

# Preston New Road WR11 Method Statement



WR11 Method Statement				
<b>Project:</b>		Preston New Road	<b>Document Number:</b> PNR-DRI-NOT-003	
<b>Approver:</b>		Technical Director	<b>Version No:</b> Issue 3	
<b>Reviewer:</b>		Drilling Manager	<b>Date of Issue:</b> May 2017	
<b>Author:</b>		PPE Manager	<b>Proposed date of Review:</b>	
Version	Section	Revision Information	Date	Reviser
0.1	All	Draft for review by Drilling Manager	March 17	
1.0	All	Approved for submission	April 17	
2.0	4.0	Removal of RPS statement	May 17	PPE Manager
3.0	4.0	Update to disposal options	May 17	PPE Manager
<p><i>Procedures are reviewed as per proposed review date, or sooner if a significant change to the operation has taken place, to ensure relevance to the systems and process that they define.</i></p>				

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### 1.0 Project Details

#### Well Operator:

Cuadrilla Bowland Limited

Cuadrilla House

Unit 6 Sceptre Court

Sceptre Way

Bamber Bridge

Preston

PR5 6AW

#### Timeline:

Estimated start date: 01<sup>st</sup> June 2017

Estimated finish date: 31<sup>st</sup> June 2017

#### Location Maps

Appendix A: Site Area 1:10,000 Red Line Map

Appendix B: Borehole Location 1:2,500



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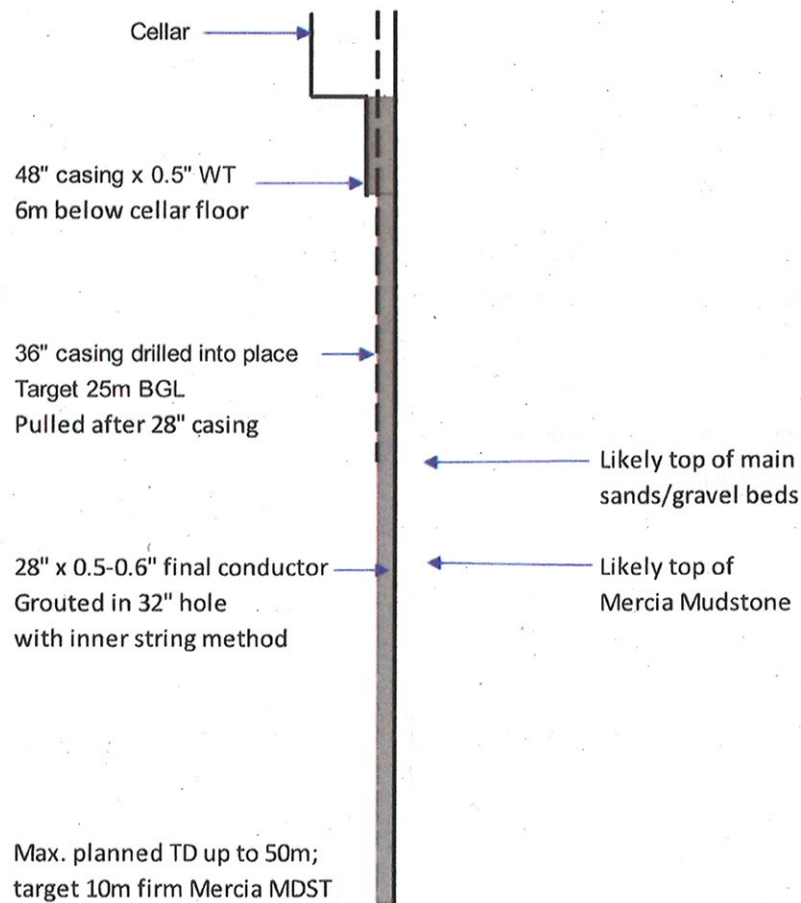
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### 2.0 Well Information

**Site Location:** Preston New Road Exploration Site

**Well Type:** Setting 2 Conductor Casings for wells PNR 1 & PNR 2

**Well Depth:** Vertical, up to 50m MDBGL (c. 50m TVDBGL)



### 3.0 Rig & Surface Information

#### Operations Summary:

	Operation
1.	Rig up PMRD Auger Rig (based on Liebherr LB16-180) for PNR-1. Note that operations may need amending if a substitution rig is required.
2.	Auger oversized hole for 48" protective casing with first rig through superficial deposits to approx. 12m BGL (6-7m below cellar floor). Grout annular clearance to cellar floor.
3.	Drill into place 36" protective casing to approx. 25m BGL.
4.	Rig down auger rig and move over to PNR-2. Repeat the above sequence. Note: adjustments may be made to the operational plans based on results from the first operation.
5.	Mobilise and rig up reverse circulating drilling rig over PNR-1.
6.	Drill 32" hole to TD at up to 50m BGL on PNR 1.
7.	Run 28" conductor. Pull 36" protective casing. Pressure-grout 28" conductor to cellar floor.
8.	Drill out conductor shoe with 26" bit to confirm clear drift.
8.	Rig down RC rig. Move rig to PNR-2 and similarly complete conductor setting, with operational adjustments according to results from the first operation.



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### Name of Rig: Auger Rig

The initial large-diameter holes will be auger-drilled with a rig provided by [REDACTED], for which they have several options including a Liebherr LB16 double rotary drilling rig and Soilmec Auger rig. The choice will depend on availability. The Liebherr unit allows casing to be drilled into place while augering within the casing bore.

### Image of Liebherr LB16-180



### Name of Rig: Rig & G28

#### SOILMEC G28

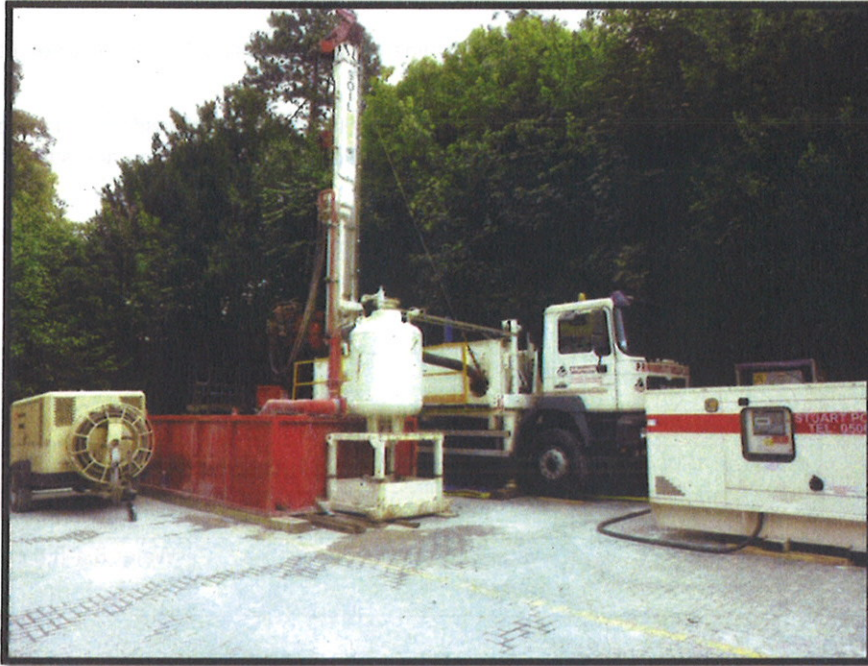
The Soilmec G28 rig can be used to drill boreholes to depths of up to 500m below ground with 27 tonnes of pullback capacity. Larger diameter holes of up to 900mm can be drilled to depths of 100-200m. The rig is powered by two top-drive hydraulic motors and is suitable to drill both direct rotary, mud flush, air and foam and reverse circulation. It has a maximum torque capacity of 2300 kgm (1253 ft-lb).



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### Image of Soilmec G28



## 4.0 Conductor Casing Construction & Fluid Control

The surface conductor section, which will be cased with 28" conductor, will be augered/drilled through the shallow sands which contain groundwater, see table 3 for formation summary. Water will be used to drill the section after the auger. Aquifers (Secondary A) are present in the shallow sands and water was encountered as shallow as 5.5m in the water wells (Appendix C). Normally pressured aquifers could flow during drilling of this section though this is considered unlikely as the water wells showed a water level elevation to 11.5m which will be below the surface elevation of these wells (12.5m) due to the site cut and fill. If groundwater ingress does happen, viscosified water will be used as a drilling fluid to drill to section TD (See Appendix D and Table 2 for information for drilling fluids). Introducing viscosified (and slightly heavier) water will stop any water flow from the well as there is no indication of artesian pressure at this elevation. If the groundwater flows into the well, drilling will continue with water and gel or polymers if required. Viscous pills will also be available if required.

A diverter (not pressure holding), will be used during the drilling of the conductor section. The diverter will be installed to direct any water flow to a diverter tank. The following steps will be used to assess the best environmental disposal option:

- 1) Assess whether drilling has utilised polymer fluids or not for the section of hole.
- 2) If polymer fluids have been used dispose of groundwater via tankering



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- 3) If large quantities of groundwater is experienced with polymer fluids being used, assess disposal options with pre-treatment e.g. settling time and then subsequent disposal to land. This will require pre-assessment from the Environment Agency.
- 4) If fluid requires disposing and is clean and uncontaminated e.g. no drilling fluids have been used then discharge to land is the best option.

Once the well is finalised a 28" mild steel conductor pipe, with 1" wall thickness and welded connections will be set in place at ~50m. It will be cemented to surface with Portland cement using a shoe and stinger. The cement and conductor pipe will keep fluids out of the borehole.

A review of offset data from the groundwater monitoring wells shows none or very low levels of shallow gas

**Table 2: Mud Type**

Hole Section	Interval (m MDBGL)	Mud Type	Mud Weight (ppg)
50"	4.5m to~ 12m	N/A – Auger drilled	
36"	~12m to ~26m	N/A – Auger drilled	Water (8.4 ppg)
35"	~26m to ~50m	Water / Gel or polymer if required	Water 8.4-8.8 ppg

The stratigraphic column for the wells is shown in Appendix C. Unconsolidated formations exist near surface.

**Table 3: Formation Summary**

Formation	Tops (m TVDBGL)
Top soil / Sub soil	0
Boulder Clay (interbedded with sands)	1m
Middle Sands	16m
Lower Boulder	25m
Mercia Mudstone	30m

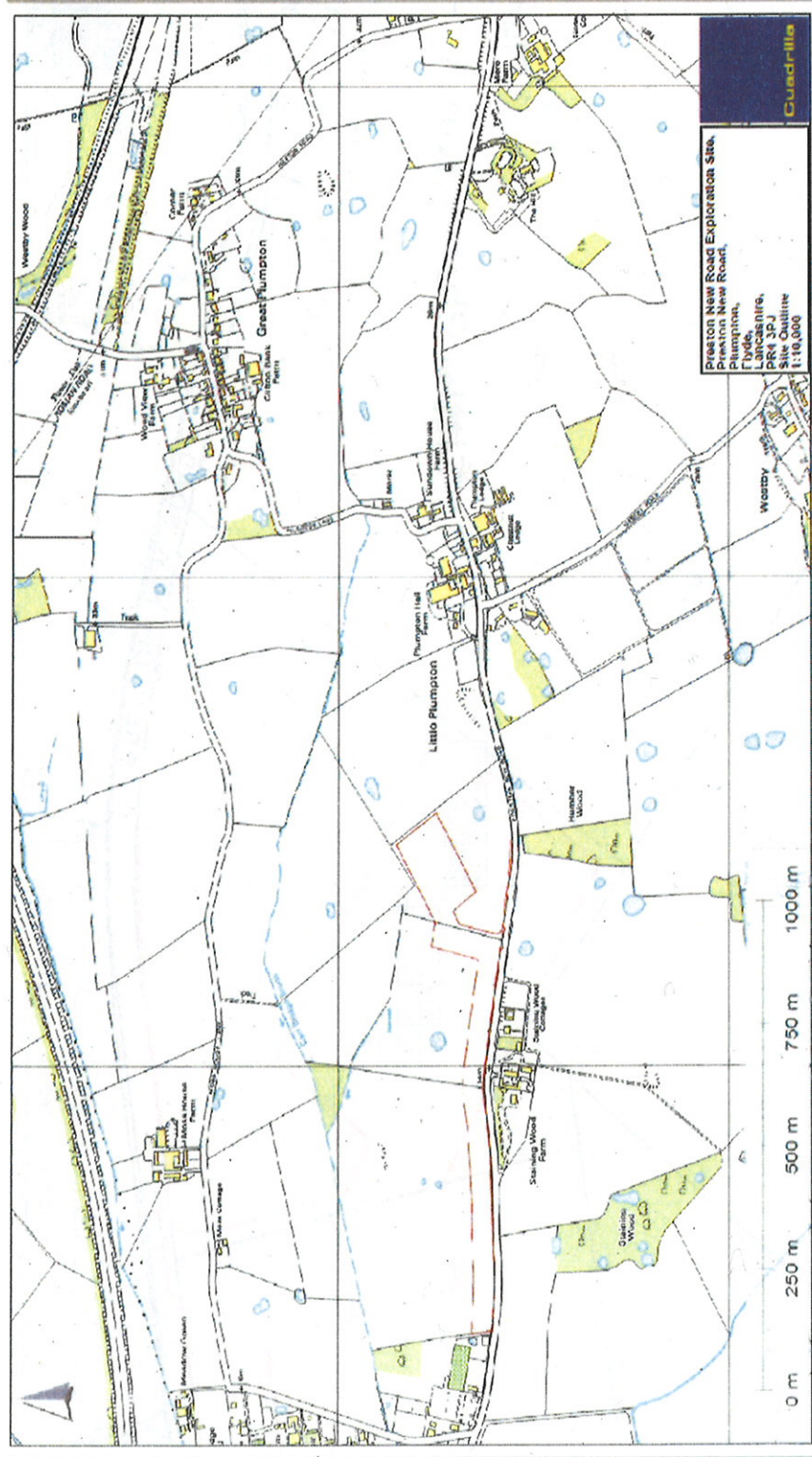




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**5.0 Appendix A 1: 10,000 Red Line Map**

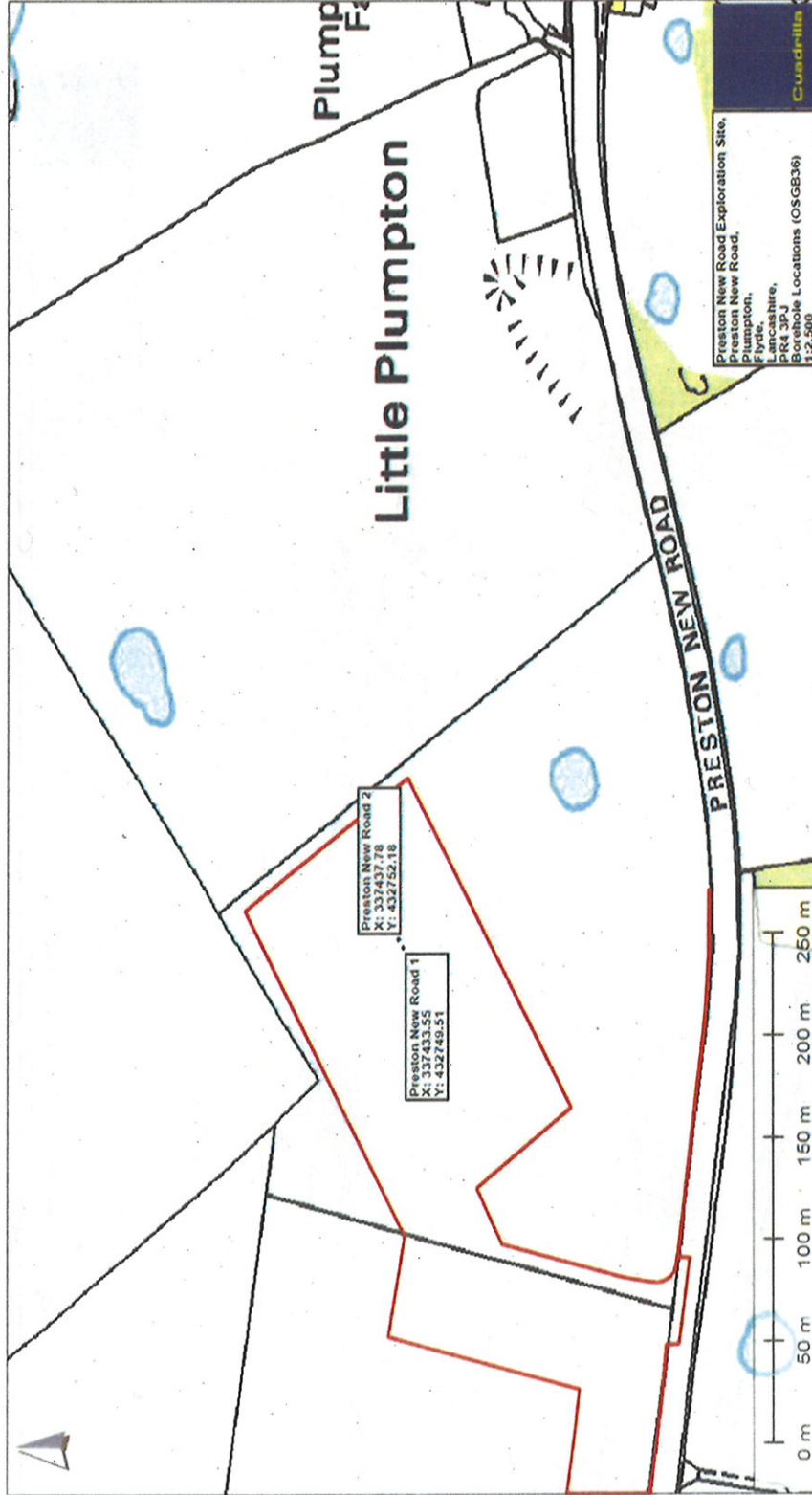


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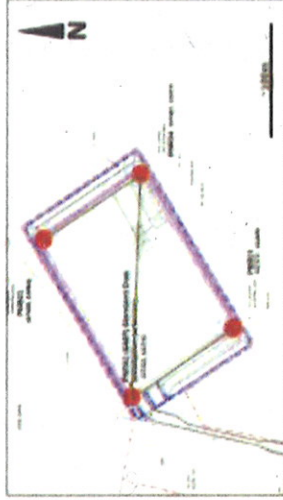
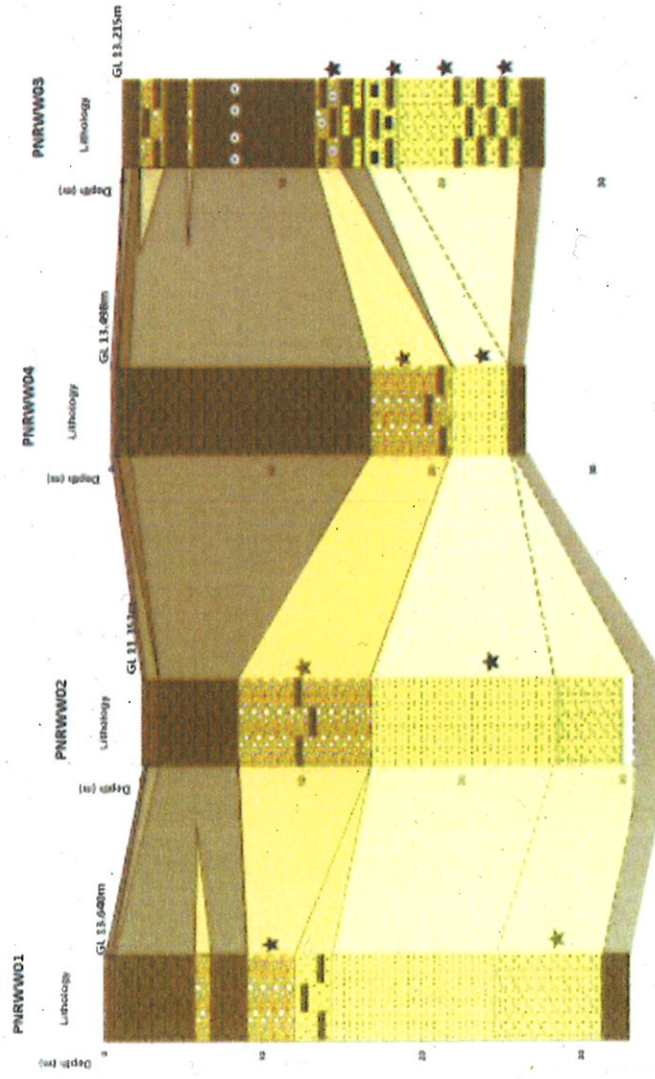
**6.0 Appendix B 1:2,500 Borehole Map**



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## 7.0 Appendix C – Groundwater Borehole

**WATER BOREHOLE WELL CORRELATION**  
 SITE: PRESTON NEW ROAD  
 DRILLING CONTRACTOR: [REDACTED]  
 LOGGED BY: [REDACTED]



Line of section

GL

- PNR01: 13.640m
- PNR02: 11.353m (positioned within a dip in the NW corner of site)
- PNR03: 13.215m
- PNR04: 13.498m

**Response Zones:**

Response zones have been placed within each well at the following intervals:

- Sands and Gravels
- Middle Sands

The purpose of these zones is to establish pre-existing baseline groundwater conditions as per legal regulatory requirements.

Response Zones are fitted with specifically designed gravel packs.

Note: PNRW03

**Key**

- ★ Response Zone
- Topsoil
- Subsoil
- Clay
- Boulder Clay
- Sands & Gravels
- Sands & Clays
- Middle Sands
- Silts & Sands

## **8.0 Appendix D – Well Drilling Product**

Currently appendix D is being reviewed to redact company information as it has been provided by a third party. We expect to add this shortly.



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**9.0 Appendix E – Groundwater and Surface Water Chemistry**

GW: Groundwater

SW: Surface Water

Feb-17	pH	Magnesium mg/l	Barium ug/l	Strontium ug/l	Sodium mg/l	Potassium mg/l	Nickel ug/l	Chromium ug/l	Cadmium ug/l	Copper ug/l	Lead ug/l	Zinc ug/l
Unit Conversion	pH											
GW	PNR-04a	0.0356	0.133	0.226	0.0396	0.0015	0.002	0.0015	0.0005	0.007	0.005	0.003
	PNR-04b	0.0347	0.066	0.565	0.026	0.0017	0.002	0.0015	0.0005	0.007	0.005	0.003
SW	PNR4	16	0.05	0.21	28	6	0.002	<0.001	<0.0001	0.009	<0.001	0.018

Feb-17	Iron ug/l	Arsenic ug/l	Boron ug/l	Mercury ug/l	Vanadium ug/l	Cobalt ug/l	Antimony ug/l	Silver ug/l	Aluminium ug/l	Lithium ug/l	Beryllium ug/l
Unit Conversion											
GW	PNR-04a	0.02	0.0025	0.03	0.001	0.002	0.002	0.005	0.02	0.013	0.0005
	PNR-04b	0.876	0.0106	0.041	0.001	0.002	0.002	0.005	0.02	0.017	0.0005
SW	PNR4	0.32	0.002	<0.01	<0.0001	<0.001	<0.001	<0.001	<0.002	0.07	<0.01



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**Subject:** FW: Section 199 WRA '91 WR11 Method Statement

**From:** [REDACTED]

**Sent:** 31 May 2017 12:57

**To:** [REDACTED]

**Cc:** [REDACTED]

**Subject:** Section 199 WRA '91 WR11 Method Statement

Thank you for submitting a revised Method Statement on the 11<sup>th</sup> May. The revision was prompted by our discussion concerning the disposal of wastewater from the conductor casing drilling process. Please note approval of the WR11 form and Method Statement is provided under Section 199(1) of the Water Resources Act 1991 – Notice of intention to drill for minerals. This submission has been considered for the conductor casing work only. As agreed a separate WR11 form and Method Statement is required for the main well.

Please note that prior discussion with the Environment Agency is required on the disposal options for any fluid involved or generated by the drilling process.

The Method Statement for the emplacement of the conductor casing at the Preston New Road site is acceptable in respect of the method of installation. 48" casing to at 6m cemented in place to Basement cellar, and 28" casing at 0.5 – 0.6" casing set to at 50m (set at 10 m into Mercia Mudstone). The 28" casing will be pressure grouted to surface. [The sand section is drilled in a 'shell and auger' fashion to avoid collapse in the hole and the casing is withdrawn post 28" emplacement].

For completeness please clarify the pipe thickness stated in section 2.0, 28" casing is 0.5-0.6" thick, section 4.0 refers to 1" wall thickness.

The aquifer within the middle sands would appear to stand at about 1 meter below the surface as seen in G/W monitoring boreholes. With the floor of the final basement cellar near that level. Does this water level stand inside the new basement cellar? (Report suggests the PAD level is 1m higher than ground, and so G/W should stand at 2 meters in the hole.)

As the secondary aquifer (middle sand) has only been seen to flow in one of the G/W monitoring boreholes it is unlikely that it will flow during the construction of the conductor casing hole. Mud circulation within the hole will be necessary for drill cutting removal, and the main consideration will be in relation to the solubility of the thick clay layer which could result in the requirement of thinning down the drilling mud. If this is the case there will be the need to have clean water on site and sufficient storage for the discarded drilling mud, and appropriate disposal routes.

The two types of mud additives are acceptable. PureBore consists of C<sub>2</sub>H<sub>4</sub>O<sub>3</sub>, which is Sodium Carboxyl Methylstarch, which is non-toxic to aquatic organisms. Ultra Bore is drilling mud based on Montmorillonite.

Please note that notification will be required if more than 20m<sup>3</sup> of groundwater is removed from the hole each day, this would trigger the requirement for a groundwater abstraction permit.

Regards

[REDACTED]  
Regulatory Officer, Cumbria and Lancashire Installations Team  
Cumbria and Lancashire Area  
Environment Agency

Address: Lutra House, Dodd Way, Walton Summit Industrial Estate, Bamber Bridge, Preston, PR5 8BX

