

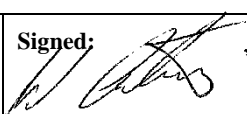
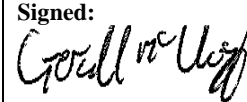
**Installation of  
MDPE Pipe in 1 bore using  
“NO-DIG”**

**DIRECTIONAL DRILLING TECHNIQUES**

**River Towy SA31 3AX**

**METHOD STATEMENT**

**For: WW UTILITIES**

<i>Method Statement Title:</i> <b>WC/CMU/T1864</b>				
Method Statement No: MS/P1864/CMU/WC/01				
<b>Location: River Towy Carmarthen</b>				
<b>Prepared By:</b> W Cartwright	<b>Position:</b> HDD Ops Manager	<b>Company:</b> CMU	<b>Signed:</b> 	<b>Date:</b> 01-06-23
<b>Checked By:</b> Gerald McCloskey	<b>Position:</b> Operations Director	<b>Company:</b> CMU	<b>Signed:</b> 	<b>Date:</b> 02-06-23

## DECLARATION

**I confirm that I have been briefed and understand 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:**

Print Name	Signed	Date

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## 1.0 INTRODUCTION

- 1.1 Method Statements are produced to a Company standard written by the senior safety officer, and prepared as contract specific by the contract engineer and are intended as instructions for undertaking specific, identified work. Where there may be included within the method statement, reference to other instructions, etc, due regard must also be given to any Health and Safety issues raised in such documents.
- 1.2 Method statements are further supported by arrangements set out in company health and safety procedures that are issued as controlled documentation to all operatives.
- 1.3 CMU undertakes to co-operate with WW UTILITIES in upholding contractual safety requirements for ensuring a safe system of work.
- 1.3.1 Exploratory points such as bore holes, trial pits or other survey points can by their nature only provide information on a relatively limited area., in general the conditions encountered may vary between exploratory points, CMU cannot be held responsible for any change in ground.
- 1.3.2 ALL WORKS WILL BE CARRIED OUT IN CONJUNCTION WITH WW UTILITIES SITE RULES.

## 2.0 METHOD OF WORK

*CMU Site Agent to ensure that Method Statement has been briefed to all operatives. All operatives to sign and date page 2.*

*WW UTILITIES will check service drawings.*

*WW UTILITIES will need to excavate a 3 mtr x 3mtr x1.2 mtr pit at start point.*

*WW UTILITIES to supply all fencing around work areas.*

*WW UTILITIES to supply excavators as required.*

*Service drawings to be provided by WW UTILITIES*

- 2.1 Directional Drilling equipment will be transported to access point via low-loader lorry, this transport is approximately 44ft in length.
- 2.2 Upon arrival of drilling equipment the lorry will be parked within a safe working area for the offloading of the drilling rig. The drill rig is a self-contained tracked machine, delivered on a low loader trailer; the trailer has ramps that will be lowered thus allowing off-loading of the drill rig. The drill will be off loaded by one operator whilst the second operator will act as banksmen guiding the drill down the ramps two men will be watching for pedestrian or traffic movement.

- 2.3 Due to the force created by the drilling equipment, it is important that the WW UTILITIES has satisfied himself that the surrounding ground can withstand the loads imparted upon it, in order to avoid ground heave and damage to items in the vicinity of the pipe. Responsibilities for damage to existing utilities are the responsibility of WW UTILITIES. It should also be remembered that drill fluid can seep through the ground and come to the surface, this is most prevalent where ground is fissured, or natural / artificial conduits are present.
- 2.4 The rig will be sited, at the launch pit (Within the site easement as defined by WW Utilities).
- 2.5 PERMIT TO DIG WILL BE OBTAINED FROM WW UTILITIES & CMU WILL USE THEIRS, WW UTILITIES MUST SIGN CMUS BEFORE ANY WORK WILL COMMENCE.**
- 2.6 Upon completion of Permit to dig, work will then proceed. Area will be cat scanned & Trial holes to be dug on any services/utilities along the bore path by WW Utilities.
- 2.7 Launch pit will be excavated by *WW UTILITIES* with suitable shoring or battering.
- 2.8 Once the launch pit has been excavated, work will then commence on the pilot bore.
- 2.9 The drill operator will rotate drill string to check operation.
- 2.10 Once all of the above have been checked then the water (**Supplied by WW Utilities**) will be added to the drilling rig to start mixing the necessary mud mix.
- 2.11 The drill operator pushes the pilot rods into the ground at the pre-agreed drill angle this is governed by the location of the existing utility services, highlighted on permit.
- 2.12 The steering engineer will then check the position of the drill head from the locator unit. This process is repeated during the pilot bore to keep the drill on course for the completion of the bore.
- 2.13 During the pilot operation drilling fluid will be used to remove spoil, support and lubricate bore path. The drilling fluid will be monitored to ensure that there are constant returns to the excavated pits, thus reducing hydraulic pressure within the bore.
- 2.14 All wet arisings from the operation, will be removed and disposed of by CMU.
- 2.15 Upon completion of the pilot bore the drill head will be removed, and a reamer will be attached on to the drill string, this will be carried out until the bore is of an acceptable size to accept the MDPE product pipe.
- 2.16 Once the bore is enlarged to the required size the product pipe will then be connected to the reamer via a swivel for installation. (Towing chains & shackles used comply with PUWER 1998 Regulations)
- 2.17 The directional drill rig operator will pull the rods back towards the launch pit, during this operation the mud fluid will be charged under pressure and forced down the drill string, until it exits at the reamer.

- 2.18 The pipe will be positioned at the reception pit by WW UTILITIES for installation.
- 2.19 WW Utilities to have a pre fabricated towing welded to product pipe ready for installation.
- 2.20 WWU to place pipe on rollers if required to reduce risk of coating damage.
- 2.21 *WW UTILITIES* Will provide a suitable machine to guide the product pipe during the installation (i.e:- pipe flick)
- 2.22 **DRILLING FLUIDS**
- 2.23 During all drilling operations the fluids pumped through the drill string will be closely monitored, this is monitored by checking volume of returns flowing back to the launch pit, visual checks across the drill line for frac-outs. The monitoring personnel are in constant communication with the drill rig operator by means of two way radios, thus able to cease all pumping activities quickly.

### **3 PORTABLE TOOLS (Noise & Vibration)**

- 3.1 Operatives and supervisors within the work zones will be obliged to use ear defenders during noisy operations based on monitoring of similar operations – to establish threshold limits and noise levels at/away from workforce. Warning signage will be posted to remind operatives/supervisors and visitors that noise zones are in operation.

When in close proximity to the directional drilling rig, ear defenders will be used (approximate noise level of 76dB).

Vibration impact on operatives carrying out the works will also be considered and the guidelines set out in the Safe Operating Procedures/Policy for Vibration Generating Work Tools will be followed.

### **4 MECHANICAL PLANT**

- 4.1 Ditchwitch Drilling Rig
- 4.2 Support Lorry
- 4.3 Mud Mixing System
- 4.4 Excavator
- 4.5 Support Vehicles
- 4.6 Mud Cleaning System (As Required)

### **5 MATERIALS**

- 5.1 Pipework as required (Free Issue)
- 5.2 Emergency spill kits
- 5.3 Bentonite Drilling Fluids
- 5.4 Silt Boom

## **6 CONTROL OF WORK (HAZARDOUS SUBSTANCES AND PROCESSES)**

- 6.1 Diesel (Gas Oil)
- 6.2 Bentonite

## **7.0 HOUSEKEEPING & WELFARE**

- 7.1 CMU will ensure that the work place is kept tidy and dispose of any waste material on a regular basis.
- 7.2 **WW UTILITIES will provide welfare within site easement**

## **8 SIGNS ,BARRIERS & TRAFFIC MANAGEMENT**

- 8.1 Where required by the presence of overhead lines, excavations or whenever road conditions dictate or vehicle load or off load requires it; signage, barriers and/or traffic management will be provided by WW UTILITIES in line with GS6, HSG47, Traffic Signs Manual Chapter 8, their Excavation Procedures and/or Traffic Management Plan

## **9 SITE RULES**

- 9.1 The site person in charge WW Utilities, shall ensure all persons under his control are made aware of the contract site rules and, where practicable, these rules shall be displayed at site.

## **10 RESPONSIBILITIES**

- 10.1 The project manager is overall responsible for contract safety management. Duties include ensuring adequate resources, equipment, training and supervision for safe undertaking of the work. Supervisors and foreman/site persons in charge are responsible for site ensuring work is conducted in accordance with this method statement, and that operatives are aware and comply with the safety arrangements, particularly the safety precautions and site rules, as given in the Appendices.

## **11 METHOD OF WORK**

### **11.1 Labour force**

- 1 Agent / Manager (Site Visits)
- 2 -3 Operatives (Permanent)

### **11.2 Permit to Work/Authorization**

Details of issue and control of permits, as applicable to the Works.

**CMU** agent / operator will have a permit to dig form that must be signed by **WW UTILITIES** representative prior to drilling commencing.

The form has details of all relevant services and utilities and any extra requirements.

## 12.0 SITE AND ACCESS

12.1 Attention will be given to ensuring a safe site, including safe access and egress for all persons who may be affected by the works, including:

- Employees
- Other workers
- Visitors
- General Public (Inc the infirm, partially sighted and children)
- Emergency Services

**WW UTILITIES** should make arrangements for and carry out the following items, which are **EXCLUDED**

- 1) All setting out information required, in a format that is accepted by the Contractors operational staff.
- 2) All traffic management required to carry out the works safely.
- 3) The protection or diversion of all services and statutory undertakers apparatus which may affect the Works.
- 4) Obtaining of all licences and Permits, the giving of notices and the payment of all fees required under law by any organisation affected by the Works.
- 5) Excavation of all trial holes
- 6) Free Supply of Portable Water

## 13 RISK ASSESSMENT/SAFETY PRECAUTIONS

A documented risk assessment (identified hazards and safety precautions for controlling risk) will precede all working activities.

Identified hazards and risk control measures (as identified from the Risk Assessment) shall be brought to the attention of the site person in charge of site works in the course of method statement induction's carried out by the site engineer.

### First Aid

A first aid kit is located in each CMU vehicle and the WW UTILITIES Welfare Unit. In addition to the CMU First Aiders and a list of other First Aiders is available in the WW UTILITIES Welfare Units. All injuries will be reported to WW UTILITIES at the first available opportunity

### Fire

If you discover a fire, raise the alarm and make your way to the Muster Point. Details of the nearest site muster point is to be recorded on the daily risk assessment.

No one is to fight the fire unless they are trained and it is safe to do so. All fires will be reported to WW UTILITIES at the first available opportunity.

## Natural Environment

Due to the nature of our works a number of animals and their habitats may be affected. These animals include, but are not limited to Badgers, Water Voles, Otters, Bats & other mammals, Newts & other amphibians, Grass snakes & other reptiles, Nesting Birds, their eggs and their young. In addition, damage to trees, hedges, plants and all other fauna will be prevented by consulting with industry standards such as BS5837:2012 Trees In Construction and similar guidance. To mitigate the risk to the wildlife and fauna all staff will receive the Site Induction before commencing works and will follow the guidelines and mitigation as stated in the WW UTILITIES Environmental Management Plan

## Asbestos

If asbestos or suspected asbestos is discovered, work will stop and WW UTILITIES informed immediately

## Contaminated Land

If you know or it is suspected that the work area is contaminated, work will stop and WW UTILITIES informed immediately

## Working Under water courses

The process of directional drilling has developed from guided borehole techniques used in the oil industry. It creates a bore through which a product pipe can be installed. The boring technique is a closed system such the material excavated at the head is passed back along the bore by a drill fluid that is designed also to seal the bore. The seal prevents the permeation of the fluid into the surrounding ground such that there is no effect on the character of that surrounding ground.

Besides the physical seal that the fluid creates along the bore, it has an operating head within the bore that balances any groundwater pressures within the natural ground.

Nonetheless, there is a construction risk that the drill fluid may break to surface. This can be mitigated by an appropriate assessment of the process in advance of the works.

## Accident/Incident Reporting

All Accidents, Incidents, Near Miss's and Hazards will be reported to WW UTILITIES immediately

## Hospital A&E

**Glangwili General Hospital**  
Dolgwili Road  
Glangwili  
Carmarthen  
SA31 2AF

[01267 235151](tel:01267235151)

## 14.0 TRAINING

Persons shall be trained as competent for duties they are to undertake. Competency certificate and qualifications are held with CMU



## **15.0 PERSONAL PROTECTIVE EQUIPMENT**

PPE and RPE appropriate to the undertakings and as per the WW UTILITIES site rules will be worn

## **16.0 Waste Management**

*CMU* undertakes to conduct its contractual activities with full respect for safeguarding the environment

Particular environmental attention will be directed at effective containment and disposal of waste. The contract work may give rise to a small quantity of non-hazardous waste, which cannot be lifted by the Vacuum tanker *CMU* shall dispose of through an approved supplier.

## **17.0 METHOD STATEMENT REVIEW**

This Method Statement shall be subject to a review of its effectiveness by the site engineer together with the site person in charge. The frequency of the review shall be determined by an assessment of potential risk and consequences. Method statements and risk assessments relating to activities with high risk shall be subject to initial, frequent and regular reviews

## **18.0 CONTRACT DOCUMENT CLAUSE**

This document shall form part of any contract entered into.

## Appendix 1

### Permit to Dig/Drill

WW Utilities:

Location:

Date:.....

Actual Crossing Point: From.....To:.....

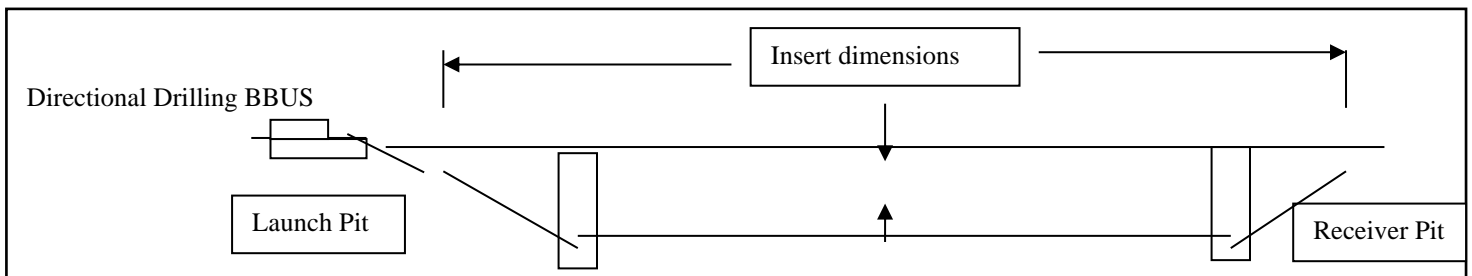
Length of shot between Launch and Receiver Pits

Pipe /Duct Dia.:

No: of pipes;

#### Underground Services / Obstructions

<b>Gas</b>	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Size.....
Position Identified?	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Depth Gas Co. Notified? Yes <input type="checkbox"/> No <input type="checkbox"/>
<b>Electricity</b>	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Size.....
Position Identified?	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Depth...Elect Co. Notified? Yes <input type="checkbox"/> No <input type="checkbox"/>
<b>Water</b>	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Size.....
Position Identified?	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Depth....Water Co. Notified ? Yes <input type="checkbox"/> No <input type="checkbox"/>
<b>Telecomm</b>	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Size.....
Position Identified?	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Depth...Comms Co. Notified? Yes <input type="checkbox"/> No <input type="checkbox"/>
<b>Cable</b>	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Size.....
Position Identified?	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Depth....Elect Co. Notified Yes <input type="checkbox"/> No <input type="checkbox"/>



Have trial holes been dug? Yes ☐ No ☐

WW UTILITIES Authority to proceed with respect to above conditions

Signed.....

Print .....

Title:..... Date .....



# Directional Drilling Appendix 3

## RISK ASSESSMENT FORM

ACTIVITY: Directional Drilling

### (C) Environmental Consequence

E1 Insignificant (No Effect)  
E2 Marginal (Minor Effect)  
E3 Serious (Major Effect)  
E4 Critical (Irreversible)  
E5 Catastrophic

### (C) Health & Safety Consequence

S1 Insignificant (No Effect) 1  
S2 Marginal (Minor Injuries) 2  
S3 Serious (Major Injuries) 3  
S4 Critical (Fatalities) 4  
S5 Catastrophic 5

### (F) Frequency

1 Improbable  
2 Unlikely  
3 As Likely As Not  
4 Probable  
5 Highly Probable

### (RR) Risk Rating (Consequence x Frequency)

1-5 Insignificant  
6-8 Acceptable **PROCEED**  
9-15 Unacceptable **WORK SHALL NOT START**  
16-25 Intolerable

No	Activity/ Event/ Feature/ Situation	Hazard/Issue/ Interaction (Cause)	Undesired Event	Consequences	Before Control			CONTROL	After Control		
					(C)	(F)	(RR)		(C)	(F)	(RR)
1	Access to / from site	General Public & local Residents.	Gaining Access to site	Fatality, or major injury. Damage to equipment & plant. Oil/diesel Spillage	S4	4	S16	Site to be delineated from public and footpaths to be diverted away from compound / working area by WW UTILITIES Signage to be erected to warn of dangers by WW UTILITIES Visiting security to be mobilised. Local residents to be fully informed of our works. By WW UTILITIES Spill response kits on site by WW UTILITIES & CMU Emergency procedures in place by WW UTILITIES & CMU	S4	2	S8
					E2	3	E6		E2	2	E4
2	Site Movements	Plant & Vehicle movements	Collision with operatives & public. Collision with other plant and equipment.	Fatality, or major injury. Damage to equipment & plant. Oil/diesel Spillage	S4	3	S12	Designated vehicle and pedestrian routes. By WW UTILITIES Trained operatives and signallers. By WW UTILITIES & or CMU Use of signaller / banksman when plant in motion by WW UTILITIES & or CMU  Spill response kits on site. By WW UTILITIES & CMU Emergency procedures in place. By WW UTILITIES & CMU	S4	2	S8
					E2	3	E6		E2	2	E4
3	Drilling	Re-Fuelling mobile plant	Diesel oil spillage	Contamination of ground, watercourses and sewers Irritants- Dermatitis	E3	3	E9	Authorised personnel to operate only  Spill response kit on site. By WW UTILITIES & CMU Drip Trays Emergency procedures in place. COSHH procedures.	E3	2	E6
					S2	3	S6		S2	2	S4
4	Drilling	Hydraulic hose leak /failure	Hydraulic oil spillage	Contamination of ground, watercourses and sewers	E3	3	E9	Correctly maintained equipment. Daily vehicle inspection carried out and copies available on site and in the WW UTILITIES Site Office Authorised personnel to operate only.	E3	2	E6

# Directional Drilling Appendix 3

## RISK ASSESSMENT FORM

ACTIVITY: Directional Drilling

**(C) Environmental Consequence**

E1 Insignificant (No Effect)  
E2 Marginal (Minor Effect)  
E3 Serious (Major Effect)  
E4 Critical (Irreversible)  
E5 Catastrophic

**(C) Health & Safety Consequence**

S1 Insignificant (No Effect) 1  
S2 Marginal (Minor Injuries) 2  
S3 Serious (Major Injuries) 3  
S4 Critical (Fatalities) 4  
S5 Catastrophic 5

**(F) Frequency**

1 Improbable  
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3 As Likely As Not  
4 Probable  
5 Highly Probable

**(RR) Risk Rating (Consequence x Frequency)**

1-5 Insignificant  
6-8 Acceptable PROCEED  
9-15 Unacceptable **WORK SHALL NOT START**  
16-25 Intolerable

No	Activity/ Event/ Feature/ Situation	Hazard/Issue/ Interaction (Cause)	Undesired Event	Consequences	Before Control			CONTROL	After Control		
					(C)	(F)	(RR)		(C)	(F)	(RR)
				Irritants- Dermatitis	S2	3	S6		S2	2	S4
5	Unloading PE pipe from transport	Falling / crushing of operatives	Collision with operatives & public.	Fatality, major injury. Damage to equipment & plant	S4 E2	3 3	S12 E6	Spill kits on site at all times Certified Plant & Lifting Gear by WW UTILITIES Trainer Operatives for off-loading by WW UTILITIES	S4 E2	2 3	S8 E6
6	Loading PE pipe into coil trailer	Falling / crushing of operatives	Collision with operatives & public.	Fatality, major injury. Damage to equipment & plant	S4 E2	3 3	S12 E6	Certified Plant & Lifting Gear Trainer Operatives for off loading	S4 E2	2 3	S8 E6
7	Setting up Directional Drill Rig	Crushing of operatives /public	Collision with operatives & public	Fatality, major injury. Damage to equipment & plant	S4 E2	3 3	S12 E6	Exclusion Zone Trained Operator working with Herras fenced area supplied by WW UTILITIES. Kerbs etc to be protected by WW UTILITIES	S4 E2	2 3	S8 6
8	Drilling	Rotating rods out of ground	Entanglement with personnel	Fatality, major injury. Damage to equipment & plant	S4 E2	3 3	S12 E6	Barriers to prevent access supplied WW UTILITIES Permit to Drill to be completed prior to work commencing. Trained personnel Only	S4 E2	2 3	S6 E6
9	Pulling back Reamer & Pipe	Crushing of operatives /public	Collision with operatives & public	Fatality, major injury. Damage to equipment & plant	S4 E2	3 3	S12 E6	Barriers to prevent access supplied by WW UTILITIES Trained personnel Only	S4 E2	2 3	S8 E6
10	Drilling	Underground services	Drill rod hitting buried underground services.	Fatality serious injury	S4	3	S12	WW UTILITIES to liaise with Stats, obtain all drawings and locate and trial hole as necessary to locate all buried services.	S4	1	S4

# Directional Drilling Appendix 3

## RISK ASSESSMENT FORM

ACTIVITY: Directional Drilling

**(C) Environmental Consequence**

E1 Insignificant (No Effect)  
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E4 Critical (Irreversible)  
E5 Catastrophic

**(C) Health & Safety Consequence**

S1 Insignificant (No Effect) 1  
S2 Marginal (Minor Injuries)  
S3 Serious (Major Injuries) 3  
S4 Critical (Fatalities)  
S5 Catastrophic

**(F) Frequency**

1 Improbable  
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3 As Likely As Not  
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5 Highly Probable

**(RR) Risk Rating (Consequence x Frequency)**

1-5 Insignificant  
6-8 Acceptable **PROCEED**  
9-15 Unacceptable **WORK SHALL NOT START**  
16-25 Intolerable

No	Activity/ Event/ Feature/ Situation	Hazard/Issue/ Interaction (Cause)	Undesired Event	Consequences	Before Control			CONTROL	After Control		
					(C)	(F)	(RR)		(C)	(F)	(RR)
								Permit to Drill			
11	Drilling	Works traffic	Collision	Fatality serious injury	S4 E2	3 3	S12 E6	Traffic management undertaken by WW UTILITIES and use of high visibility clothing for all personnel.	S3 E2	1 1	S3 E2
12	Drilling	Small tools SMALL Tools Cont.	Electrocution of operator due to faulty equipment Injury from flying debris. Damage to hearing	Electrocution causing death or burns Damage to eyes	S4	3	S12	Use of safety glasses at all times Use of ear defenders Use of gloves at all times All small tools to be P A T tested prior to use  110volts only	S4	1	S4
13	Drilling	COSHH	Pipe grease	Causes dermatitis	S3	2	S6	Wear gloves Good hygiene before eating COSHH Assessment	S3	2	S6
14	Drilling	COSHH	Diesel oil	Dermatitis and poisoning if ingested	S3	3	S9	Cover exposed skin and wear gloves COSHH Assessment	S3	1	S3
15	Drilling	COSHH	Skin contact Eye contact Ingestion	Fatality Burns Dermatitis and asphyxiation	S4	3	S12	Identify all substances to be used Carry out COSHH assessment Provide adequate first aid facilities Only competent personnel to be used	S4	2	S8
16	Drilling	Eating & drinking	Increase contact with contaminant during meal breaks	Ingestion due to direct contact via hand & mouth	S3	4	S12	Provision of suitable welfare facilities	S3	1	S3
17	Drilling	Moving / lifting of loads	Failure of lifting equipment	Load falling fatality Crushing/ injury damage	S4	3	S12	Only fully approved and tested appliances and equipment to be used	S4	1	S4

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## **FRAC-OUT CONTINGENCY PLAN (FCP)**

### **Introduction and Purpose**

Directional bore operations have a potential to release drilling fluids into the surface environment through “frac-outs” (Break out of drilling fluids).

“Break-Out” occurs when fluid pathways are developed between the bore hole and surface, due to the hydraulic pressure of drill fluid within the annulus of the bore exceeding the confining formation strength of the surrounding lithology.

Stakeholders should be reminded that Drilling Fluids are freshwater suspensions of inert clay particles. Although slippery, they are environmentally benign and in fact can be utilised to improve the water retention of poor-quality soils. Control of Substances Hazardous to Health, (COSHH), and Material Safety Data Sheets, (MSDS), are kept on site for all products involved in the drilling operation.

During the drilling of the pilot hole entry and exit curves, when the depth of cover, formation consolidation and confining strength are at a minimum, Break-Out is most likely.

Break-Out can also travel to surface via existing pathways, e.g., previously installed utilities, foundation piles and existing boreholes. Any Site Investigation bores sunk must be offset to the proposed drill line and sealed up on completion.

Once punch out at exit point has been achieved, the annular pressure within the bore is relieved. Break-Out during Hole Opening and Pipe Pulling operations is therefore much less likely to occur.

Three stages to the management of a Break-Out:

- Prevention
- Containment
- Control

### **Prevention**

As previously noted, Break-Out occurs when annular fluid pressures exceed formation fracture pressures. Annular fluid pressures are minimised by constant monitoring of the drilling fluid parameters.

The Drill Fluid Technician will monitor Drill Fluid levels in the mixing tank on a regular basis, (hourly), to ensure that the fluid levels decrease in volume.

The Drill Rig Operator will monitor the Drill Fluid pressures 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.

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The Drill Fluid Technician will monitor active fluid levels in the entry and exit pit and account for any unexpected changes. The amount of fluid being taken by the additional hole volume drilled will be calculated. (The Drill Fluid is designed to allow water loss in porous formations in order to build filter cake).

The Drill Fluid Technician will report to the Drilling Supervisor should drilling fluid circulation be lost. The drilling operations will temporarily cease, and an inspection of the drilling line must be implemented to determine if the fluid loss is to the surface or being lost down hole into the surrounding formation.

The bore hole will be reamed on a regular basis to keep the annulus clear.

When drilling clay-based formations, inhibitors may be used to prevent the absorption of water and subsequent swelling and sloughing of the formations.

#### Containment

A Break-Watch programme will be operated at all times as Break-Out may occur some distance from the bore path.

Prior to drilling, potential Break-Out pathways will be identified and contingency plans put in place.

- Sandbags and Straw Bales will be available to control drill fluid at surface.
- On site Vacuum truck will be available to transfer drill fluid from the containment point back to the recycling system. This would be the preferred option as the surface area would not be disturbed.
- An excavator will be available to dig a pit to contain fluid (If possible, due to site conditions and/or constraints at the Breakout location).
- If drilling is being undertaken in contaminated land, Break-Out may be contaminated.

In the event that Break-Out is experienced, the rig will immediately shut off the pumps and the drilling assembly will be pulled off bottom to reduce annular pressures.

#### Control

Deploy Silt boom across the watercourse to mitigate bloom particles.

The freshwater based, bentonite suspension, drill fluid systems are, essentially, low viscosity grouts. In most cases, the fracture pathways will quickly seal up.

Break-Out is likely to indicate that the bore hole requires additional reaming to reduce the pressure required to return drill fluid to surface. A clearing (swabbing) pass of the in-situ reamer may be sufficient to prevent further Break-Out.

Various Lost Circulation Material (LCM) drill fluid additives are available to seal fractures in the formation. These vary from locally available substances such as sawdust, wheat chaff, kapok, etc to specifically produced materials such as mica flakes and proprietary chemical additives such as Diamond Seal™ or Micro-Fill. As a worst-case scenario, cement may be forced into the bore to seal up the pathways. The cement plug can subsequently be drilled out or side-tracked.

It is often the case that a combination of containment and control will be required to enable economic completion of the bore.

#### Clean up.

The containment and clean-up of all spills shall begin immediately. Site Management shall be notified immediately of any spills and shall be consulted regarding clean-up procedures.



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- In areas where excavation is permitted, where the drilling fluid has reached the surface, the following shall apply. All material contaminated with Bentonite shall be removed to a depth of 600mm, contained, and then be taken from site and disposed of at an approved recycling or disposal facility.
  - In the areas, which have been identified as “No Dig”, the drill fluid (Bentonite) shall be allowed to dry naturally on the surface and then be removed once hardened, without the need of excavation. Following agreement of works methodology with the client, the hardened Bentonite can then be taken away from site and disposed of at an approved recycling or disposal facility.
  - Vacuum truck will be called in if required in extreme circumstances to transfer any residual drill fluid from the surface of the containment point back to the recycling system.

#### Site Responsibilities:

##### The Drill Supervisor:

- Has overall responsibility for implementing this FCP.
- Shall be notified immediately when a frac-out is detected.
- Responsible for coordinating on site response and clean-up activities.
- Shall ensure all waste materials are properly contained, labelled, and removed from site and disposed of at an approved recycling or disposal facility.
- Shall assure a copy of this plan is available (onsite) and accessible to all drilling personnel.
- Shall ensure that all workers are familiar with the procedure for response to a frac-out.