have been mixed and fully hydrated.
- The above are generalized concentrations of PENETROL DRY EU surfactant to be added to water-based drilling fluids. The ultimate usage concentration will be based on local geology, application and mixing efficiency. In the event that further information is needed please refer to the Product Data Sheet or contact your local Baroid IDP representative.

Packaging PENETROL DRY EU surfactant is packaged in 9 kg re-sealable plastic pails.

Availability PENETROL DRY EU surfactant is a regionally sourced product and may not be available through all Baroid Industrial Drilling Products Retailers. To locate the Baroid IDP retailer nearest you contact CEBO Holland

CEBO Holland, BV

Authorized Retailer, Baroid IDP

Westerduinweg 1

NL-1976 BV IJmuiden

Customer Service: +31 (0)255-546262

Declaration

I confirm that I have read, or been instructed on, the contents of this Risk Assessment & Method Statement. I have been made aware of the risks involved and agree to abide by the control measures and method of work.

I will inform my site supervisor immediately of any changes which may affect the health and safety of me/us or others likely to be affected by the works:

[illegible]