

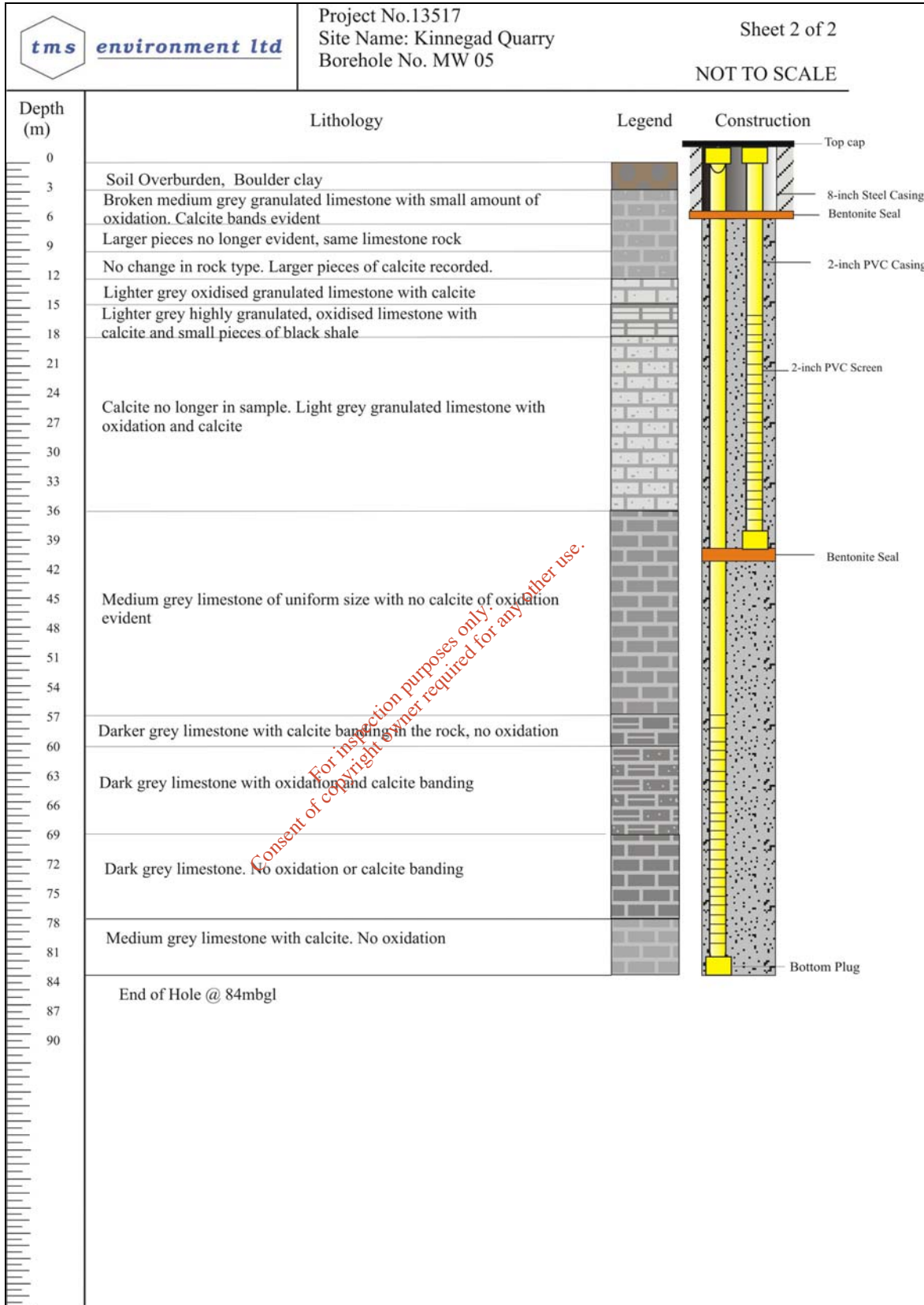



Lands Soils & Geology Chapter

Appendix 7A

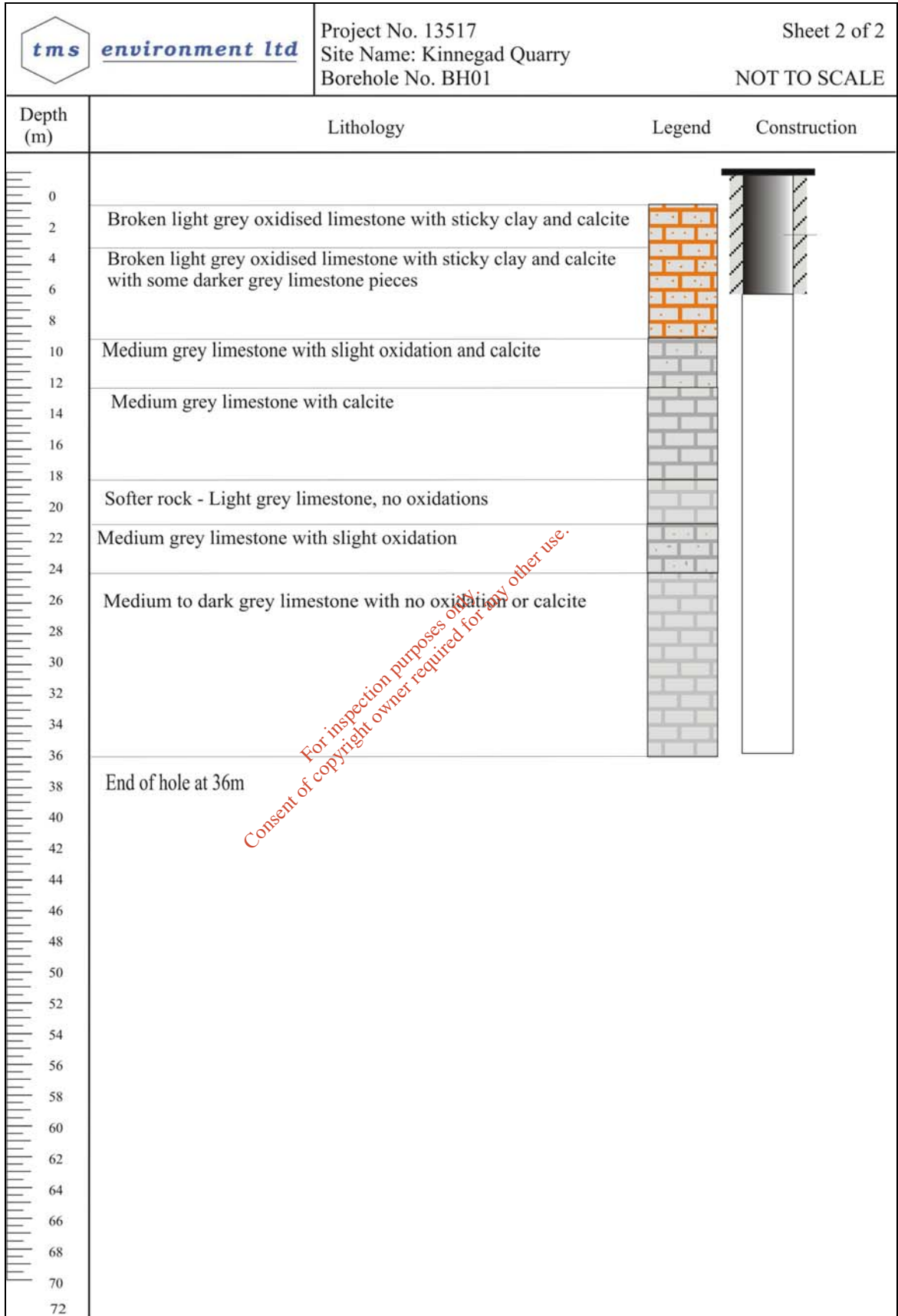
Historic BH Logs

(Application Area 2022)



 <p>tms environment ltd 53 Broomhill Drive, Tallaght, Dublin 24, Ireland. Tel: +353-1-4626710</p>	<p>BOREHOLE LOG</p>	<p>Sheet 1 of 2 BOREHOLE NO.BH01</p>
<p>GENERAL DETAILS</p> <p>Project No: 13517 Client: Irish Asphalt Ltd. Site Name: Kinnegad Quarry Grid Ref: 257053.911/ 243177.242 Ground Level: 85.337 Top of Casing: 85.853 Total Depth: 36 meters</p> <p>Commenced: 20/10/2008 Completed: 20/10/2008 Contractor: Dunnes Drilling Services Ltd Machine: Atlas Copco Drilling Method: Air Rotary Logged by: Phoebe Conway, TMS Environment Ltd.</p> <p>DRILLING DETAILS</p> <p>Ground level - 6mbgl: drilled at 10-inch diameter. 6 - 36mbgl: drilled at 8-inch diameter. Casing depth: 0 - 6mbgl</p> <p>Casing diameter: 8-inch to 6mbgl</p> <p>WATER</p> <p>Water strike at 3mbgl Estimated Yield: 400 gallons per hour</p> <p>FINAL INSTALLATION</p> <p>Left as open hole</p> <p>NOTES</p> <p>Drilling stopped at 36mtrs as no water encountered. Initial water strike sealed off with casing</p>		

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Lands Soils & Geology Chapter

Appendix 7B

2021 Site Investigation Results

Monitoring Wells & Production Wells Detail

The Monitoring Wells (MWs) are essentially Site Investigation (SI) BHs, which were drilled and completed by Petersen Drilling Ltd. using Rotary ODEX technique with reference to industry guidelines (Guidance on the design and installation of groundwater quality monitoring points, EA).

The drilling diameter was 120 mm and installation consisted of 50 mm ID HDPE standpipe with slotted casing used in the water-bearing sections. The annulus was filled with 10mm gravel around the slotted casing. Bentonite clay was used as a seal to surface. Temporary ODEX casing was used for drilling close to ground level and was removed upon completion after the HDPE standpipe was installed.

Raised lockable headworks, set within a concrete plinth, completed the installations. The headworks extend 0.5m above and below ground level.

Summary Information of note is presented in Table Appendix 7B_A, overleaf.

Borehole Logs for these 2021 MW Installations are also presented in this Appendix.

Figure 7.8 of the LSG Chapter presents MW Locations.

MWs were installed across the entire landholding and not just the application area.

In addition to the SI MWs, three Production Wells (PWs) were drilled in the application area for the Water Assessment: The PW IDs = ONGW18S, ONGW18D & ONGW19. Summary details for those three PWs are also presented in the Summary Table Appendix 7BA. PW Logs are presented in The Water Chapter's Appendices.



Table Appendix 7B A: Geology summary of 2021/2022 well drilling programme

(Refer to Figure 7.8 for locations)

Info	Name	Easting	Northing	Location	Depth (m)	Base of BH Elev (m OD)	Lithology (m bgl)
Peterssen Drilling Monitoring Wells [MW] Site Investigation BHs (2021). Drilled over the entire landholding.	ONGW12	657,500	744,200	Adjacent to sandpit near northern settlement pond	10.7	63.77	0 – 3.5 = medium dense, brown, silty gravelly SAND with cobbles and boulders 3.5 – 9.7 = medium dense, fine, grey/brown silty SAND 9.7 – 10.7 = firm to stiff grey, silty gravelly CLAY with high amount of cobbles
	ONGW13	657,271	742,722	West of limestone quarry sump	80.5	6.21	0 – 0.5 = hardcore fill MADE GROUND 0.5 – 3.5 = grey clayey fill, MADE GROUND 3.5 – 7.2 = firm, grey silty CLAY possible fill 7.2 – 9.8 = firm to stiff, brown CLAY, frequent limestone fragments and boulder, possible fill 9.8 – 80.5 = strong to very strong grey LIMESTONE with rare fractures
	ONGW14	657,038	743,167	Centre of application area	60	10	0 – 0.3 = rock fill MADE GROUND 0.3 – 1.3 = weak, highly fracture LIMESTONE 1.3 – 4.8 = medium strong, grey LIMESTONE, occasional fractures 4.8 – 7.5 = extremely weak, brown, weathered LIMESTONE with brown clay infill 7.5 – 10.0 = strong grey LIMESTONE with occasional to rare fractures
	ONGW15S	657,216	743,355	Immediately north of balancing pond	80	6.7	0 – 0.3 = firm brown TOPSOIL 0.3 – 1.1 = firm, brown silty sandy CLAY 1.1 – 1.7 = firm to stiff light brown silty sandy gravelly CLAY with frequent limestone fragments, possibly highly weathered rock 1.7 – 30.0 = strong grey LIMESTONE with frequent fractures and occasional clay infill 30.0 – 80.0 = strong to very strong grey LIMESTONE with rare fractures, occasional calcite
	ONGW15D	657,215	743,356	Immediately north of balancing pond	25	61.67	0 – 0.3 = firm brown TOPSOIL 0.3 – 1.7 = firm, brown silty sandy CLAY 1.7 – 3.5 = medium strong grey weathered LIMESTONE 3.5 – 25.0 = strong to very strong grey LIMESTONE with occasional fractures
	ONGW16	657,040	743,553	Northwest of application area, close to boundary of ownership	27.5	57.21	0 – 1.0 = hardcore fill MADE GROUND 1.0 – 3.5 = medium dense, brown silty gravelly SAND 3.5 – 6.4 = soft to firm brown sandy SILT 6.4 – 10.10 = stiff to very stiff dark grey blackish silty, gravelly CLAY with occasional cobbles 10.10 – 27.5 = weak to medium strong laminated greyish black MUDSTONE SHALE, occasional weathered joints
	ONGW17	657,166	743,484	Immediately north of application area. Adjacent to road overpass	80	4.27	0 – 0.3 = soft brown TOPSOIL 0.3 – 3.5 = firm to stiff, silty sandy gravelly CLAY with frequent limestone boulder 3.5 – 4.0 = weak to medium strong grey weathered LIMESTONE 4.0 – 19.5 = very strong grey limestone with rare fractures 19.5 – 20.0 = minor fractured zone 20.0 – 80.0 = very strong grey limestone with rare fractures
Briddy Drilling Production Wells [PW] in Application Area (2022)	ONGW18S	657,034	743,171	6 m from ONGW14	9	58.32	0 – 2 = fill material 3 – 7 = strong grey limestone 7 – 8.5 = clay with gravels 8.5 – 9.0 = strong grey limestone
	ONGW18D	657,031	743,174	6 m from ONGW14	63	7	0 – 2 = fill material 3 – 7 = strong grey limestone 7 – 8.5 = clay with gravels 8.5 – 63 = strong grey limestone Small 0.5 – 1.0 m clay bands logged at 19 m, 31 m, 48 m.
	ONGW19	657,093	743,298	Southwest of balancing pond	63	4.79	0 – 63 = strong grey limestone



Depth of Stratum Top (m)	Driller's Stratum Description	Sample / Hole / Test Details					Drilling Details				Standard Penetration Test													
		No	Type	In situ test	From (m)	To (m)	Liner Dia (mm)	Core run time (hhmm)	Total core Recovery (m)	Flush Return %	Flush Colour	Self Weight Pen (mm)	75 mm	150 mm	Seating Pen (mm)	75 mm	150 mm	225 mm	300 mm	Main Pen (mm)	N value	Casing Depth (m)	Water/flush level (m)	
0.00	Medium dense brown silty gravelly SAND with frequent cobbles and boulders		RO		0.00	10.70		0000		100	grey												0.00	0.00
3.50	Medium dense fine brownish grey silty SAND																							
9.70	Firm to stiff grey high cobble content silty gravelly CLAY																							

Shift details				Drilling Equipment Details												Ground Water Record								Backfill (m)			
Start time (hhmm)	Hole (m)	Water (m)	Casing (m)	Casing (C) Open Hole (RO) Coring (RC)	Dia. (mm)	From (m)	To (m)	Barrel	Liner Type	Core Dia (mm)	Bit Type	Casing Type	Bit serial No	Flush	Polymer	Time of strike	Depth Struck (m)	Casing (m)	Inflow	5 min	10 min	15 min	20 min	Depth Seated (m)	Type	From (m)	To (m)
1235				C	140.00	0.00	10.70					Sim. Casing				1345	3.50	3.50	Very Slow	0.00	0.00	0.00	0.00	N/S			
				RO	154.00	0.00	10.70				DTH Button Bit		115	Air	No												
																1545	9.50	9.50	Medium	0.00	0.00	0.00	0.00	10.50			
1555	10.70	3.50	10.70																								

Time from	Duration (hhmm)	Remarks or details of any additional testing information, Dayworks	SPT I.D. Number	PD1	Calibration Date	01/02/2021	Project Title				
1235		CAT Scanned: Yes	SPT Rod Type	2 3/8 Regular	SPT Energy Ratio	0.00	Kinnegad				
1235		Permit Completed: Yes	Drilling Crew Details			CSCS No					
			Support Operative	John Whyte			Weather	Fine		Project No	40-21
			Lead Driller	Stephan Petersen			Date	20/10/2021		Day	Wednesday
			Site category	Green			Rig type	Knebel HY79		Borehole Number	
			Project Engineer	P Bartley			Inclination		Orientation	ONGW 12	
			Lead Driller's signature				Sheet	1 of 2		Completed	Y





Depth of Stratum Top (m)	Driller's Stratum Description	Sample / Hole / Test Details					Drilling Details					Standard Penetration Test														
		No	Type	In situ test	From (m)	To (m)	Liner Dia (mm)	Core run time (hhmm)	Total core Recovery (m)	Flush Return %	Flush Colour	Self Weight Pen (mm)	75 mm	150 mm	Seating Pen (mm)	75 mm	150 mm	225 mm	300 mm	Main Pen (mm)	N value	Casing Depth (m)	Water/flush level (m)			

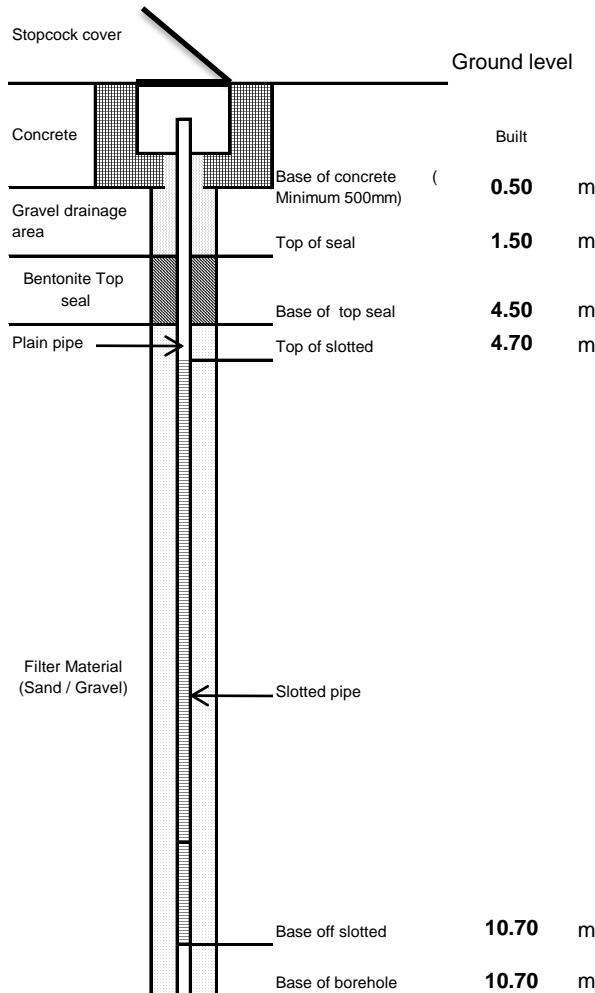
Shift details				Drilling Equipment Details											Ground Water Record								Backfill (m)					
Start time (hhmm)	Hole (m)	Water (m)	Casing (m)	Casing (C) Open Hole (RO) Coring (RC)	Dia. (mm)	From (m)	To (m)	Barrel	Liner Type	Core Dia (mm)	Bit Type	Casing Type	Bit serial No	Flush	Polymer	Time of strike	Depth Struck (m)	Casing (m)	Inflow	5 min	10 min	15 min	20 min	Depth Sealed (m)	Type	From (m)	To (m)	
0820	10.70	4.30	10.70																									
Finish time (hhmm)	Hole (m)	Water (m)	Casing (m)																									
0940																												

Time from	Duration (hhmm)	Remarks or details of any additional testing information, Dayworks	SPT I.D. Number	PD1	Calibration Date	01/02/2021	Project Title Kinnegad					
			SPT Rod Type	2 3/8 Regular	SPT Energy Ratio	0.00						
			Drilling Crew Details			CSCS No						
			Support Operative	John Whyte			Weather	Fine		Project No	40-21	
			Lead Driller	Stephan Petersen			Date	21/10/2021		Day	Thursday	
			Site category	Green			Rig type	Knebel HY79		Borehole Number		
			Project Engineer	P Bartley			Inclination		Orientation	ONGW 12		
			Lead Driller's signature				Sheet	2 of 2		Completed	Y	



Summary of Standpipe Installation

Schematic Diagram (not to scale)



Installation Details

Standpipe diameter (id)	50	mm
Borehole diameter	154	mm
Slot size	1	mm
Geosock	Yes	
Gas tap	None	
Filter type	Gravel	
Type of cover	Upright	
Initial reading	4.30	m
Time of Initial reading	0940	hhmm

	Base (m)	Top (m)
Concrete	0.50	GL
Gravel drainage	1.50	0.50
Borehole seal top	4.50	1.50
Filter zone	10.70	4.50
Plain pipe	4.70	GL
Slotted zone	10.70	4.70
Base of borehole	10.70	

Remarks

Rig type	Knebel HY79	Project Title			
Drilling Crew Details		Kinnegad			
Support Operative	John Whyte	Project No		40-21	
Lead Driller	Stephan Petersen	Day	Thursday	Date	October 21, 2021
Site category	Green	Borehole Number		ONGW 12	
Engineer	P Bartley				
Lead Driller's signature					



Depth of Stratum Top (m)	Driller's Stratum Description	Sample / Hole / Test Details					Drilling Details				Standard Penetration Test														
		No	Type	In situ test	From (m)	To (m)	Liner Dia (mm)	Core run time (hhmm)	Total core Recovery (m)	Flush Return %	Flush Colour	Self Weight Pen (mm)	75 mm	150 mm	Seating Pen (mm)	75 mm	150 mm	225 mm	300 mm	Main Pen (mm)	N value	Casing Depth (m)	Water/flush level (m)		
			RO		0.00	80.50		0000		100	grey													0.00	0.00

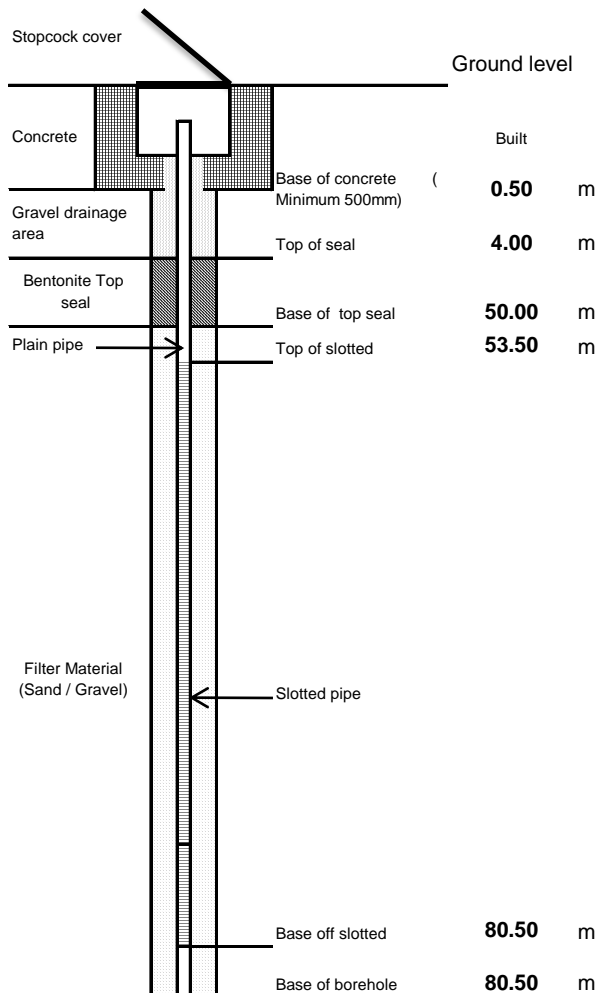
Shift details				Drilling Equipment Details											Ground Water Record										Backfill (m)			
Start time (hhmm)	Hole (m)	Water (m)	Casing (m)	Casing (C) Open Hole (RO) Coring (RC)	Dia. (mm)	From (m)	To (m)	Barrel	Liner Type	Core Dia (mm)	Bit Type	Casing Type	Bit serial No	Flush	Polymer	Time of strike	Depth Struck (m)	Casing (m)	Inflow	5 min	10 min	15 min	20 min	Depth Seated (m)	Type	From (m)	To (m)	
0820	80.00	0.00	11.00	RO	120.00	11.00	80.50				DTH Button Bit			Air	No													
Finish time (hhmm)	Hole (m)	Water (m)	Casing (m)																									
1145																												

Time from	Duration (hhmm)	Remarks or details of any additional testing information, Dayworks	SPT I.D. Number	PD1	Calibration Date	01/02/2021	Project Title					
1145	0030	Dayworks: Airlift development of well	SPT Rod Type	2 3/8 Regular	SPT Energy Ratio	0.00	Kinnegad					
			Drilling Crew Details			CSCS No						
			Support Operative		John Whyte		Weather	Variable		Project No	40-21	
			Lead Driller		Stephan Petersen		Date	04/11/2021		Day Thursday		
			Site category		Green		Rig type	Knebel HY79		Borehole Number		
			Project Engineer		P Bartley		Inclination	Orientation		ONGW 13		
			Lead Driller's signature					Sheet	2 of 2		Completed	Y



Summary of Standpipe Installation

Schematic Diagram (not to scale)



Installation Details

Standpipe diameter (id)	50	mm
Borehole diameter	120	mm
Slot size	1	mm
Geosock	No	
Gas tap	None	
Filter type	Gravel	
Type of cover	Upright	
Initial reading	0.00	m
Time of Initial reading	1145	hhmm

	Base (m)	Top (m)
Concrete	0.50	GL
Gravel drainage	4.00	0.50
Borehole seal top	50.00	4.00
Filter zone	80.50	50.00
Plain pipe	53.50	GL
Slotted zone	80.50	53.50
Base of borehole	80.50	

Remarks

2nd bentonite seal 12 to 13m

Rig type	Knebel HY79	Project Title			
Drilling Crew Details		Kinnegad			
Support Operative	John Whyte	Project No		40-21	
Lead Driller	Stephan Petersen	Day	Thursday	Date	November 4, 2021
Site category	Green	Borehole Number		ONGW 13	
Engineer	P Bartley				
Lead Driller's signature					



Depth of Stratum Top (m)	Driller's Stratum Description	Sample / Hole / Test Details					Drilling Details				Standard Penetration Test																	
		No	Type	In situ test	From (m)	To (m)	Liner Dia (mm)	Core run time (hhmm)	Total core Recovery (m)	Flush Return %	Flush Colour	Self Weight Pen (mm)	75 mm	150 mm	Seating Pen (mm)	75 mm	150 mm	225 mm	300 mm	Main Pen (mm)	N value	Casing Depth (m)	Water/flush level (m)					
0.00	Rock fill MADE GROUND																											
0.30	Weak highly fractured LIMESTONE																											
1.30	Medium strong grey LIMESTONE occasional fractures																											
4.80	Extremely weak brown weathered karst LIMESTONE with brown clay infill																											
7.50	Strong grey LIMESTONE with occasional fractures																											
10.00	Very strong grey LIMESTONE very rare fractures																											

Shift details				Drilling Equipment Details										Ground Water Record							Backfill (m)						
Start time (hhmm)	Hole (m)	Water (m)	Casing (m)	Casing (C) Open Hole (RO) Coring (RC)	Dia. (mm)	From (m)	To (m)	Barrel	Liner Type	Core Dia (mm)	Bit Type	Casing Type	Bit serial No	Flush	Polymer	Time of strike	Depth Struck (m)	Casing (m)	Inflow	5 min	10 min	15 min	20 min	Depth Seated (m)	Type	From (m)	To (m)
1040				C	140.00	0.00	2.20					Sim. Casing				1210	1.20	1.20	Fast	0.40	0.00	0.00	0.00	N/S			
				RO	154.00	0.00	2.20				DTH Button Bit		115	Air	No												
1620	45.00	0.40	2.20																								

Time from	Duration (hhmm)	Remarks or details of any additional testing information, Dayworks	SPT I.D. Number	PD1	Calibration Date	01/02/2021	Project Title				
1040		CAT Scanned: Yes	SPT Rod Type	2 3/8 Regular	SPT Energy Ratio	0.00	Kinnegad				
1040		Permit Completed: Yes	Drilling Crew Details			CSCS No					
		General; yield test at 4m approx 1 /s	Support Operative	John Whyte		Weather					
			Lead Driller	Stephan Petersen		Date	29/10/2021		Day	Friday	
			Site category	Green			Rig type	Knebel HY79		Borehole Number	
			Project Engineer	P Bartley			Inclination		Orientation	ONGW 14	
			Lead Driller's signature			Sheet	1 of 2		Completed	Y	





Depth of Stratum Top (m)	Driller's Stratum Description	Sample / Hole / Test Details					Drilling Details				Standard Penetration Test													
		No	Type	In situ test	From (m)	To (m)	Liner Dia (mm)	Core run time (hhmm)	Total core Recovery (m)	Flush Return %	Flush Colour	Self Weight Pen (mm)	75 mm	150 mm	Seating Pen (mm)	75 mm	150 mm	225 mm	300 mm	Main Pen (mm)	N value	Casing Depth (m)	Water/flush level (m)	
			RO		0.00	60.00		0000		100	grey												0.00	0.30

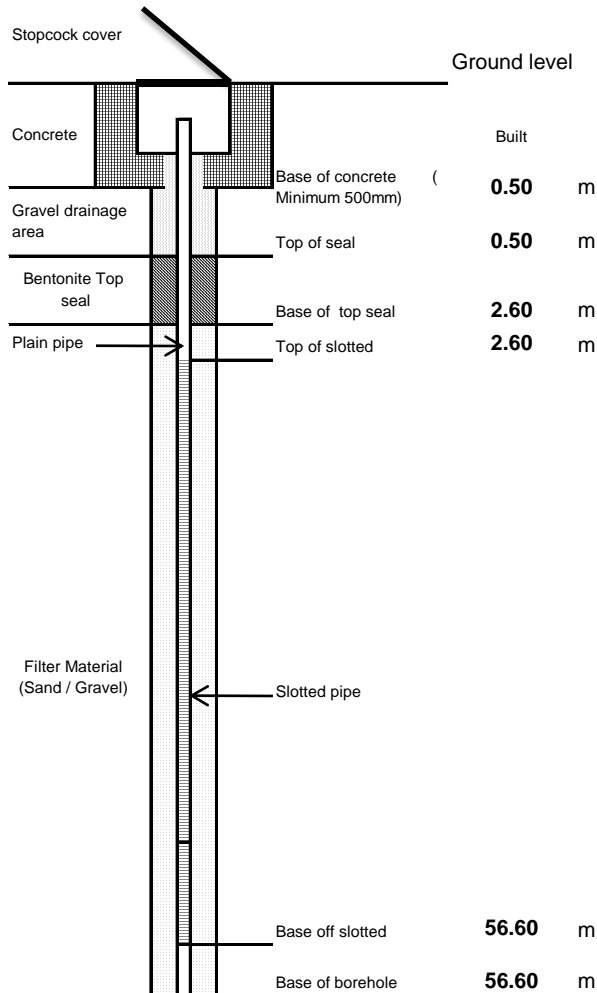
Shift details				Drilling Equipment Details											Ground Water Record								Backfill (m)					
Start time (hhmm)	Hole (m)	Water (m)	Casing (m)	Casing (C) Open Hole (RO) Coring (RC)	Dia. (mm)	From (m)	To (m)	Barrel	Liner Type	Core Dia (mm)	Bit Type	Casing Type	Bit serial No	Flush	Polymer	Time of strike	Depth Struck (m)	Casing (m)	Inflow	5 min	10 min	15 min	20 min	Depth Seated (m)	Type	From (m)	To (m)	
0810	45.00	0.30	2.20	RO	120.00	2.20	60.00				DTH Button Bit			Air	No													
Finish time (hhmm)	Hole (m)	Water (m)	Casing (m)																									
1540																												

Time from	Duration (hhmm)	Remarks or details of any additional testing information, Dayworks	SPT I.D. Number	PD1	Calibration Date	01/02/2021	Project Title					
1100	0230	Dayworks: Reaming borehole. Cleared obstruction from borehole	SPT Rod Type	2 3/8 Regular	SPT Energy Ratio	0.00	Kinnegad					
1410	0030	Dayworks: Airlift development of well	Drilling Crew Details			CSCS No						
		General; repeated borehole collapse around 7m, 60-57m backfall	Support Operative		John Whyte		Weather	Variable		Project No	40-21	
			Lead Driller		Stephan Petersen		Date	01/11/2021		Day	Monday	
			Site category		Green		Rig type	Knebel HY79		Borehole Number		
			Project Engineer		P Bartley		Inclination	Orientation		ONGW 14		
			Lead Driller's signature					Sheet	2 of 2		Completed	Y



Summary of Standpipe Installation

Schematic Diagram (not to scale)



Installation Details

Standpipe diameter (id)	50	mm
Borehole diameter	120	mm
Slot size	1	mm
Geosock	No	
Gas tap	None	
Filter type	Gravel	
Type of cover	Upright	
Initial reading	0.40	m
Time of Initial reading	1540	hhmm

	Base (m)	Top (m)
Concrete	0.50	GL
Gravel drainage	0.50	0.50
Borehole seal top	2.60	0.50
Filter zone	56.60	2.60
Plain pipe	2.60	GL
Slotted zone	56.60	2.60
Base of borehole	56.60	

Remarks

Rig type	Knebel HY79	Project Title			
Drilling Crew Details		Kinnegad			
Support Operative	John Whyte	Project No		40-21	
Lead Driller	Stephan Petersen	Day	Monday	Date	November 1, 2021
Site category	Green			Borehole Number	
Engineer	P Bartley			ONGW 14	
Lead Driller's signature					



Depth of Stratum Top (m)	Driller's Stratum Description	Sample / Hole / Test Details					Drilling Details					Standard Penetration Test													
		No	Type	In situ test	From (m)	To (m)	Liner Dia (mm)	Core run time (hhmm)	Total core Recovery (m)	Flush Return %	Flush Colour	Self Weight Pen (mm)	75 mm	150 mm	Seating Pen (mm)	75 mm	150 mm	225 mm	300 mm	Main Pen (mm)	N value	Casing Depth (m)	Water/flush level (m)		
			RO		0.00	80.00		0000		100	grey													0.00	Dry

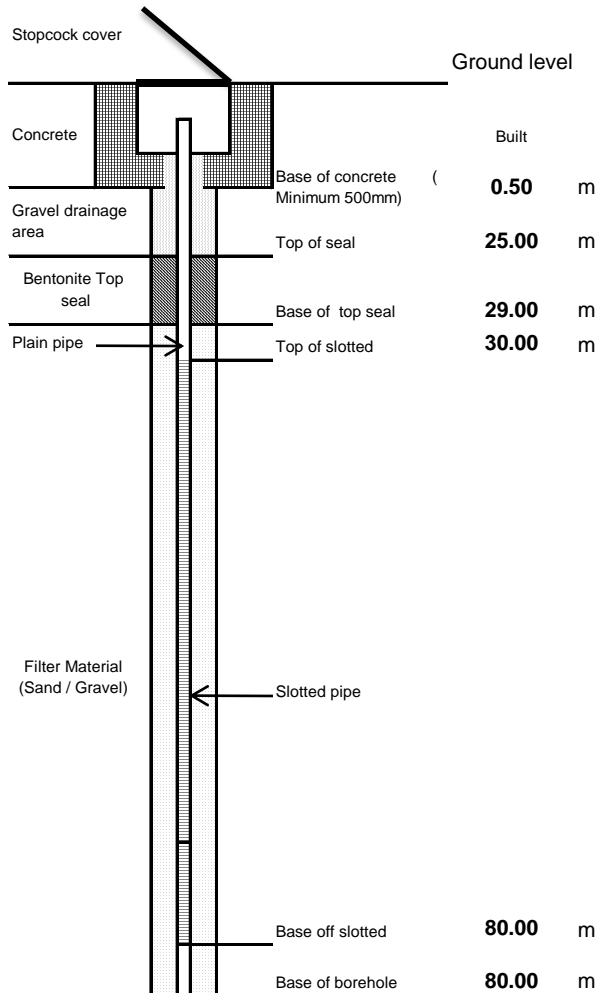
Shift details				Drilling Equipment Details												Ground Water Record										Backfill (m)			
Start time (hhmm)	Hole (m)	Water (m)	Casing (m)	Casing (C) Open Hole (RO) Coring (RC)	Dia. (mm)	From (m)	To (m)	Barrel	Liner Type	Core Dia (mm)	Bit Type	Casing Type	Bit serial No	Flush	Polymer	Time of strike	Depth Struck (m)	Casing (m)	Inflow	5 min	10 min	15 min	20 min	Depth Seated (m)	Type	From (m)	To (m)		
0750	60.00	5.00	2.00	RO	120.00	2.00	80.00				DTH Button Bit			Air	No														
Finish time (hhmm)	Hole (m)	Water (m)	Casing (m)																										
1545																													

Time from	Duration (hhmm)	Remarks or details of any additional testing information, Dayworks	SPT I.D. Number	PD1	Calibration Date	01/02/2021	Project Title					
			SPT Rod Type	2 3/8 Regular	SPT Energy Ratio	0.00	Kinnegad					
			Drilling Crew Details			CSCS No						
			Support Operative	John Whyte			Weather	Variable		Project No	40-21	
			Lead Driller	Stephan Petersen			Date	26/10/2021		Day	Tuesday	
			Site category	Green			Rig type	Knebel HY79		Borehole Number		
			Project Engineer	P Bartley			Inclination		Orientation	ONGW 15		
			Lead Driller's signature				Sheet	2 of 2		Completed	Y	



Summary of Standpipe Installation

Schematic Diagram (not to scale)



Installation Details

Standpipe diameter (id)	50	mm
Borehole diameter	120	mm
Slot size	1	mm
Geosock	No	
Gas tap	None	
Filter type	Gravel	
Type of cover	Upright	
Initial reading	Dry	m
Time of Initial reading	1355	hhmm

	Base (m)	Top (m)
Concrete	0.50	GL
Gravel drainage	25.00	0.50
Borehole seal top	29.00	25.00
Filter zone	80.00	29.00
Plain pipe	30.00	GL
Slotted zone	80.00	30.00
Base of borehole	80.00	

Remarks

2nd bentonite seal 2 to 1m

Rig type	Knebel HY79	Project Title			
Drilling Crew Details		Kinnegad			
Support Operative	John Whyte				
Lead Driller	Stephan Petersen	Project No	40-21		
Site category	Green	Day	Tuesday	Date	October 26, 2021
Engineer	P Bartley	Borehole Number			
Lead Driller's signature					



Depth of Stratum Top (m)	Driller's Stratum Description	Sample / Hole / Test Details					Drilling Details				Standard Penetration Test														
		No	Type	In situ test	From (m)	To (m)	Liner Dia (mm)	Core run time (hhmm)	Total core Recovery (m)	Flush Return %	Flush Colour	Self Weight Pen (mm)	75 mm	150 mm	Seating Pen (mm)	75 mm	150 mm	225 mm	300 mm	Main Pen (mm)	N value	Casing Depth (m)	Water/ flush level (m)		
0.00	Firm brown TOPSOIL		RO		0.00	25.00		0000		100	grey													0.00	Dry
0.30	Firm brown silty sandy CLAY																								
1.70	Medium strong grey weathered LIMESTONE																								
3.50	Strong to Very strong grey LIMESTONE with occasional fractures																								

Shift details				Drilling Equipment Details											Ground Water Record								Backfill (m)					
Start time (hhmm)	Hole (m)	Water (m)	Casing (m)	Casing (C) Open Hole (RO) Coring (RC)	Dia. (mm)	From (m)	To (m)	Barrel	Liner Type	Core Dia (mm)	Bit Type	Casing Type	Bit serial No	Flush	Polymer	Time of strike	Depth Struck (m)	Casing (m)	Inflow	5 min	10 min	15 min	20 min	Depth Seated (m)	Type	From (m)	To (m)	
1550				C	140.00	0.00	2.10					Sim. Casing																
				RO	154.00	0.00	2.10				DTH Button Bit		115	Air	No													
Finish time (hhmm)	Hole (m)	Water (m)	Casing (m)	RO	120.00	2.10	25.00				DTH Button Bit			Air	No													
1655	25.00	Dry	2.10																									

Time from	Duration (hhmm)	Remarks or details of any additional testing information, Dayworks	SPT I.D. Number	PD1	Calibration Date	01/02/2021	Project Title							
1550		CAT Scanned: Yes	SPT Rod Type	2 3/8 Regular	SPT Energy Ratio	0.00	Kinnegad							
1550		Permit Completed: Yes	Drilling Crew Details			CSCS No								
		DREM (5.60m - 5.90m): fractured rock zone, with some clay infill	Support Operative		John Whyte		Weather	Variable		Project No	40-21			
			Lead Driller		Stephan Petersen		Date	26/10/2021		Day			Tuesday	
			Site category		Green		Rig type	Knebel HY79		Borehole Number				
			Project Engineer		P Bartley		Inclination	Orientation		ONGW 15B				
			Lead Driller's signature					Sheet	1 of 2		Completed		Y	





Depth of Stratum Top (m)	Driller's Stratum Description	Sample / Hole / Test Details						Drilling Details				Standard Penetration Test															
		No	Type	In situ test	From (m)	To (m)	Liner Dia (mm)	Core run time (hhmm)	Total core Recovery (m)	Flush Return %	Flush Colour	Self Weight Pen (mm)	75 mm	150 mm	Seating Pen (mm)	75 mm	150 mm	225 mm	300 mm	Main Pen (mm)	N value	Casing Depth (m)	Water/flush level (m)				

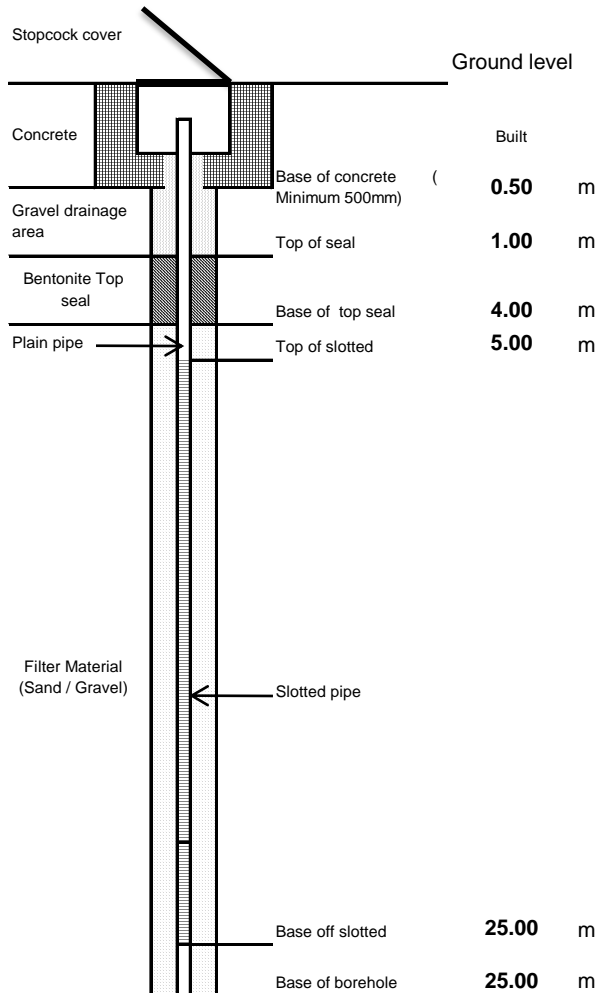
Shift details				Drilling Equipment Details												Ground Water Record								Backfill (m)					
Start time (hhmm)	Hole (m)	Water (m)	Casing (m)	Casing (C) Open Hole (RO) Coring (RC)	Dia. (mm)	From (m)	To (m)	Barrel	Liner Type	Core Dia (mm)	Bit Type	Casing Type	Bit serial No	Flush	Polymer	Time of strike	Depth Struck (m)	Casing (m)	Inflow	5 min	10 min	15 min	20 min	Depth Seated (m)	Type	From (m)	To (m)		
0810	25.00	5.00	2.10																										
Finish time (hhmm)	Hole (m)	Water (m)	Casing (m)																										
1055																													

Time from	Duration (hhmm)	Remarks or details of any additional testing information, Dayworks	SPT I.D. Number	PD1	Calibration Date	01/02/2021	Project Title									
1350	0045	Dayworks: Airlift development of both wells	SPT Rod Type	2 3/8 Regular	SPT Energy Ratio	0.00	Kinnegad									
			Drilling Crew Details			CSCS No										
			Support Operative		John Whyte		Weather		Variable			Project No		40-21		
			Lead Driller		Stephan Petersen		Date		29/10/2021			Day		Friday		
			Site category		Green		Rig type		Knebel HY79			Borehole Number				
			Project Engineer		P Bartley		Inclination		Orientation			ONGW 15B				
			Lead Driller's signature			Sheet		2 of 2		Completed		Y				



Summary of Standpipe Installation

Schematic Diagram (not to scale)



Installation Details

Standpipe diameter (id)	50	mm
Borehole diameter	120	mm
Slot size	1	mm
Geosock	No	
Gas tap	None	
Filter type	Gravel	
Type of cover	Upright	
Initial reading	Dry	m
Time of Initial reading	1350	hhmm

	Base (m)	Top (m)
Concrete	0.50	GL
Gravel drainage	1.00	0.50
Borehole seal top	4.00	1.00
Filter zone	25.00	4.00
Plain pipe	5.00	GL
Slotted zone	25.00	5.00
Base of borehole	25.00	

Remarks

Rig type	Knebel HY79	Project Title			
Drilling Crew Details		Kinnegad			
Support Operative	John Whyte	Project No		40-21	
Lead Driller	Stephan Petersen	Day	Friday	Date	October 29, 2021
Site category	Green	Borehole Number		ONGW 15B	
Engineer	P Bartley				
Lead Driller's signature					



Depth of Stratum Top (m)	Driller's Stratum Description	Sample / Hole / Test Details					Drilling Details				Standard Penetration Test													
		No	Type	Insitu test	From (m)	To (m)	Liner Dia (mm)	Core run time (hhmm)	Total core Recovery (m)	Flush Return %	Flush Colour	Self Weight Pen (mm)	75 mm	150 mm	Seating Pen (mm)	75 mm	150 mm	225 mm	300 mm	Main Pen (mm)	N value	Casing Depth (m)	Water/ flush level (m)	
0.00	Hardcore Fill MADE GROUND		RO		0.00	36.00		0000		100	black												0.00	0.00
1.00	Medium dense brown silty gravelly SAND																							
3.50	Soft to firm brown sandy SILT																							
6.40	Stiff to very stiff dark grey blackish silty gravelly CLAY with occasional cobble																							
10.10	Weak to Medium strong laminated greyish black MUDSTONE SHALE occasional weatherd joints																							

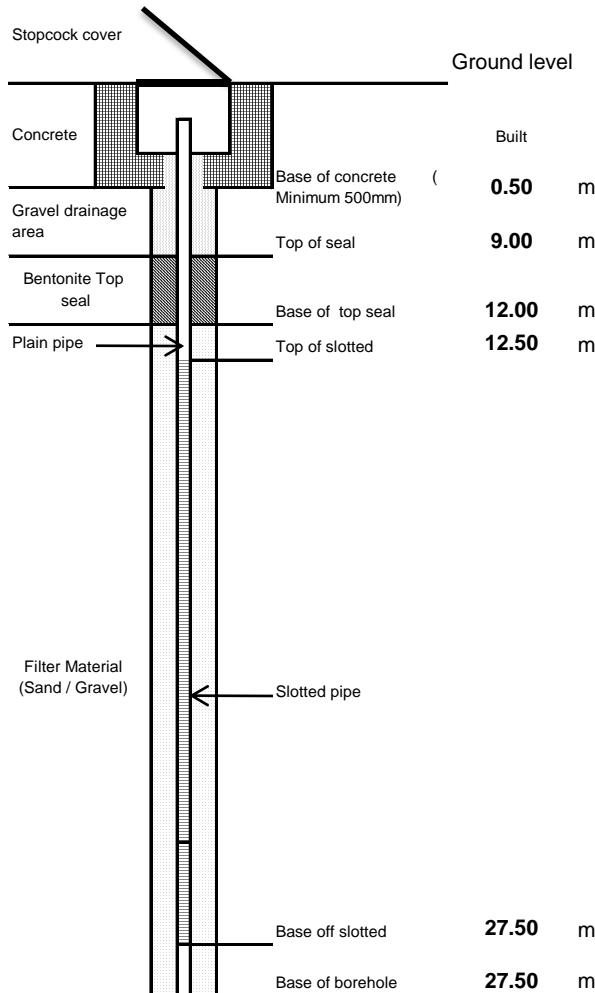
Shift details				Drilling Equipment Details												Ground Water Record								Backfill (m)			
Start time (hhmm)	Hole (m)	Water (m)	Casing (m)	Casing (C) Open Hole (RO) Coring (RC)	Dia. (mm)	From (m)	To (m)	Barrel	Liner Type	Core Dia (mm)	Bit Type	Casing Type	Bit serial No	Flush	Polymer	Time of strike	Depth Struck (m)	Casing (m)	Inflow	5 min	10 min	15 min	20 min	Depth Seated (m)	Type	From (m)	To (m)
1405				C	140.00	0.00	11.00					Sim. Casing				0920	21.00	11.00	Medium	0.00	0.00	0.00	0.00	N/S	Collapse	36.00	27.50
				RO	154.00	0.00	11.00				DTH Button Bit		115	Air	No												
				RO	120.00	11.00	36.00				DTH Button Bit			Air	No												
1705																											

Time from	Duration (hhmm)	Remarks or details of any additional testing information, Dayworks	SPT I.D. Number	PD1	Calibration Date	01/02/2021	Project Title				
1405		CAT Scanned: Yes	SPT Rod Type	2 3/8 Regular	SPT Energy Ratio	0.00	Kinnegad				
1405		Permit Completed: Yes	Drilling Crew Details			CSCS No					
		General; Borehole collapse at 27 m due to highly unstable formation	Support Operative			John Whyte	Weather	Variable		Project No	40-21
1500	0045	Dayworks: Airlift development of well	Lead Driller			Stephan Petersen	Date	02/11/2021		Day	Tuesday
			Site category			Green	Rig type	Knebel HY79		Borehole Number	
			Project Engineer			P Bartley	Inclination		Orientation	ONGW 16	
			Lead Driller's signature				Sheet	1 of 1		Completed	Y



Summary of Standpipe Installation

Schematic Diagram (not to scale)



Installation Details

Standpipe diameter (id)	50	mm
Borehole diameter	120	mm
Slot size	1	mm
Geosock	No	
Gas tap	None	
Filter type	Gravel	
Type of cover	Upright	
Initial reading	0.00	m
Time of Initial reading	1425	hhmm

	Base (m)	Top (m)
Concrete	0.50	GL
Gravel drainage	9.00	0.50
Borehole seal top	12.00	9.00
Filter zone	27.50	12.00
Plain pipe	12.50	GL
Slotted zone	27.50	12.50
Base of borehole	27.50	

Remarks

Rig type	Knebel HY79	Project Title			
Drilling Crew Details		Kinnegad			
Support Operative	John Whyte	Project No		40-21	
Lead Driller	Stephan Petersen	Day	Tuesday	Date	November 2, 2021
Site category	Green	Borehole Number		ONGW 16	
Engineer	P Bartley				
Lead Driller's signature					



Depth of Stratum Top (m)	Driller's Stratum Description	Sample / Hole / Test Details					Drilling Details				Standard Penetration Test													
		No	Type	In situ test	From (m)	To (m)	Liner Dia (mm)	Core run time (hhmm)	Total core Recovery (m)	Flush Return %	Flush Colour	Self Weight Pen (mm)	75 mm	150 mm	Seating Pen (mm)	75 mm	150 mm	225 mm	300 mm	Main Pen (mm)	N value	Casing Depth (m)	Water/flush level (m)	
			RO		0.00	80.00		0000		100	grey												0.00	Dry

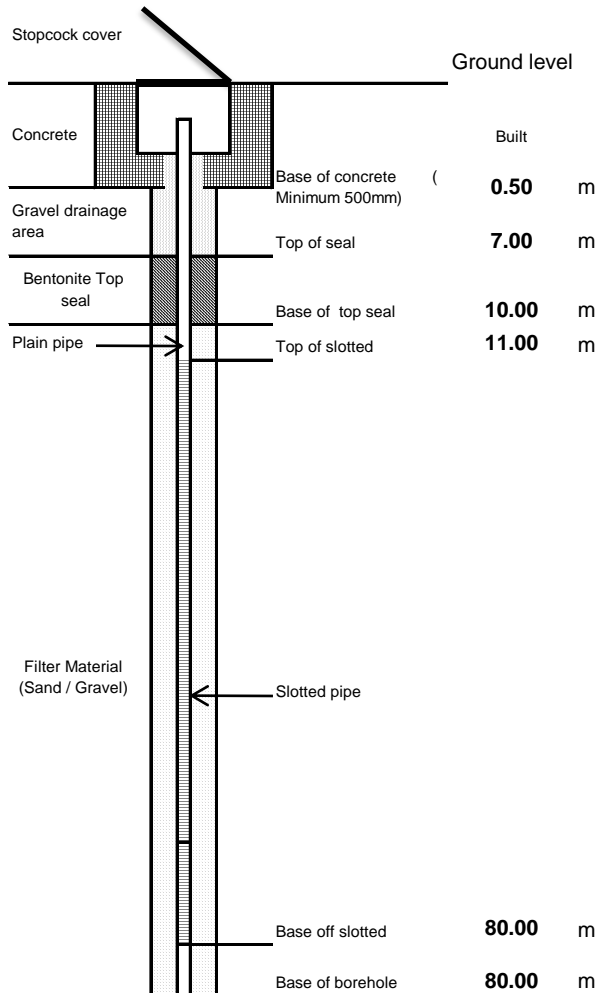
Shift details				Drilling Equipment Details											Ground Water Record										Backfill (m)			
Start time (hhmm)	Hole (m)	Water (m)	Casing (m)	Casing (C) Open Hole (RO) Coring (RC)	Dia. (mm)	From (m)	To (m)	Barrel	Liner Type	Core Dia (mm)	Bit Type	Casing Type	Bit serial No	Flush	Polymer	Time of strike	Depth Struck (m)	Casing (m)	Inflow	5 min	10 min	15 min	20 min	Depth Seated (m)	Type	From (m)	To (m)	
0815	42.00	Dry	5.00	RO	120.00	5.00	80.00				DTH Button Bit			Air	No													
Finish time (hhmm)	Hole (m)	Water (m)	Casing (m)																									
1710																												

Time from	Duration (hhmm)	Remarks or details of any additional testing information, Dayworks	SPT I.D. Number	PD1	Calibration Date	01/02/2021	Project Title				
			SPT Rod Type	2 3/8 Regular	SPT Energy Ratio	0.00	Kinnegad				
			Drilling Crew Details			CSCS No					
			Support Operative	John Whyte			Weather	Variable		Project No	40-21
			Lead Driller	Stephan Petersen			Date	08/11/2021		Day	Monday
			Site category	Green			Rig type	Knebel HY79		Borehole Number	
			Project Engineer	P Bartley			Inclination		Orientation	ONGW 17	
			Lead Driller's signature				Sheet	2 of 2		Completed	Y



Summary of Standpipe Installation

Schematic Diagram (not to scale)



Installation Details

Standpipe diameter (id)	50	mm
Borehole diameter	120	mm
Slot size	1	mm
Geosock	No	
Gas tap	None	
Filter type	Gravel	
Type of cover	Upright with lock	
Initial reading	Dry	m
Time of Initial reading	1610	hhmm

	Base (m)	Top (m)
Concrete	0.50	GL
Gravel drainage	7.00	0.50
Borehole seal top	10.00	7.00
Filter zone	80.00	10.00
Plain pipe	11.00	GL
Slotted zone	80.00	11.00
Base of borehole	80.00	

Remarks

Rig type	Knebel HY79	Project Title			
Drilling Crew Details		Kinnegad			
Support Operative	John Whyte	Project No		40-21	
Lead Driller	Stephan Petersen	Day	Monday	Date	November 8, 2021
Site category	Green			Borehole Number	
Engineer	P Bartley			ONGW 17	
Lead Driller's signature					



Lands Soils & Geology Chapter

Appendix 7C

**Geophysical Report
Apex (2022)**