

Attachment A

Review of Baseline Groundwater Monitoring Program in the MTSGS Buffer Zone

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3 September 2020

Dixon Sand Pty Ltd
Old Northern Road
MAROOTA, NSW 2756

Attention: Mark Dixon

Dear Mark,

Haerses Rd Quarry – Review of 2018-2020 Groundwater Monitoring Results

Preamble

The Haerses Road sand quarry was approved by Development Consent dated 14 February 2006 (DA 165-7-2005). This permitted extraction from Maroota Sands. Extraction has continued from the extraction areas approved within that consent.

A modification to this consent DA 165-7-2005 Modification 1 (MOD1) was approved on 18 January 2018, to permit extraction from the MOD 1 extraction area which comprises resources within the Hawkesbury Sandstone formation.

Conditions 16 and 17 of Schedule 3 of the MOD 1 consent state as follows:

16. *Prior to the commencement of quarrying operations within the Mod 1 extraction area, the Applicant must:*
- (a) *install additional monitoring bores in accordance with EA (Mod 1);*
 - (b) *install one additional monitoring bore in the south-western corner of the Mod 1 extraction area;*
 - (c) *install loggers in each on-site bore to enable continuous groundwater level monitoring;*
 - (d) *install water level loggers in all existing on-site quarry dams and in new quarry dams when constructed; and*
 - (e) *carry out an aquifer pumping test within the SCBGS, to the satisfaction of CLWD.*
17. *Prior to commencing quarrying operations within the MTSGS buffer zone, the Applicant must complete a baseline groundwater monitoring program, in consultation with CLWD and to the satisfaction of the Secretary. The program must include monthly monitoring of groundwater levels and quality within the MTSGS buffer zone for a period of not less than 2 years.*

The Applicant must not commence quarrying operations within the MTSGS buffer zone without the prior approval of the Secretary.

The requirements specified under Condition 16 were completed in 2018. As required, the program was discussed with Crown Lands Department of Water (CLWD) in a series of consultation meetings with them. The Scope of Work that was carried out was recommended by CLWD following this consultation process.

The agreed Scope of Work was as follows:

- Expansion of the existing groundwater monitoring network to include three additional clustered monitoring bores at four locations within the proposed Maroota Tertiary Sand Groundwater Source (MTSGS) buffer zone, targeting the following at each cluster location:
 - Perched water in weathered sandstone (NB: fresh unweathered sandstone was encountered near surface rather than weathered sandstone)
 - Perched water in the unweathered sandstone; and
 - Deep regional groundwater system in unweathered sandstone.
- Drill a fifth additional monitoring bore to the west of the extraction area and just south of existing bore BH5.
- Drill a cored hole south of the upland swamp (northern cluster site). The core will be examined to understand the modes of groundwater flow.
- Where ground conditions allow, undertake downhole geophysical logging of a dry hole to understand moisture content.
- Undertake an aquifer test comprising of either a pumping test or falling head test (FHT) depending on yields encountered.
- Install loggers in each on-site bore to enable continuous groundwater level monitoring. Undertake monthly monitoring of groundwater levels and quality.

The results of this program of work were presented in a letter report dated 15 November 2018 (Golder Associates, 2018). This report was submitted to both CLWD and DPIE respectively for comment. Final acceptance of this report as satisfying Condition 16 has been received from both departments. Their letters of acceptance are included as **Attachment A**.

The newly installed bores were incorporated into the existing monitoring program and monitoring from the new bores commenced on 30 July 2018. This monitoring has been ongoing now for over 2 years, and the results are presented and discussed below.

Monitoring Program

The existing monitoring network comprised a series of piezometers installed primarily within the original consent extraction area, and designed to monitor groundwater in the Maroota Sands formation. Two deeper Hawkesbury Sandstone bores were also monitored.

Fourteen monitoring piezometers (H1 to H14) were installed over the period 2003 to 2006. Monitoring started from H1 to H10 in 2005, and from H11 to H14 from 2006. At the present time, bores H2, H6, H7, H9, H12 and H14 are still operational. H3 was dry when drilled, and a number of bores have since been removed from the monitoring network generally before being mined out. H13 was monitored until August 2018, when it was decommissioned as it was located in the Mod 1 processing plant area.

Two deeper monitoring bores were installed in 2011 to monitor groundwater the underlying Hawkesbury Sandstone formation – BH4 and BH5.

Locations of all past and present bores are shown on **Figure 1**.

Monitoring of the above network of bores comprised monthly measurement of water level and six-monthly measurement of pH and EC. This monitoring program has continued to the present time.

The new bores installed in 2018 were as follows:

- Three-bore clusters at four sites, each cluster comprising a shallow bore to perched groundwater in the near-surface slightly weathered zone, an intermediate depth bore to a perched zone in the unweathered Hawkesbury Sandstone, and a deeper bore to the regional Hawkesbury Sandstone aquifer (BH1A to C, BH2A to C, BH3A to C and BH6A to C);
- A shallow bore (BH5B) adjacent to existing Hawkesbury Sandstone bore BH5.

The new bores have been subjected to a more intense monitoring program, comprising:

- Installation of dataloggers in all thirteen bores, set to record water level at 12 hourly intervals;
- Manual measurement of water level monthly in all bores; and
- Monthly sampling (after purging) of each bore and site measurement of pH, EC and TDS.

Monitoring Results

Bore water level data and water quality data are presented as composite hydrographs, with water levels converted to mAHD and water quality plots comprising pH and EC (**Figures 2 to 6**).

Water quality data are presented below in **Table A1** (in **Appendix A**).

Each bore cluster is plotted on a single figure, as follows:

- **Figure 2** – bores BH1A to C (Site 1);
- **Figure 3** – bores BH2A to C (Site 2);
- **Figure 4** – bores BH3A to C (Site 3);
- **Figure 5** – bores BH6A to C (Site 6);
- **Figure 6** – bores BH5 and BH5B (Site 5).

Both manual and datalogger water levels are plotted on these figures.

Discussion of Monitoring Results

The plots show the presence of at least two perched aquifers, with very different water levels at different depths – generally the deepest piezometer at each site reported the lowest water level, and the shallowest bore the highest water level, while the intermediate bore showed an intermediate water level. This pattern indicates a downward gradient with depth as each zone of perched groundwater, and finally the regional water table, is encountered. The deeper groundwater level at each site represents the laterally extensive and continuous regional water table. The shallow and intermediate water levels represent perched aquifers, which are believed to be not laterally continuous, and may be ephemeral, especially the perched layer closest to the surface.

Groundwater recharge occurs primarily by infiltration of incident rainfall and downward percolation through the strata. This downward flow of water extends initially to the first (shallowest) perching layer, and then in turn through or around that perching layer to progressively deeper strata including any intermediate perching layers, and ultimately to the deeper regional water table. Within the regional water table and within each perched aquifer, groundwater flow is mainly lateral under the prevailing hydraulic gradient within each aquifer. Elsewhere in the profile, water flow only occurs vertically under gravity, under conditions of only partial saturation. The perched aquifers may pinch out if the underpinning perching layer pinches out, or reaches the ground surface, where a spring or seepage face may develop.

In reality, the water level or head in each perched aquifer is influenced mainly by the topographic elevations of the locations where that aquifer is recharged and discharges. As the perched groundwater is not regionally continuous, there may be significant differences in the perched groundwater levels from site to site.

The northern cluster site (BH1A to C) is an exception – at that site the water level in the deep bore BH1A (screened at 64-70m) is 2-3m higher than the water level in the intermediate bore BH1B (screened at 34-40m). The reason for the difference at this site is not known. The water level in each aquifer is normally influenced mainly by the topographic elevation in the area where that aquifer is recharged, and it could be that the intermediate perched aquifer is recharged at a topographically deeper site than the regional aquifer.

At all five cluster sites, the shallowest bore (ie BH1C, BH2C, BH3C, BH6C and BH5B) reported a water level well above the regional water table level. The head difference between the shallow and deep bore at each site is around 5m at Site 1, 12m at Site 2, 45m at Site 3 and 25m at Site 6.

At Site 5, there are only two bores, a deeper bore BH5 (screened at 59-65m) at the Hawkesbury Sandstone regional water table and a shallower bore BH5B (screened at 25-35m) at a perched zone in the unweathered Hawkesbury Sandstone. The head difference between the two bores at Site 5 is 10m. The screened depth in BH5B is consistent with the intermediate bore screen intervals at the other four cluster sites. At Site 5, there is no shallow piezometer equivalent to the shallowest perched aquifer piezometers at the other four cluster sites.

Both the perched and regional water tables display a strong influence of rainfall on the hydrographs (**Figures 2 to 6**). The relationship with rainfall is best examined by comparing hydrograph trends with the rainfall cumulative deviation (RCD) trend for the nearest BoM rainfall recording station (Maroota Old Telegraph Road – station 067014). The RCD is calculated by comparing the actual monthly rainfall with the long-term average rainfall for each month, and accumulating the difference or deviation from average. In periods of above average rainfall, the RCD curve will display a rising trend, while in periods of below average rainfall, the RCD curve will trend downwards.

Figures 2 to 6 show that the RCD was trending downwards through most of the monitoring period, as it was an extended period of below average rainfall. Between June 2017 and January 2020, rainfall was below average in all but two months (October 2018 and March 2019), and the total rainfall deficit relative to average through this period was more than 1500mm. However, since January 2020, rainfall has been overall above average, and the RCD curve has trended slightly upwards overall.

Most hydrographs have trended in a similar way to the RCD curve, with an overall downward trend through 2018-2019, and then a rising trend since February 2020. This confirms a close relationship between groundwater levels and rainfall. Both the perched groundwater and the regional water table show this relationship, demonstrating that rainfall is the primary recharge source for all aquifers.

Three cross-sections are plotted on **Figures 7 and 8**. The locations of each cross-section are plotted on the location plan **Figure 1**. The cross-sections show the surface topography, simple geology, the locations and depths of each of the cluster bores and other older monitoring bores, as well as the water levels in each monitoring bore. The current state of sand extraction is also depicted where a cross-section is aligned across one of the active extraction pits.

Cross-Section A-A' (**Figure 7**) crosses the southern edge of the property, and passes through cluster Site 6 (see **Figure 1** for location). Cell 1A has been excavated to a depth of 10-15m, and is dry. The elevation of the floor of the excavated cell is similar to the water level in shallow bore BH6C at the adjacent cluster site. The water levels in the intermediate and deep piezometers BH6B and BH6A are 25-30m lower. The approximate elevation of the main regional Hawkesbury Sandstone water table is shown on Section A-A', with a gradient to the west which is inferred from the water level information from Section B-B' about 400m to the north.

The extent of the Maroota Sand formation is shown on the cross-section, based on geological information from borehole H14 and site observations, and correlations with other boreholes to the

north within the site. The base of the Maroota Sands is more than 30m higher than the regional water table in the Hawkesbury Sandstone. The groundwater present in the Maroota Sands forms a perched aquifer, as depicted on Section A-A' on **Figure 7**, and is hydraulically separate from the underlying Hawkesbury Sandstone groundwater.

Cross-Section B-B' (**Figure 7**) is located about 400m north of Section A-A', and passes through cluster Sites 5 and 2, then through the Stage 2 West pit in the Maroota Sands deposit, and on to bore BH4 to the east adjacent to the dry Hawkesbury Sandstone Stage 2 East pit (see **Figure 1** for location). Two old boreholes H1 and H4 which monitor the Maroota Sands lie on this Section.

As with Section A-A', the regional Hawkesbury Sandstone water table is some 20-30m below the base of the Maroota Sands. Shallow bore BH2C did report water for a time, but the water level has fallen and is now at the base of the bore, and is probably just reporting sump water inside the bore casing. The intermediate bores BH2B (at Site 2) and BH5B (at Site 5) both report a water level about 10m above the deeper regional water table, and 15-20m lower than the base of the Maroota Sands. The perched groundwater in the Maroota Sands is evidenced by the water levels in bores H1 and H4, which indicate a perched water table at around 177-178 mAHD, about 35-40m higher than the regional Hawkesbury Sandstone water table at around 140 mAHD.

Cross-Section C-C' (**Figure 8**) is a north-south section that passes through the Hawkesbury Sandstone resource only, and includes cluster bore Sites 1, 2, 3 and 6 (see **Figure 1** for location). This Section shows some inconsistency in the depth to the regional Hawkesbury Sandstone water table, with a much deeper water level at Site 3 (bore BH3A) than at either Site 1 or Site 2. There is no Maroota Sands along this Section.

The water levels shown on Sections A-A' and B-B' (**Figure 7**) show that there is no hydraulic connection between the Maroota Sands groundwater and the underlying regional aquifer within the Hawkesbury Sandstone. There is also a clear distinction between the Maroota Sands groundwater and perched groundwater within the Hawkesbury Sandstone. It is therefore unlikely that any excavation of Hawkesbury Sandstone within the buffer zone around the Maroota Sands approved area will cause any disturbance to the groundwater remaining in the Maroota Sands after sand extraction has been completed down to the approved depth.

The water quality data (EC and pH, plotted on **Figures 2 to 6**) show generally similar quality in all aquifers. EC is generally in the range 150 to 250 $\mu\text{S}/\text{cm}$, and pH generally in the range 4.5 to 6. However, the deep bore at cluster Site 6 (BH6A) starts with a very high EC, at 5,000 $\mu\text{S}/\text{cm}$, then declining steadily over a 6-8 month period to less than 500 $\mu\text{S}/\text{cm}$, before slowly rising again over the latter stage of the 2 year monitoring period. pH is also anomalous, at 11-12.5. High pH values like this are usually related to contamination with cement during grouting. However, the cause in this instance is not known.

It is recommended that the current monitoring program continue, and periodic assessment of the impacts of sand extraction be undertaken. There is no evidence to suggest that extraction cannot safely proceed within the temporary buffer zone along the eastern margin of the Hawkesbury Sandstone resource.

References

- Department of Primary Industries – Office of Water, 2015. *Water Access Licence WAL 25941*.
- Department of Primary Industries – Office of Water, 2015. *Water Access Licence WAL 25956*.
- ERM, 2005. *Haerses Road Sand Quarry Environmental Impact Statement*. Final version dated 14 June 2005.
- ERM, 2007. *Haerses Road Sand Quarry Rehabilitation and Landscape Management Plan*. Dated 14 June 2005.
- EMM, 2018. *Maroota Extractive Industry Groundwater Study*. Report prepared for Department of Industry – Water, dated 23 November 2018.

Golder Associates Pty Ltd, 2018. *Haerses Road Drilling Results – DA 165-7-2005 MOD 1*. Letter report dated 15 November 2018.

Golder Associates Pty Ltd, 2020. *Extraction Depth for DA 165-7-2005*. Letter report dated 27 March 2020.

Minister for Planning, 2018. *Development Consent DA165-7-2005*. Original consent dated 14 February 2006. Updated for the MOD 1 approval, dated 22 January 2018.

Figures

- Figure 1 HS Pit Bores – Groundwater Levels March 2020
- Figure 2 Water Level and Water Quality Hydrographs – Bores BH1A to BH1C
- Figure 3 Water Level and Water Quality Hydrographs – Bores BH2A to BH2C
- Figure 4 Water Level and Water Quality Hydrographs – Bores BH3A to BH3C
- Figure 5 Water Level and Water Quality Hydrographs – Bores BH6A to BH6C
- Figure 6 Water Level and Water Quality Hydrographs – Bores BH5 and BH5A
- Figure 7 Cross-Sections A-A' and B-B' – Piezometers and Water Levels
- Figure 8 Cross-Section C-C' – Piezometers and Water Levels

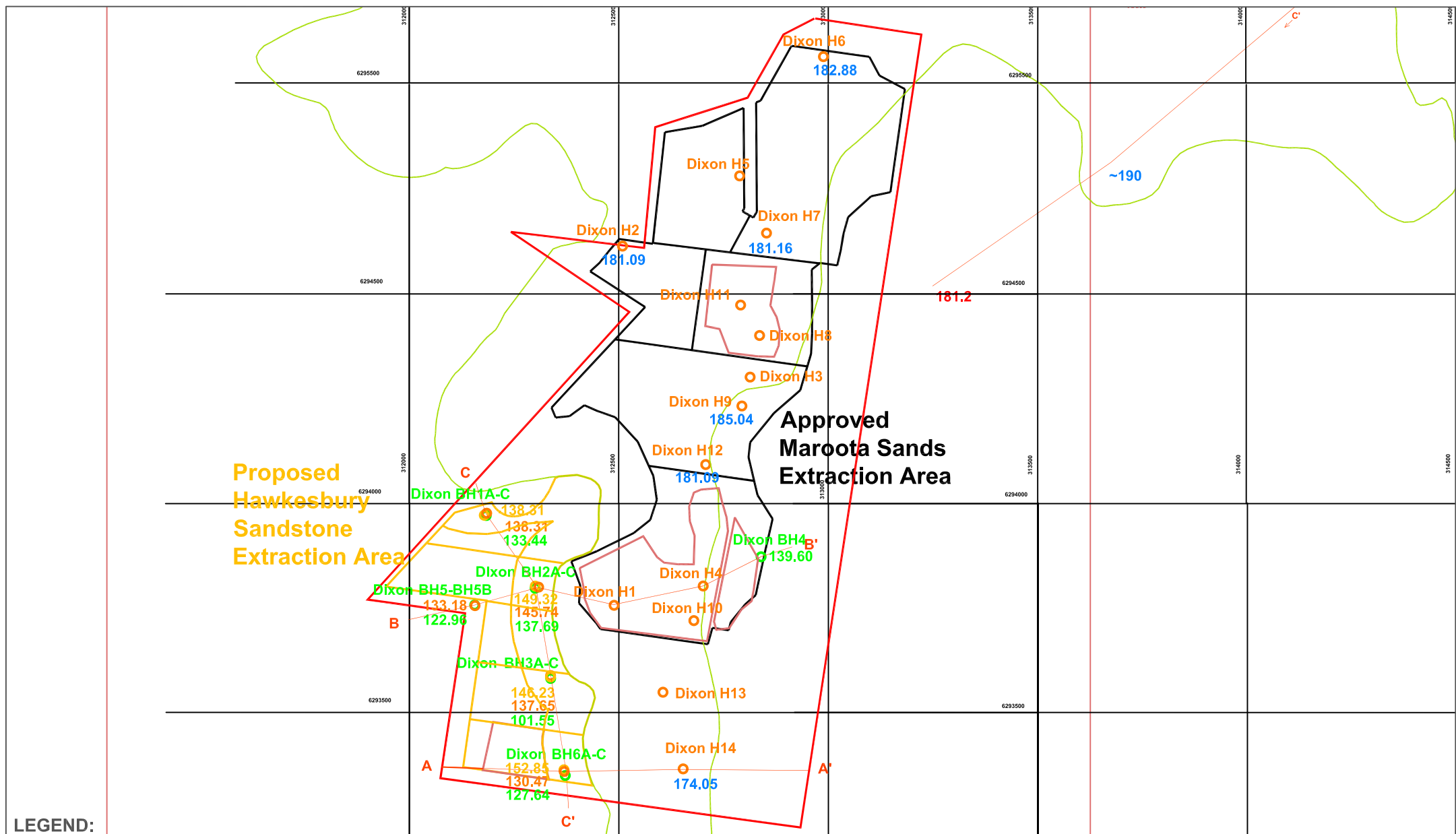
I would be happy to discuss any of the above conclusions.

Yours faithfully,

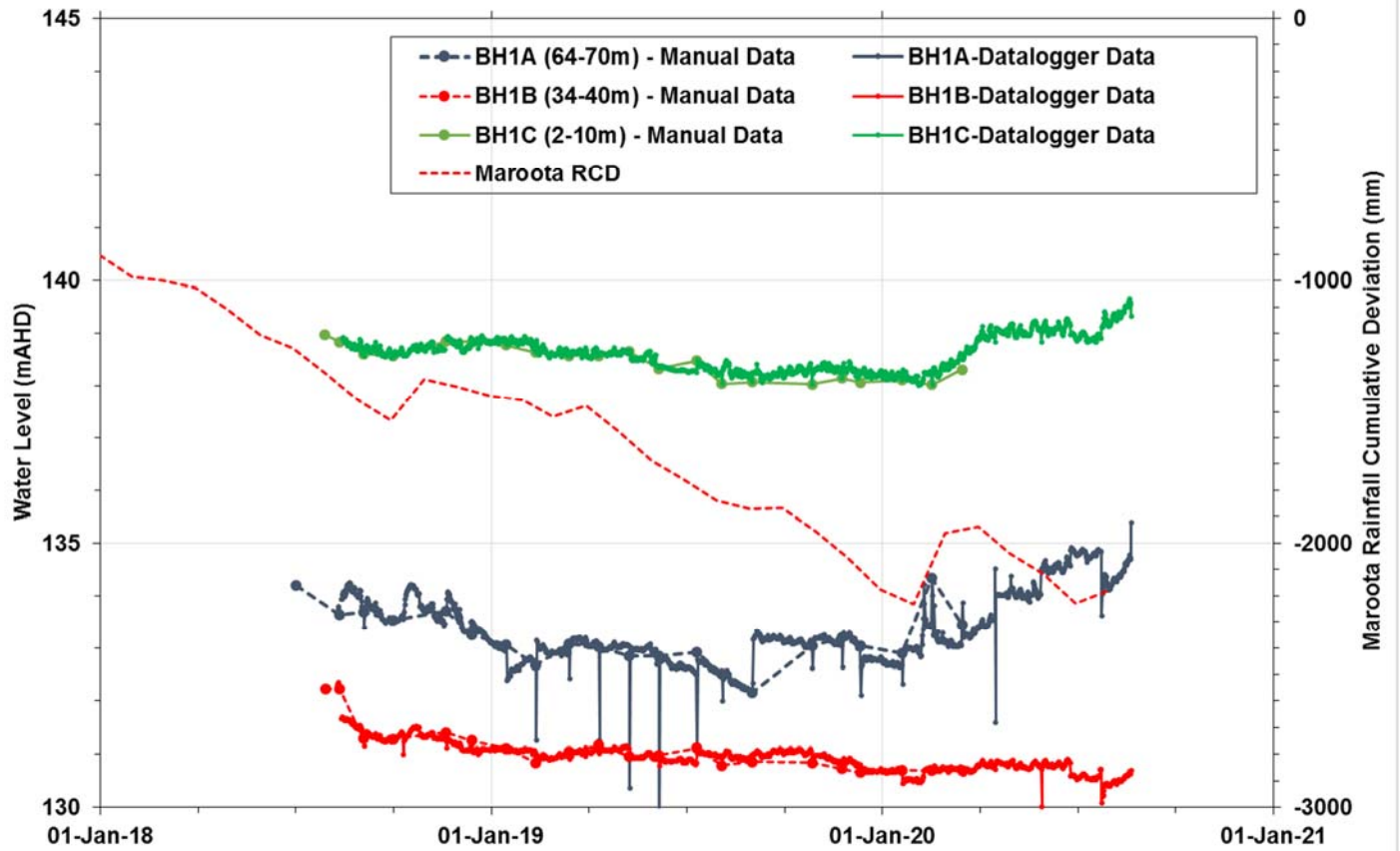
A handwritten signature in purple ink, appearing to be 'P. Dundon', with a stylized, flowing script.

Peter Dundon

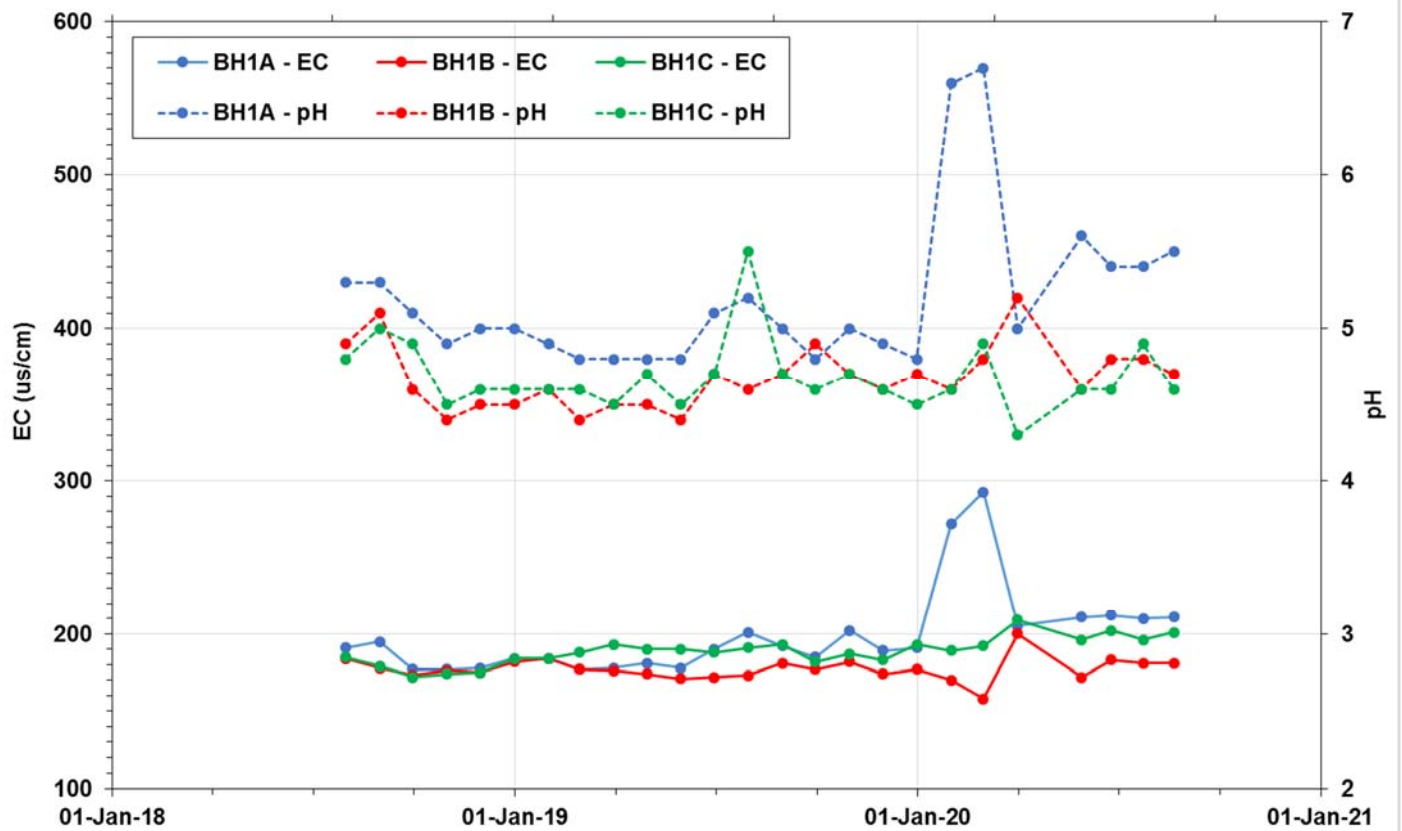
Director



Hydrograph BH1A-C

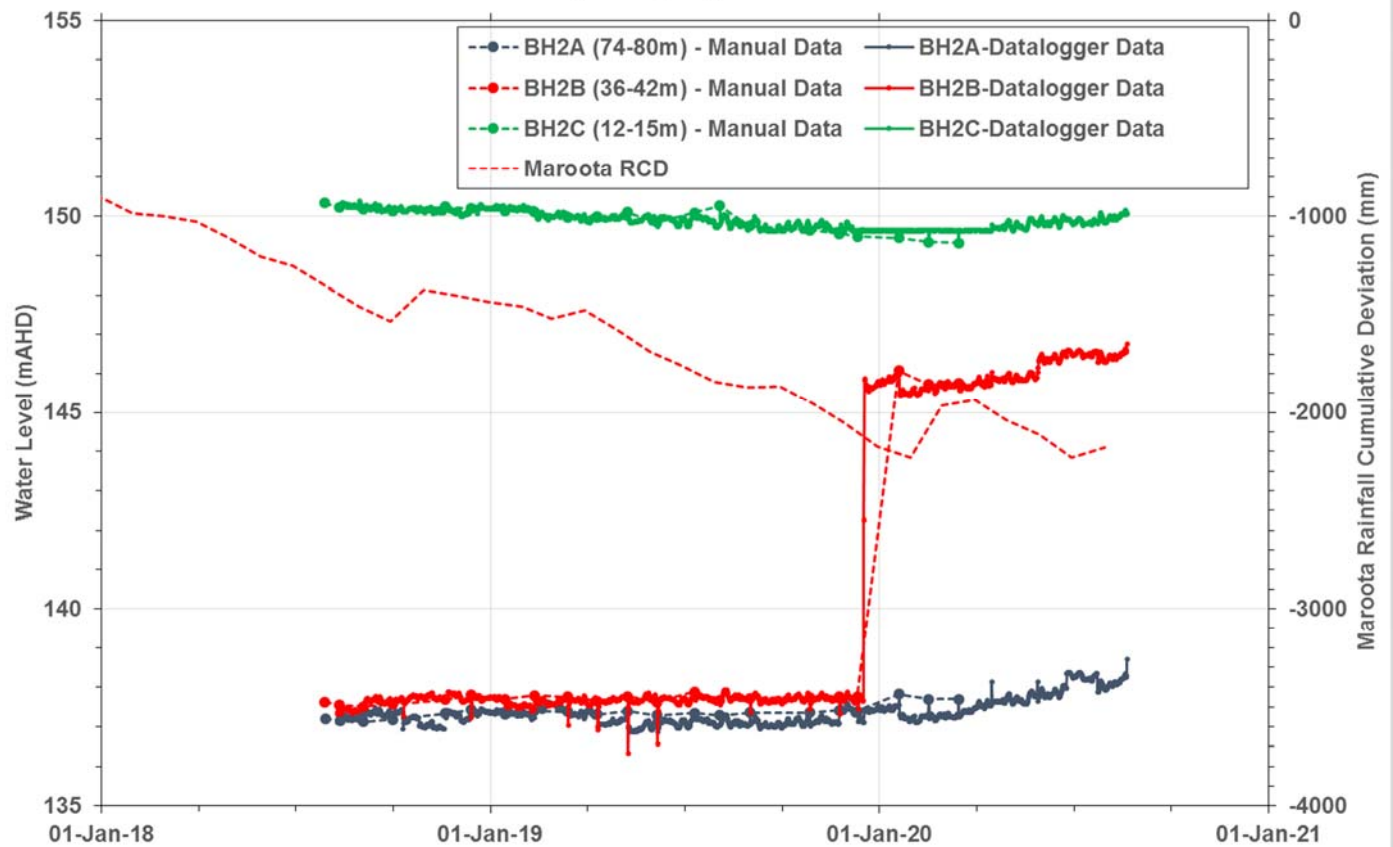


Haerses Road Quarry - Buffer Zone Monitoring Wells BH1A to BH1C - Electrical Conductivity and pH

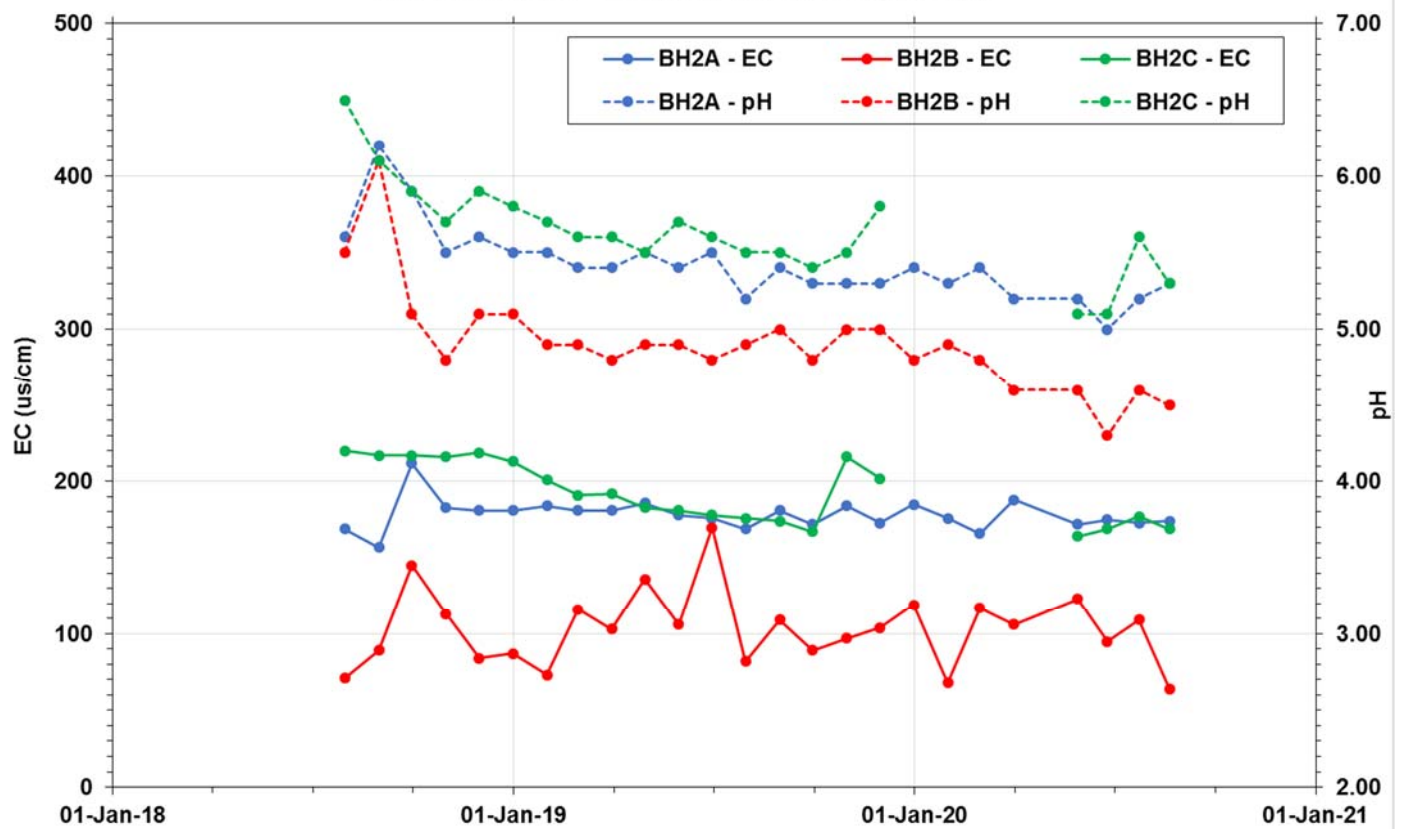


Date: 2 September 2020		Scale: as shown	<div>Dixon Sand Pty Ltd</div> <div>Haerses Road Quarry</div> <div>Water Level and Water Quality Hydrographs</div> <div>Bores BH01A to BH01C</div> <div>Figure 2</div>
Author: PD	Checked: PD	Project No: 20-0381	
Dwg No: 0381-004a		Revision: A	
Dundon Consulting Pty Ltd			

Hydrograph BH2A-C



Haerses Road Quarry - Buffer Zone Monitoring Wells BH2A to BH2C - Electrical Conductivity and pH



Date: 2 September 2020

Scale: as shown

Author: PD

Checked: PD

Project No: 20-0381

Dwg No: 0381-005a

Revision: A

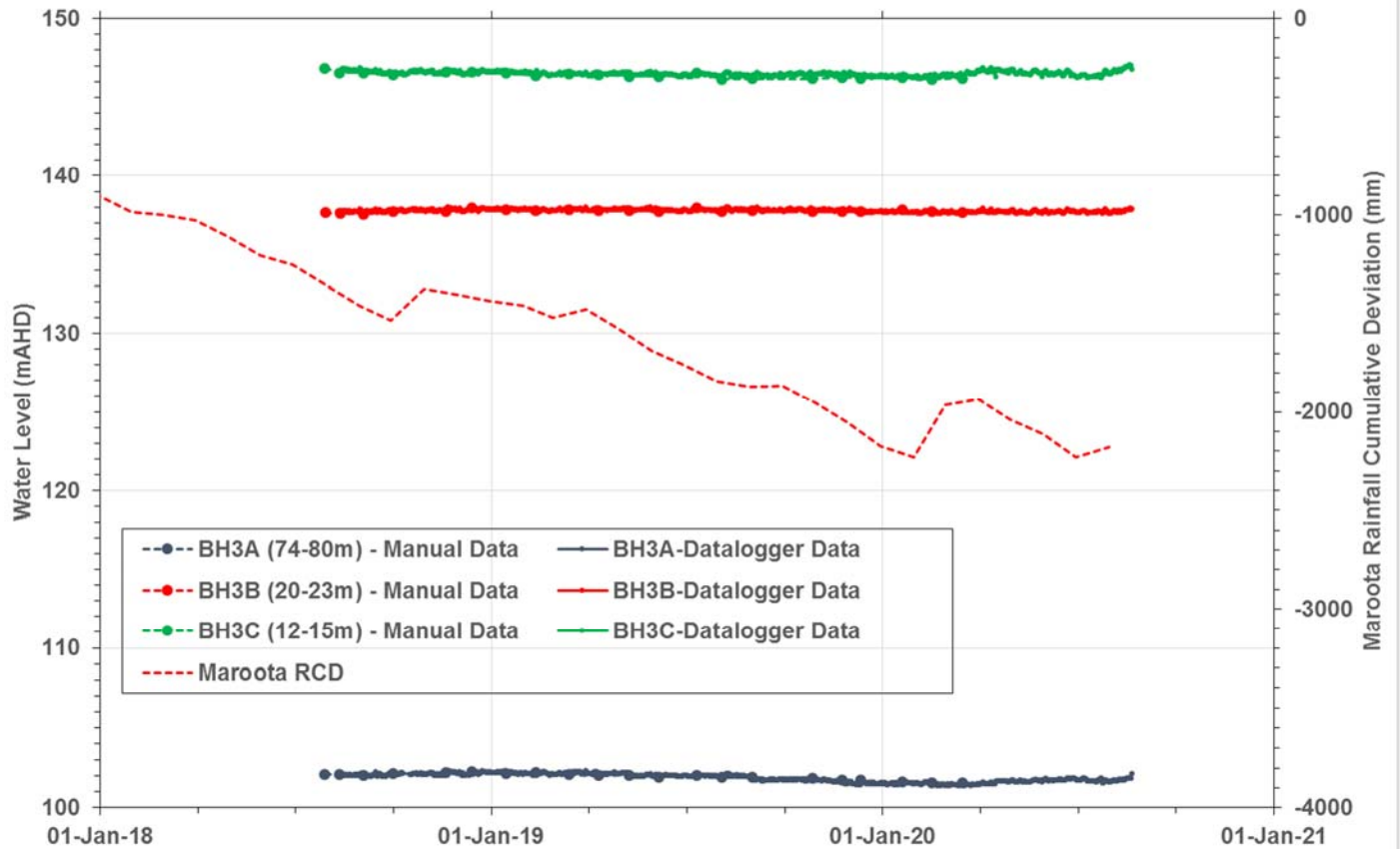
Dixon Sand Pty Ltd

**Haerses Road Quarry
Water Level and Water Quality Hydrographs
Bores BH02A to BH02C**

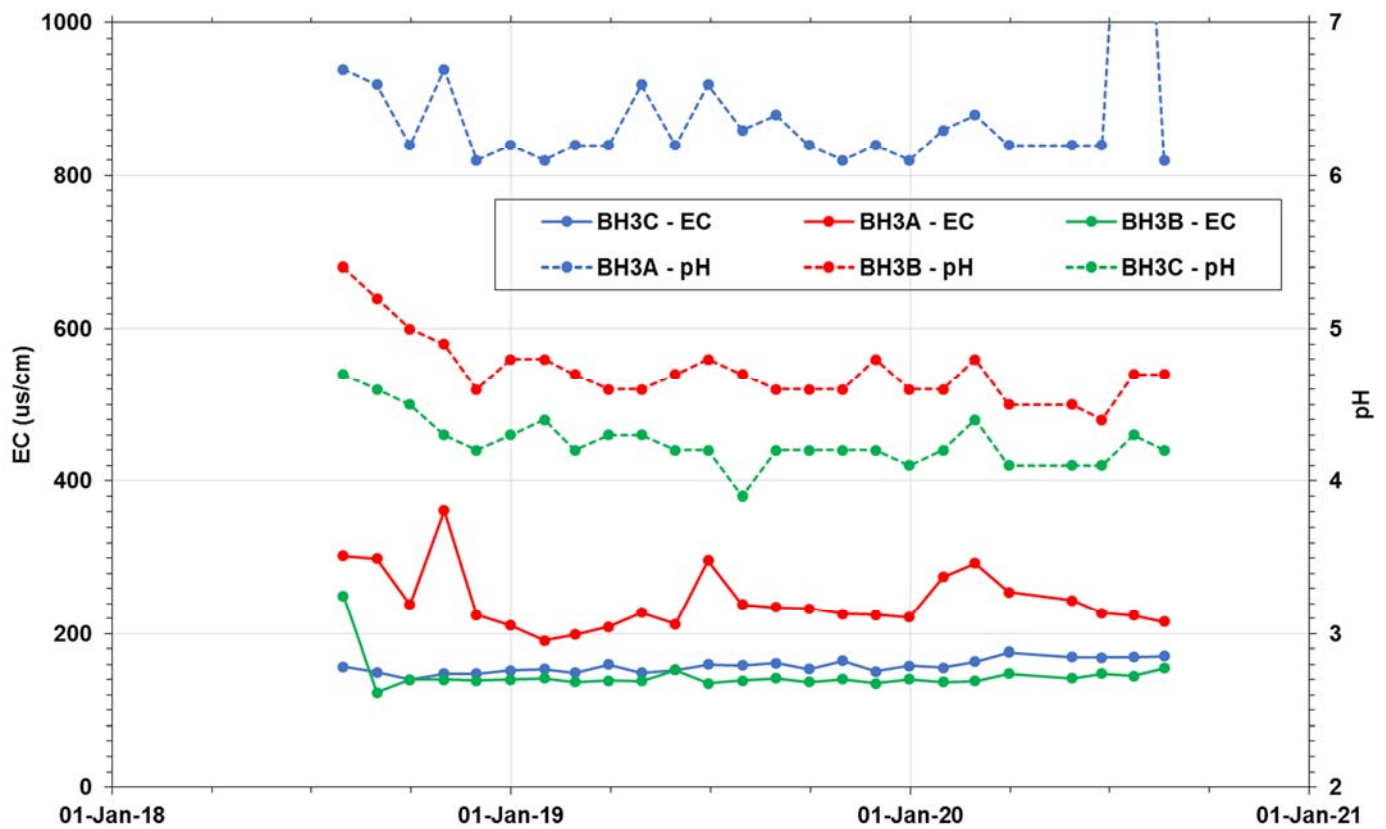
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Figure 3

Hydrograph BH3A-C

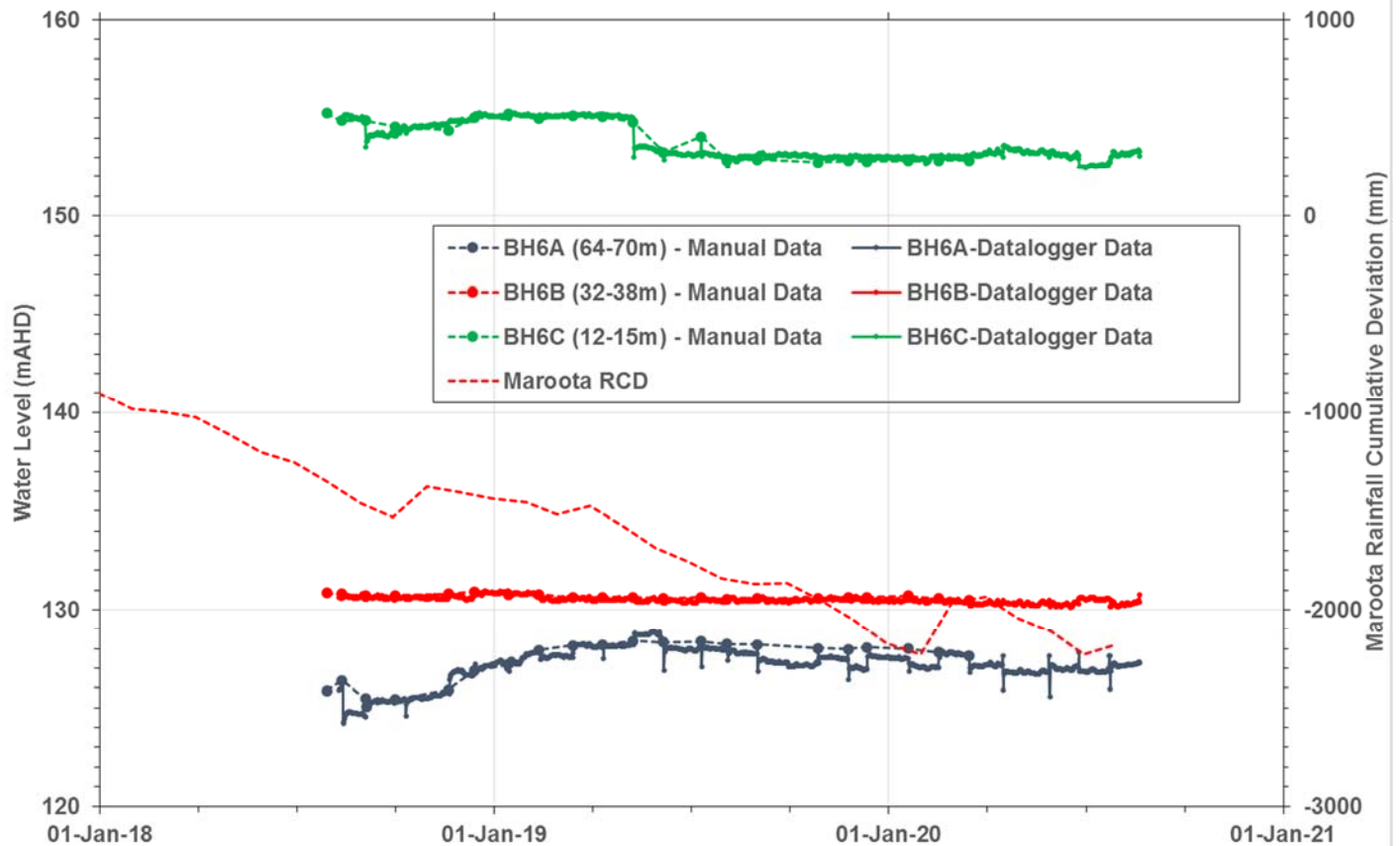


Haerses Road Quarry - Buffer Zone Monitoring Wells BH3A to BH3C - Electrical Conductivity and pH

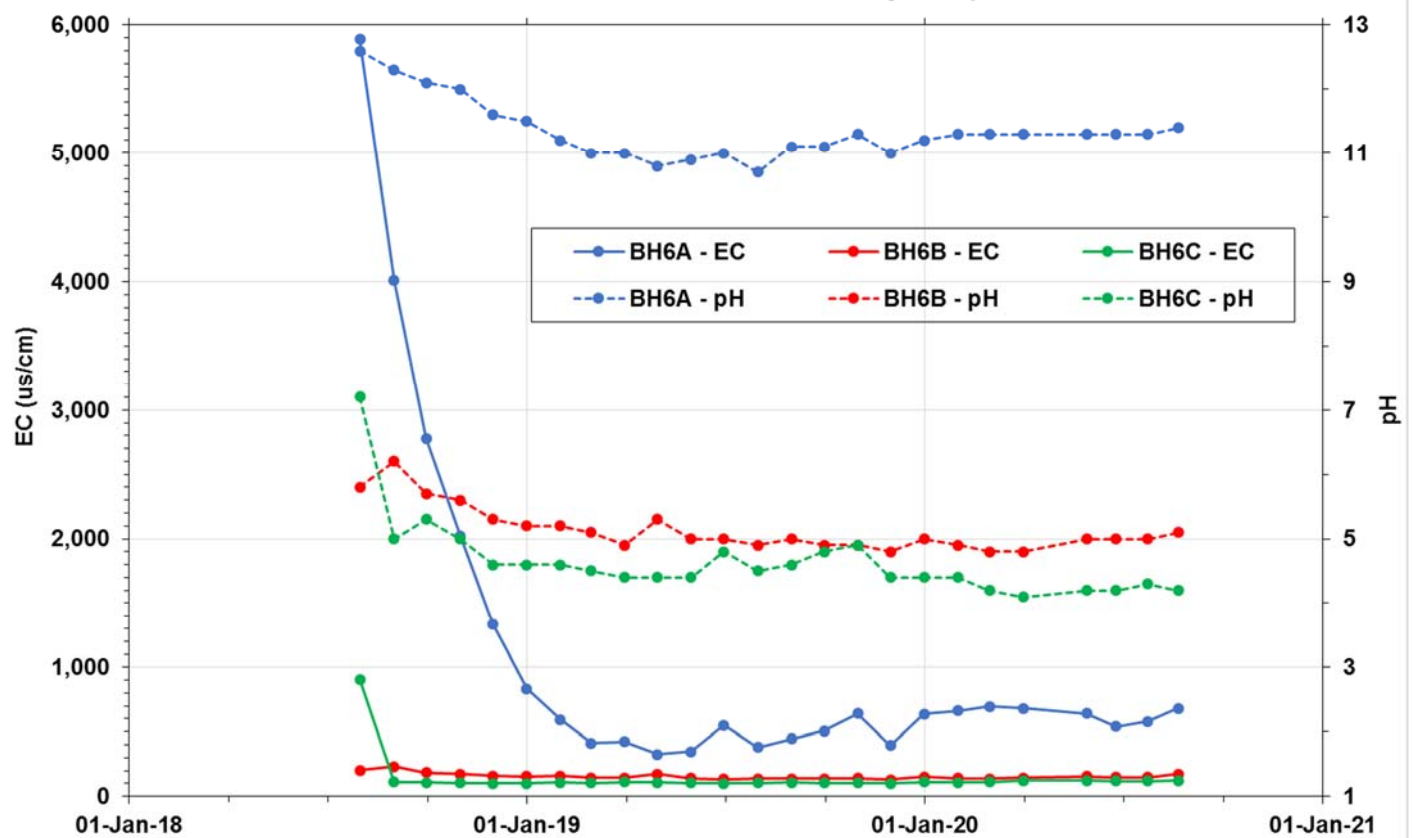


Date: 2 September 2020		Scale: as shown	Dixon Sand Pty Ltd	
Author: PD	Checked: PD	Project No: 20-0381	Haerses Road Quarry Water Level and Water Quality Hydrographs Bores BH03A to BH03C	
Dwg No: 0381-006a		Revision: A		
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Hydrograph BH6A-C and H14



Haerses Road Quarry - Buffer Zone Monitoring Wells BH6A to BH6C - Electrical Conductivity and pH



Date: 2 September 2020

Scale: as shown

Dixon Sand Pty Ltd

Author: PD

Checked: PD

Project No: 20-0381

Haerses Road Quarry

Dwg No: 0381-007a

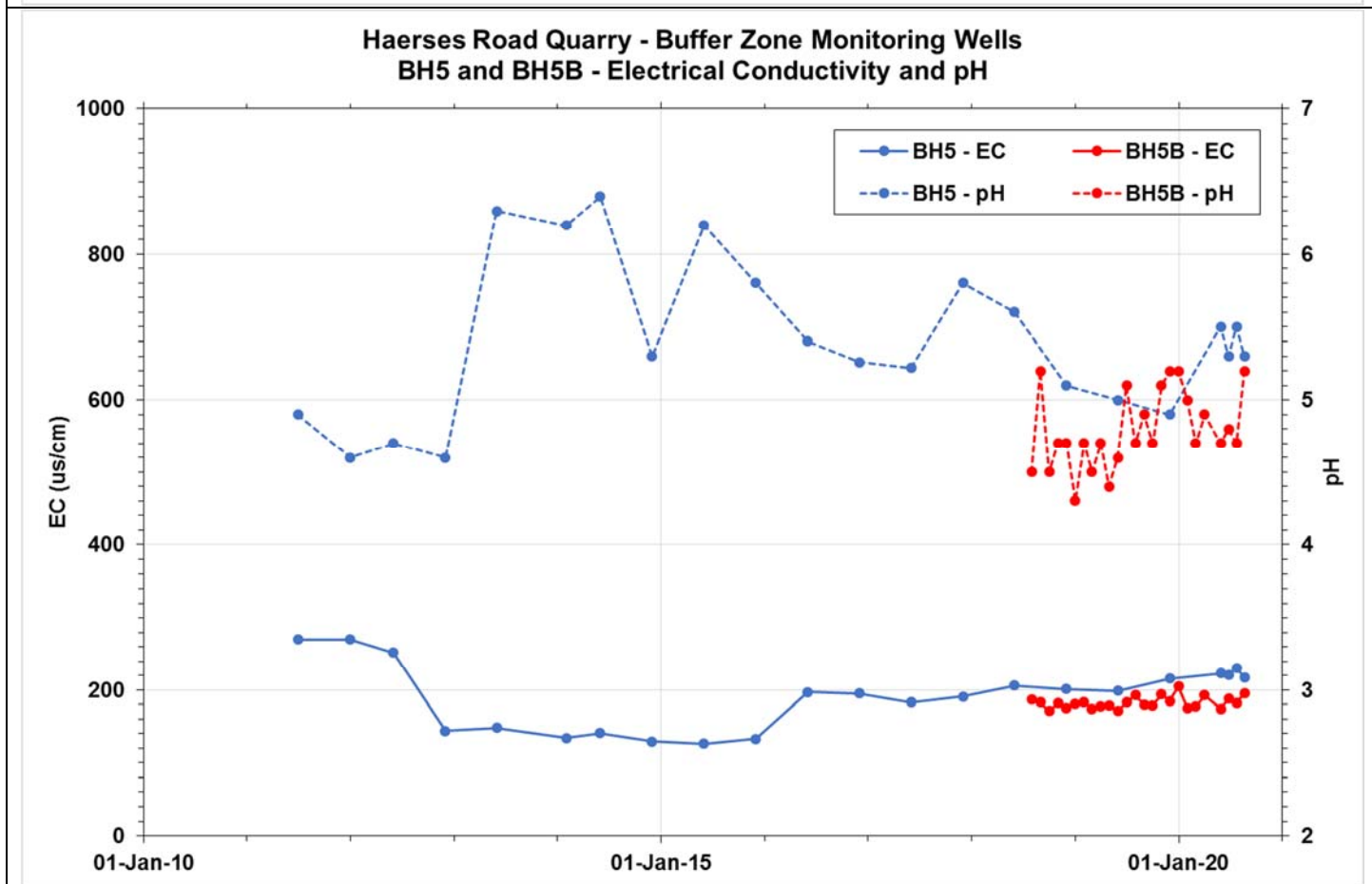
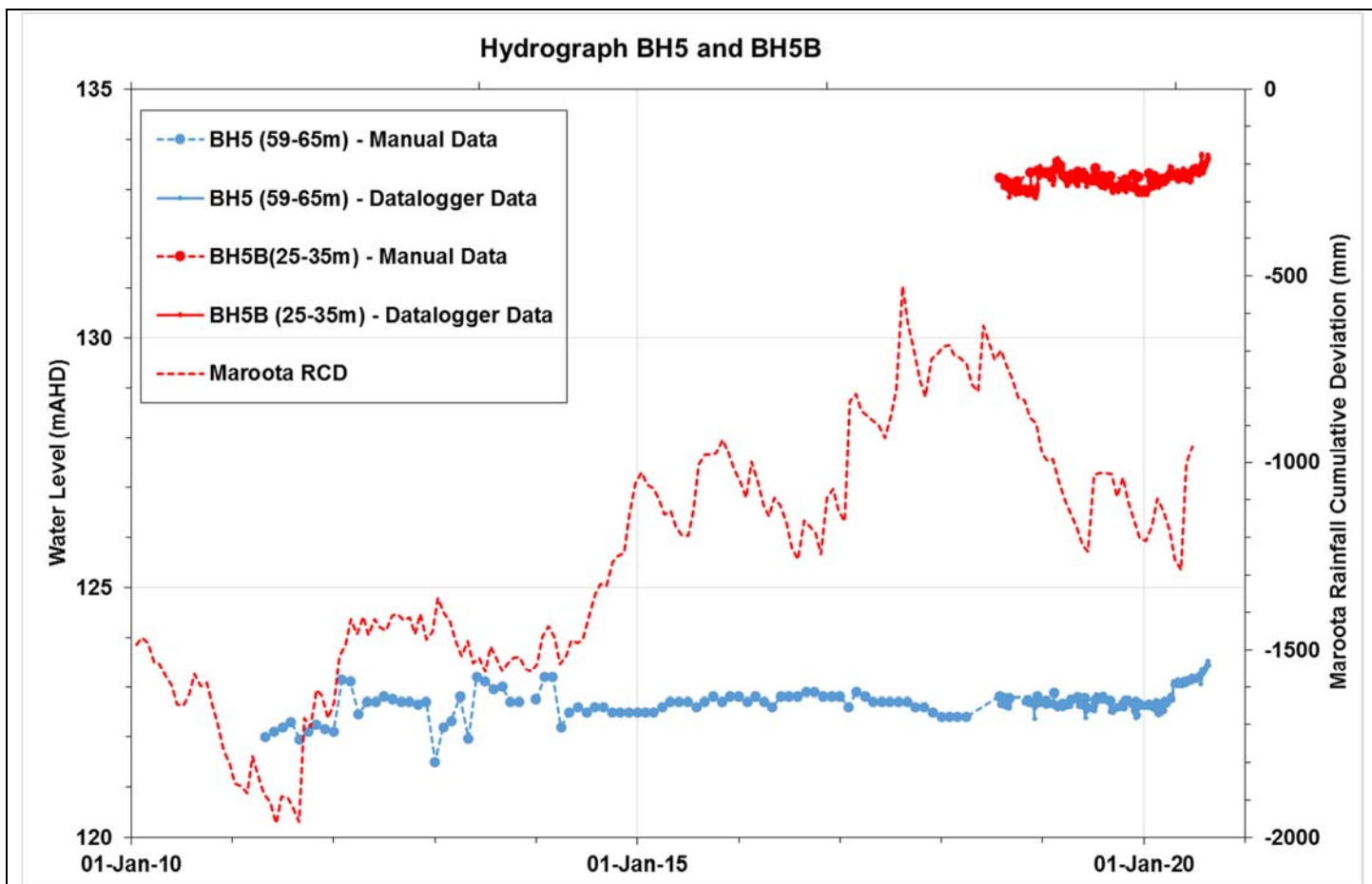
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Water Level and Water Quality Hydrographs

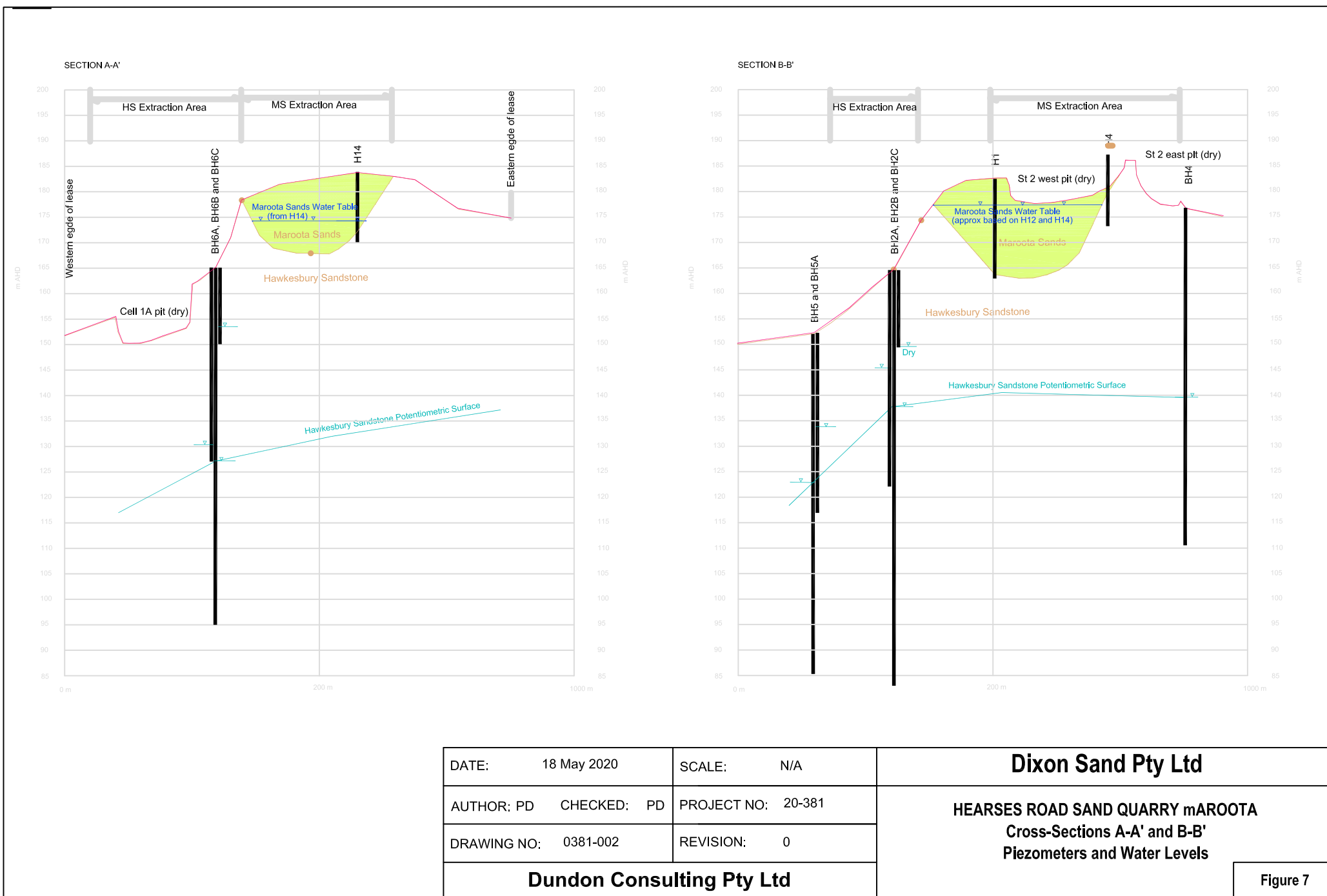
Bores BH06A to BH06C

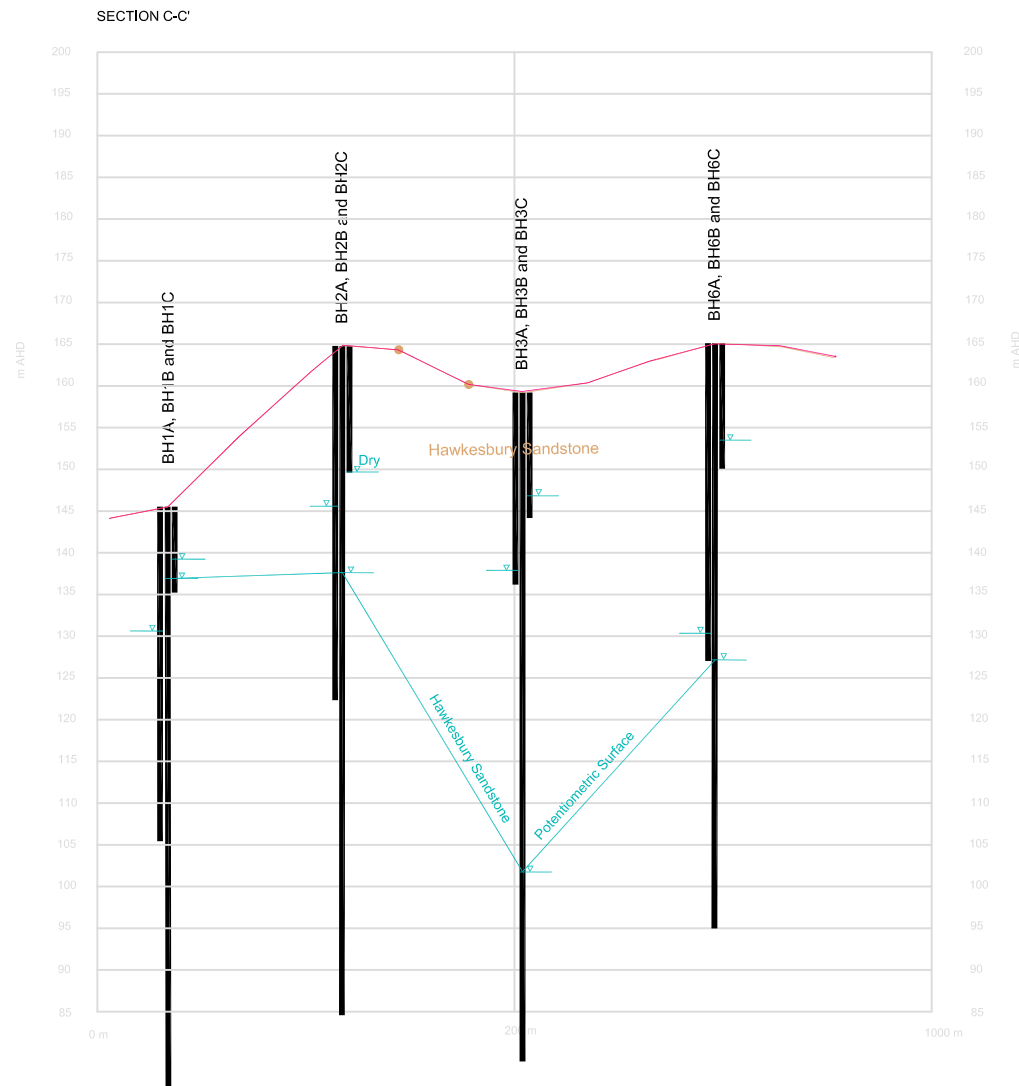
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Figure 5



Date: 2 September 2020		Scale: as shown	Dixon Sand Pty Ltd Haerses Road Quarry Water Level and Water Quality Hydrographs Bores BH05 and BH05B
Author: PD	Checked: PD	Project No: 20-0381	
Dwg No: 0381-008a	Revision: A		
Dundon Consulting Pty Ltd			
			Figure 6





DATE:	18 May 2020	SCALE:	N/A	Dixon Sand Pty Ltd	
AUTHOR: PD	CHECKED: PD	PROJECT NO:	20-381	HEARSES ROAD SAND QUARRY mAROOTA Cross-Section C-C' Piezometers and Water Levels	
DRAWING NO:	0381-003	REVISION:	0		
Dundon Consulting Pty Ltd				Figure 8	

Appendix A

Table A1: Water Quality Monitoring Data – Cluster Bores

	BH1A			BH1B			BH1C			BH2A			BH2B		
Date	pH	EC	TDS	pH	EC	TDS	pH	EC	TDS	pH	EC	TDS	pH	EC	TDS
1/8/2018	5.3	178	88	4.5	175	76	4.6	175	82	5.6	181	84	5.1	158	81
1/9/2018	5.3	184	102	4.5	182	91	4.6	184	83	5.5	181	87	5.1	172	61
1/10/2018	5.1	184	87	4.6	184	71	4.6	184	80	5.5	184	73	4.9	159	63
1/11/2018	4.9	177	102	4.4	177	91	4.6	188	95	5.4	181	116	4.9	157	94
1/12/2018	5	178	96	4.5	176	129	4.5	193	117	5.4	181	103	4.8	156	94
1/1/2019	5	181	128	4.5	174	126	4.7	190	133	5.5	186	136	4.9	159	98
1/2/2019	4.9	178	110	4.4	171	94	4.5	190	110	5.4	178	106	4.9	155	88
1/3/2019	4.8	190	70	4.7	172	122	4.7	188	150	5.5	176	170	4.8	148	77
1/4/2019	4.8	201	126	4.6	173	79	5.5	191	127	5.2	169	82	4.9	158	83
1/5/2019	4.8	192	98	4.7	181	89	4.7	193	96	5.4	181	109	5.0	159	92
1/6/2019	4.8	185	68	4.9	177	79	4.6	182	113	5.3	172	89	4.8	157	78
1/7/2019	5.1	202	112	4.7	182	110	4.7	187	93	5.3	184	97	5.0	164	93
1/8/2019	5.2	189	80	4.6	174	102	4.6	183	121	5.3	173	104	5.0	154	103
1/9/2019	5	191	97	4.7	177	135	4.5	193	106	5.4	185	119	4.8	162	80
1/10/2019	4.8	272	194	4.6	170	73	4.6	189	82	5.3	176	68	4.9	157	56
1/11/2019	5	293	88	4.8	158	108	4.9	192	133	5.4	166	117	4.8	154	102
1/12/2019	4.9	205	94	5.2	200	96	4.3	209	112	5.2	188	106	4.6	164	76
1/1/2020	4.8	211	184	4.6	172	101	4.6	196	122	5.20	172.00	123	4.6	156	132
1/2/2020	6.6	212	130	4.8	183	86	4.6	202	114	5.00	175.00	95	4.3	163	97
1/3/2020	6.7	210	154	4.8	181	115	4.9	196	110	5.20	173.00	109	4.6	163	133
1/4/2020	5	211	84	4.7	181	99	4.6	201	105	5.30	174.00	64	4.5	161	75
29/5/2020	5.6	178	88	4.5	175	76	4.6	175	82	5.6	181	84	5.1	158	81
25/6/2020	5.4	184	102	4.5	182	91	4.6	184	83	5.5	181	87	5.1	172	61
24/7/2020	5.4	184	87	4.6	184	71	4.6	184	80	5.5	184	73	4.9	159	63
21/8/2020	5.5	177	102	4.4	177	91	4.6	188	95	5.4	181	116	4.9	157	94

	BH2C			BH3A			BH3B			BH3C			BH5B		
Date	pH	EC	TDS	pH	EC	TDS	pH	EC	TDS	pH	EC	TDS	pH	EC	TDS
1/8/2018	5.9	219	122	6.1	225	165	4.6	139	80	4.2	148	66	4.7	175	70
1/9/2018	5.8	213	137	6.2	211	138	4.8	140	77	4.3	152	54	4.3	181	160
1/10/2018	5.7	201	106	6.1	191	100	4.8	142	82	4.4	154	65	4.7	183	85
1/11/2018	5.6	191	128	6.2	199	135	4.7	137	78	4.2	149	102	4.5	174	99
1/12/2018	5.6	192	143	6.2	209	142	4.6	139	401	4.3	160	281	4.7	177	250
1/1/2019	5.5	183	131	6.6	228	172	4.6	138	127	4.3	149	122	4.4	178	122
1/2/2019	5.7	181	122	6.2	213	136	4.7	153	92	4.2	153	79	4.6	171	102
1/3/2019	5.6	178	182	6.6	297	266	4.8	135	219	4.2	160	158	5.1	183	103
1/4/2019	5.5	176	111	6.3	239	164	4.7	139	89	3.9	159	92	4.7	193	93
1/5/2019	5.5	174	130	6.4	235	139	4.6	142	74	4.2	162	73	4.9	180	78
1/6/2019	5.4	167	107	6.2	233	118	4.6	137	84	4.2	154	70	4.7	179	84
1/7/2019	5.5	216	147	6.1	226	139	4.6	141	87	4.2	165	90	5.1	194	104
1/8/2019	5.8	202	576	6.2	225	817	4.8	135	116	4.2	151	136	5.2	185	135
1/9/2019				6.1	222	133	4.6	141.0	42	4.1	158	96	5.2	205	123
1/10/2019				6.3	275	188	4.6	137.0	59	4.2	156	58	5.0	175	79
1/11/2019				6.4	293	225	4.8	138.0	83	4.4	164	83	4.7	177	101
1/12/2019				6.2	255	150	4.5	148.0	80	4.1	176	88	4.9	193	101
1/1/2020	5.1	164	136	6.2	244	173	4.5	142	98	4.1	170	105	4.7	174	107
1/2/2020	5.1	169	87	6.2	227	101	4.4	148	53	4.1	169	60	4.8	188	98
1/3/2020	5.6	177	109	9.6	224	108	4.7	145	86	4.3	170	97	4.7	182	94
1/4/2020	5.3	169	87	6.1	216	76	4.7	155	71	4.2	171	62	5.2	196	115
29/5/2020	5.9	219	122	6.1	225	165	4.6	139	80	4.2	148	66	4.7	175	70
25/6/2020	5.8	213	137	6.2	211	138	4.8	140	77	4.3	152	54	4.3	181	160
24/7/2020	5.7	201	106	6.1	191	100	4.8	142	82	4.4	154	65	4.7	183	85
21/8/2020	5.6	191	128	6.2	199	135	4.7	137	78	4.2	149	102	4.5	174	99

	BH6A			BH6B			BH6C			BH4			BH5		
Date	pH	EC	TDS	pH	EC	TDS	pH	EC	TDS	pH	EC	TDS	pH	EC	TDS
1/8/2018	11.6	1330	328	5.3	160	102	4.6	101	23						
1/9/2018	11.5	834	301	5.2	155	105	4.6	100	51						
1/10/2018	11.2	593	140	5.2	160	104	4.6	107	57						
1/11/2018	11.0	413	191	5.1	143	110	4.5	103	70						
1/12/2018	11.0	423	194	4.9	143	112	4.4	112	105	5.6	140		5.1	201	
1/1/2019	10.8	326	220	5.3	174	113	4.4	107	45						
1/2/2019	10.9	348	160	5.0	141	101	4.4	103	53						
1/3/2019	11.0	550	216	5.0	132	136	4.8	100	122						
1/4/2019	10.7	381	156	4.9	137	81	4.5	103	54						
1/5/2019	11.1	446	136	5.0	138	78	4.6	106	35						
1/6/2019	11.1	508	170	4.9	136	67	4.8	103	45	5.4	121		5	199	
1/7/2019	11.3	640	216	4.9	139	70	4.9	105	63						
1/8/2019	11.0	396	204	4.8	131	119	4.4	101	72						
1/9/2019	11.2	639	208	5.0	150	82	4.4	113	57						
1/10/2019	11.3	664	240	4.9	142	76	4.4	108	82						
1/11/2019	11.3	694	111	4.8	135	80	4.2	110	80						
1/12/2019	11.3	680.0	192	4.8	143	84	4.1	121	24	5.6	153		4.9	216	
1/1/2020	11.3	641	278	5	154	98	4.2	122	237						
1/2/2020	11.3	541	140	5	147	69	4.2	118	50						
1/3/2020	11.3	579	186	5	147	84	4.3	119	52						
1/4/2020	11.4	682	212	5.1	172	82	4.2	121	62						
29/5/2020	11.6	1330	328	5.3	160	102	4.6	101	23				5.5	223	126
25/6/2020	11.5	834	301	5.2	155	105	4.6	100	51				5.3	221	122
24/7/2020	11.2	593	140	5.2	160	104	4.6	107	57				5.5	231	146
21/8/2020	11.0	413	191	5.1	143	110	4.5	103	70				5.3	217	127

Attachment A

Environment

From: Lauren Evans <Lauren.Evans@planning.nsw.gov.au>
Sent: Monday, 2 December 2019 9:44 AM
To: Environment
Cc: David Dixon; Mark Dixon
Subject: RE: HPE CM: Dixon Sand - Haerses Road Quarry DA165-7-2005 Pre-commencement

Follow Up Flag: Follow up
Flag Status: Flagged

Dear Hunny

Thanks for your email.

I note that Dixon Sand has:

-) undertaken the works required under condition 16 of Schedule 3, to the satisfaction of DPIE Water;
-) updated the Soil & Water Management Plan under condition 19 of Schedule 3, to the satisfaction of the Secretary; and
-) retired the biodiversity credits required under condition 30 of Schedule 3, to the satisfaction of the Secretary and BCD.

As such, the Department considers that the pre-commencement requirements for works within cells 1A and 2A of the Mod 1 extraction area have been met.

However, the Department notes that condition 24 of Schedule 3 must be satisfied prior to transporting any quarry products derived from quarrying operations within the Mod 1 extraction area.

Regards

Lauren Evans

Team Leader
Energy and Resource Assessments | Planning and Assessment
320 Pitt Street | GPO Box 39 | Sydney NSW 2001
T 02 9274 6311 E lauren.evans@planning.nsw.gov.au



**Planning,
Industry &
Environment**

The Department of Planning, Industry and Environment acknowledges that it stands on Aboriginal land. We acknowledge the traditional custodians of the land and we show our respect for elders past, present and emerging through thoughtful and collaborative approaches to our work, seeking to demonstrate our ongoing commitment to providing places in which Aboriginal people are included socially, culturally and economically.

From: Environment <environment@dixonsand.com.au>
Sent: Tuesday, 26 November 2019 2:41 PM
To: Lauren Evans <Lauren.Evans@planning.nsw.gov.au>
Cc: David Dixon <david@dixonsand.com.au>; Mark Dixon <Mark@dixonsand.com.au>
Subject: RE: HPE CM: Dixon Sand - Haerses Road Quarry DA165-7-2005 Pre-commencement

Hi Lauren,

The DPIE-Water has reviewed and provided confirmation for the completion of actions required under Condition 16 of Schedule 3 of DA165-7-2005 Mod 1.

Attached are the email correspondences and comments from the DPIE-Water.

I believe that by providing the above, together with the Secretary's approval for payment into the Biodiversity Conservation Trust Fund as an alternate mechanism under Condition 33 of Schedule 3 of DA165-7-2005 (letter dated 01/11/2019), all pre-commencement requirements have been met in order for Dixon Sand to commence extraction in Cells 1A and 2A of Mod 1 (refer to attached request dated 31/07/2019).

Could the Department please provide confirmation.

Kind Regards,

Hunny Churcher
Environmental Officer
Dixon Sand Pty Ltd
P: 02 4566 8348
m: 0405 844 207
w: www.dixonsand.com.au

From: Lauren Evans <Lauren.Evans@planning.nsw.gov.au>
Sent: Tuesday, 24 September 2019 11:58 AM
To: Environment <environment@dixonsand.com.au>
Cc: Mark Dixon <Mark@dixonsand.com.au>
Subject: FW: HPE CM: Dixon Sand - Haerses Road Quarry DA165-7-2005 Pre-commencement

Hi Hunny

Thanks for your time this morning. As discussed, there are some outstanding issues that need to be resolved before vegetation clearing/quarrying operations can commence in the MOD 1 extraction area.

Groundwater

Condition 16 of Schedule 3 requires items (a) to (e) to be completed to the satisfaction of DoI/NRAR prior to commencing quarrying operations in the MOD 1 extraction area. We will need formal advice indicating that DoI/NRAR are satisfied that the requirements of condition 16 have been met.

I understand that you have been consulting with NRAR, but you haven't received any written response. Please follow up again using the generic email address (water.referrals@nrar.nsw.gov.au). I will also make some enquiries to confirm who the appropriate contact is. I will let you when I hear back.

Biodiversity Offsets

I understand from the information provided, and from our conversation this morning, that the Haerses Road and Porters Road offset areas have been established, however there was a credit shortfall for two species (including the Dural Woodland Snail), for which you have now paid into the Biodiversity Conservation Fund.

Condition 33 of Schedule 3 allows the use of alternative offsetting mechanisms under the FBA to satisfy the credit requirements in conditions 30 to 32, but only with the agreement of the Secretary. This is because the Commonwealth has not yet endorsed payment into the Fund as an acceptable offsetting mechanism for EPBC-listed species. I understand that you have discussed payment into the Fund with OEH and the Biodiversity Conservation Trust. However, I'd appreciate if you could confirm whether Dixon Sand sought agreement from the Planning Secretary. If agreement has not been granted, we will need to discuss a way forward.

Please call me if you'd like to discuss.

Kind Regards

Lauren Evans

Team Leader

Energy and Resource Assessments | Planning and Assessment

320 Pitt Street | GPO Box 39 | Sydney NSW 2001

T 02 9274 6311 E lauren.evans@planning.nsw.gov.au**Planning,
Industry &
Environment**

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From: Richard Bonner <Richard.Bonner@environment.nsw.gov.au>**Sent:** Monday, 9 September 2019 10:08 AM**To:** Environment <environment@dixonsand.com.au>**Cc:** Alfarid Hussain <Alfarid.Hussain@planning.nsw.gov.au>**Subject:** RE: HPE CM: Dixon Sand - Haerses Road Quarry DA165-7-2005 Pre-commencement

Hi Hunny, see attached.

Regards

Richard Bonner**Senior Conservation Planning Officer, Greater Sydney**

Climate Change and Sustainability | Department of Planning, Industry and Environment

T 02 9995 6917 | E richard.bonner@environment.nsw.gov.au

Level 2, 10 Valentine Avenue, Parramatta, NSW 2150

www.dpie.nsw.gov.au**Planning,
Industry &
Environment**

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From: Environment <environment@dixonsand.com.au>**Sent:** Friday, 30 August 2019 2:22 PM**To:** Richard Bonner <Richard.Bonner@environment.nsw.gov.au>**Cc:** David Dixon <david@dixonsand.com.au>; Mark Dixon <Mark@dixonsand.com.au>; Alfarid Hussain <Alfarid.Hussain@planning.nsw.gov.au>**Subject:** HPE CM: Dixon Sand - Haerses Road Quarry DA165-7-2005 Pre-commencement**Importance:** High

Hi Richard,

Hope you are well.

Dixon Sand has completed the actions required in Condition 30 of Schedule 3, DA165-7-2005.

Please find attached the cover letter and documents to demonstrate compliance.
The condition requires OEH to confirm their satisfaction that the condition has been fulfilled.

Please do not hesitate to contact me should you require any clarification or additional information.

Kind Regards,

Hunny Churcher
Environmental Officer
Dixon Sand Pty Ltd
P: 02 4566 8348
m: 0405 844 207
w: www.dixonsand.com.au

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Any views expressed in this email are those of the individual sender except where the sender expressly and with authority states them to be the views of the NSW Office of Environment and Heritage.

PLEASE CONSIDER THE ENVIRONMENT BEFORE PRINTING THIS EMAIL

Contact: Ellie Randall
Phone: 02 4275 9308
Email: ellie.randall@nrar.nsw.gov.au

Hunny Churcher
Environmental Officer
Dixon Sand Pty Ltd
PO Box 4019
Pitt Town NSW 2756

Our ref: OUT19/15984

email: environment@dixonsand.com.au

Dear Hunny

26 November 2019

Installation of additional Monitoring Wells and Water level Data Loggers at Haerses Road Quarry (DA165-7-2005 Modification 1) – Response to Submission

Thank you for giving the Department of Planning, Industry and Environment – Water (DPIE-Water) the opportunity to comment on the additional monitoring wells and water level data loggers as required per condition 16 of schedule 3 of DA165-7-2005 (Modification 1). DPIE-Water has reviewed the response to submission and has no further comments.

Should you have any further queries in relation to this submission please do not hesitate to contact Ellie Randall on (02) 4275 9308. Please note the generic email address for correspondence is nrar.servicedesk@industry.nsw.gov.au.

Yours sincerely



Alison Collaros
Licensing and Approvals Manager (East)
Natural Resources Access Regulator
Department of Planning, Industry and Environment