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Strada Shelburne Pit/Quarry

MAXIMUM PREDICTED WATER TABLE REPORT

Strada Aggregates Inc.

File 123016 | January 13, 2025

Document Control

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Issue	Date	Description				
0	January 13, 2025	Draft for Client Review				

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1 Introduction

Tatham Engineering Limited (Tatham) was retained by Strada Aggregates Inc. (Strada) to prepare this Maximum Predicted Water Table report in support of a Class A aggregate license for the proposed Strada Pit/Quarry.

The site is located at 437159 4th Line, in Shelburne and currently operates as an above water pit comprised of three ARA licences (#626199, #625155 and #129167). The site is bound by County Road 17 on the south, 4th Line on the west, the Bonnefield agricultural property and Sideroad 15 to the north and the CBM property and 13th Line to the east. Strada is proposing to combine the three existing licences to allow the pit operations to continue and permit below water quarry extraction within the northern 2/3rds of the site (existing licences #626199 and #129167).

The purpose of this report is to identify the maximum predicted water table elevation, in metres above sea level (m asl), relative to the proposed depth of excavation at the site.

This letter outlines the field program conducted at the site used to determine the maximum predicted water table elevation. Additional details and results from the field monitoring program are summarized in the Strada Pit/Quarry Level 1 and 2 Hydrogeological Assessment (Tatham and Earthfx, 2024).

2 Proposed Site Development

At the time quarry operations commence, it is expected the available sand and gravel resource will have been extracted from all portions of the site except for the northern portion of existing License #626199. The proposed phasing sequence is shown on Figure 1 through 7.

Quarry operations will commence in Phase 1A which is located in the southern portion of existing License #129167 and will operate concurrently with pit operations in Phase 2C which is located in the northern portion of existing License #626199.

The quarry floor elevation is expected to vary between 438 m asl and 442 m asl based upon the geological formations. The quarry is anticipated to be extracted in three lifts with lifts varying in height as each follows the geological formations across the site. Lift 1 is approximately 11 to 24 m deep, lift 2 is approximately 11 to 17 m deep, and lift 3 is approximately 14 to 23 m deep.

Quarry extraction will occur in a phased manner divided between four phases with each phase containing multiple sub-phases. Quarry operations will occur sequentially. Phases 1A, 1B, 2A, 2B, and 2C will extract lift 1 and 2. Phase 3A includes extraction of lift 3. Phase 3B, 4A and 4B include extraction of lifts 1, 2 and 3.

All material will be processed by portable plants within close proximity to the active pit and quarry working faces. A portion of the material will also be transported to the wash plant within existing License #626155 where it will be washed.

The new license is proposed to ship a maximum of 2 million tonnes per annum and will utilize both of the existing pit entrance/exits until Phase 3B is extracted. After which only the south entrance/exit will be used.

2.1 WATER CONTROL FEATURES

2.1.1 Benches

Three benches will be used to reach the full extraction depth of the proposed quarry extraction area. The first bench coincides with the Guelph formation; the second bench with the Ancaster/Niagara Falls formation, and the third bench with the Gasport formation. Gravel extraction in the remaining northern pit area will be extracted in conjunction with Phase 1 quarry development, along with simultaneous extraction of Bench 1 and 2.

2.1.2 Water Control Barriers

Groundwater inflow control barriers will be constructed along the overburden and bedrock benches as pit/quarry development progresses, thus restricting groundwater inflow to a limited

active extraction face. Barriers will be constructed on Bench 1 (Guelph) and Bench 3 (Gasport), while no barriers are needed in the Ancaster/Niagara Falls bench because permeability and pump testing indicate it is a significant aquitard.

The design of the barriers will meet all standards for site closure, grading and rehabilitation. Geotechnical analysis indicates the on-site Tavistock till may be suitable for water control barriers if confirmed to be sufficiently impermeable by a geotechnical consultant prior to construction of the barriers. If the on-site Tavistock Till is not considered to be sufficiently impermeable, off-site soil may need to be imported for the construction of the barriers.

A limited portion of the final deep Gasport bench face will be left open to allow long-term drainage of the quarry lake into the Gasport aquifer. The Rehabilitation scenario, presented below, demonstrates this will ensure the lake elevation never rises high enough to result in off-site overland discharge.

2.1.3 Injection Wells

Four injection wells will be constructed along the eastern property boundary prior to Phase 1. Two of the injection wells will be installed in the Guelph Formation and the remaining two will be installed in the Gasport unit. The combined capacity of the injection wells is assumed to be at least 12 L/s. Water captured from the buried tile drain constructed along the western property limit will be diverted directly to the injection wells ensuring water being infiltrated via the injection wells is non-contact water collected upgradient of the on-going aggregate activities.

2.1.4 On-Site Infiltration Systems

Groundwater and surface water (including stormwater and precipitation) will be captured and infiltrated on-site. Three on-site infiltration systems will be constructed, including two infiltration ponds in the south portion of the site and a two-part infiltration trench along the northeast portion of the site. The infiltration systems will be constructed in peripheral areas of sand and gravel materials, thus locally recharging the overburden aquifers with no off-site overland surface water flow.

A buried tile drain will be constructed along the western property boundary to collect groundwater and reduce groundwater mounding to the west of the property. The clean water from the drains will be injected directly into two Guelph and two Gasport injection wells along the eastern property boundary.

The combination of bench barriers (to restrict inflow), and on-site re-infiltration ensures no offsite surface water discharge will occur, and groundwater drawdowns will be minimal.

The proposed infiltration systems are shown on Figure 8.

2.2 PHASE ONE

Phase 1 represents the final extraction of sand and gravel from the north portion of the pit, (in the area labeled Phase 2C/Phase 3A in Figure 1, which refers to later phases of bedrock removal); and extraction of bedrock from Bench 1 and 2 in the central portion of the site, labeled as Phase 1A and Phase 1B. The open extraction faces are shown as dotted lines in Figure 1. A cross section showing the extraction conditions is shown in Figure 2.

The start of bedrock extraction will be a sinking cut located in the Phase 1A area. Groundwater levels in the Phase 1A area are near the lowest recorded on site, and extraction from this initial location will have the minimal impact on the overburden water table.

Overburden water control barriers have been constructed on three sides of the overburden (green line). Progressive barriers have been constructed along the south and east face of Bench 1 (dark blue line), and an open face exists in Bench 1 and 2 along the west and northern faces (dashed red lines).

Quarry floor drains have been constructed to distribute inflow to both the infiltration trenches in the northeast portion of the site and the southern infiltration galleries.

2.3 PHASE TWO

Phase 2 represents the complete extraction of aggregate from Bench 1 and 2 under Phases 1 and 2 and the ongoing extraction of Phase 2C. The open extraction face is shown as dotted lines in Figure 3. A cross section showing the extraction conditions is shown in Figure 4.

Overburden water control barriers have been constructed on four sides of the overburden (green line). Progressive barriers have been constructed along three sides of Bench 1 (dark blue line), and an open face exists in Bench 1 and 2 along the northern face (dashed red line).

Quarry floor drains are constructed to distribute inflow to both the infiltration trenches in the northeast portion of the site and the southern infiltration galleries.

During this phase a buried tile drain constructed along the north western property boundary will collect groundwater so as to reduce groundwater mounding to the west of the property. This water is collected and directly injected into the Guelph and Gasport injection wells along the eastern property boundary. Any excess is added to the eastern infiltration system trenches. The combined injection capacity of these wells is 12 L/s, and a minimum length of 570 m of drain is estimated to generate this flow.

2.4 PHASE THREE

Phase 3 represents the continued extraction of Bench 2 and initial extraction of Bench 3. Phase 3 only includes a partial removal of Bench 3 with the remaining portion of Bench 3 to be removed

in Phase 4. The analysis and presentation of potential impacts were limited to Phase 4 (discussed below) which is considered to be a "worst case scenario" when comparing Phase 3 and Phase 4 conditions.

2.5 PHASE FOUR

Phase 4A represents extraction of bedrock from the second to final Phase 4A cell (Figure 5). In this scenario Benches 1, 2 and 3 are all open along the active face in the south east portion of the excavation. The location of the open extraction faces is shown as a dotted red line in Figure 5. A cross section showing the extraction conditions is shown in Figure 6.

Overburden water control barriers have been constructed on four sides of the overburden (green line). Barriers have been constructed along the majority of Bench 1, with the exception of the south face (dark blue line). As noted, an open face exists in Bench 1, 2 and 3 in the Phase 4A cell (dashed red line). Quarry floor drains are constructed to distribute inflow to both the infiltration trenches at the northeast portion of the site and the southern infiltration ponds.

During this phase a buried tile drain constructed along the north western property boundary will collect groundwater so as to reduce groundwater mounding to the west of the property. This water is collected and conveyed to the Guelph and Gasport injection wells along the eastern property boundary and any excess is added to the eastern infiltration trenches. The combined injection rate is 12 L/s. The drain is subdivided into three segments to provide flexibility in diverting and controlling flow, as needed. In the model representation, the north and central segment divert 12 L/s directly to the injection wells (with any seasonal excess going to the northern infiltration trench), and the southern segment discharges into the central infiltration site.

2.6 REHABILITATION

The Rehabilitation scenario represents conditions after final rehabilitation and closure of the pit and quarry.

At this time, all on-site water control and infiltration systems will be modified and/or removed so as to allow groundwater and surface water conditions to return to near baseline conditions without any active long-term water management.

Water control barriers constructed on all four sides of the pit/quarry in the overburden and Bench 1 will remain in place for the purpose of slope rehabilitation (Figure 7). The exception to this is a 365-m portion of the eastern overburden barrier will be opened to allow lateral seepage into the shallow groundwater system east of the property. The area of barrier opening is shown as a thick orange line in Figure 7. Seepage from this opening will eliminate drawdowns and support streamflow in the tributary flowing into NAT-18. The barriers constructed on Bench 3 will remain in place; however, a small portion of the Gasport formation along the western face of Phase 4 will remain open to the quarry lake to ensure the lake does not overtop and discharge as surface water.

Water from the western tile drain will no longer be infiltrated into the bedrock injection wells. The wells will be sealed and decommissioned. The northern segment of the tile drain will be opened to freely drain into the quarry lake. This will prevent long-term groundwater mounding west of the quarry.

All the infiltration ponds and trenches will be re-graded and converted into appropriate future land uses, as outlined on the closure site plans. The southern portion of the site, west of the constructed wetland and Wetland NAT-19, will be re-graded so runoff and interflow can enter and support the constructed wetland. Any excess water in the constructed wetlands will be allowed to overflow into Wetland NAT-18.

In summary, the site will be returned to a condition restoring local and regional surface and groundwater conditions, with no need for any form of active water management.

3 Field Program

3.1 DRILLING AND MONITORING WELL INSTALLATION

The development of the Shelburne property has evolved since the licensing of the North Pit in 2001. Several groundwater monitoring well drilling and coring programs have been conducted since 2001. The drilling programs were designed to allow for a detailed characterization of the groundwater regimes and to enhance the understanding of the water level responses in the overburden and bedrock aquifer and aquitard systems to rainfall and snowmelt events as well as to overburden removal and pumping. The network has been upgraded and expanded to specifically support the ARA pit/quarry license application.

There is an extensive network of drilling and monitoring wells at the site, including monitor nests, core holes and pumping wells which are summarized in Table 1. The monitoring network is shown in Figure 9. Due to extraction activities, several of these wells are not active at the current time (either destroyed, pulled/decommissioned, or no longer accessible). There are currently 22 active groundwater well nest locations monitoring 30 discrete aquifer/aquitard intervals in the overburden and bedrock aquifers at the property.

In general, monitors labelled with an "A" suffix are screened at the base of the sand and gravel unit (water table aquifer). Monitors labelled with a "B" suffix are screened at the base of the Tavistock Till (just above the bedrock contact). Monitors labelled with a "C" suffix are constructed within the bedrock aquifer. Borehole logs for all the monitoring wells are included in Appendix A.

Key well data (Well ID, depth, screen setting, etc.) are presented in Table 1.

3.2 WATER LEVEL MEASUREMENTS

Groundwater monitoring on-site began in 2002. Over the course of the monitoring period, each monitoring well has been equipped with an automatic pressure transducer datalogger and is monitored continuously. The pressure transducer data is calibrated using manual groundwater measurements and corrected for barometric pressure.

A summary of the water levels for the A, B and C series monitoring wells are provided in Figures 10 to 12, and individual hydrographs are provided in Appendix B.

In general, the groundwater monitoring history shows a strong degree of seasonal response but a few monitors show a very muted response. The response is likely affected by changes in storage properties (i.e. specific yield) when the water table is mainly within the overlying till (as it is on the western boundary), within the weathered bedrock (center of the site), or deeper within the bedrock (eastern boundary). Water levels and the local response to recharge events are also affected to some extent by soil stripping and gravel extraction operations

The groundwater levels in the A and B series wells are very similar with respect to measured water levels and trends. The groundwater levels in the C series wells tend to be about 0 to 4.0 m higher than those measured in the A and B series wells, with the exception of several monitors along the western site limit where the groundwater levels in the C series wells were about 3 to 15 m lower than those measured in the A and B series wells.

Table 1: Groundwater Monitoring Well Network

Current Well Nest ID	Current Well Monitor ID	2016 Pit Name	Status ²	Well Tag Number	MECP ID	Easting	Northing	Survey Elevation (masl) ¹	Stick up (m)	Top of Casing (masl)	Borehole Depth (m)	Borehole Bottom Elevation (masl)	Top Monitor Depth (m)	Bottom Monitor Depth (m)	Top Monitor Elevation (masl)	Bottom Monitor Elevation (masl)
PW1	PW1	PW1	Inactive	A006812	17-06267	561425	4888246	503.37	0.48	503.85	48.76	454.61	20.11	48.76	483.26	454.61
OW1	OW1	OW1	Inactive	A006830	17-06269	561395	4888238	504.12	0.21	504.33	48.76	455.36	18.28	48.76	485.84	455.36
OW2	OW2A-08		Destroyed	A047161	71-06056	561215	4887224	509.69	0.55	510.24	25.60	484.09	7.05	10.10	502.64	499.59
OW2	OW2B-08		Destroyed	A047161	71-06056	561215	4887224	509.69	0.55	510.24	25.60	484.09	22.55	25.60	487.14	484.09
OW2-07	OW2C-07		Destroyed	A049591	70-43351	561218	4887224	509.48	0.64	510.12	72.24	437.24	26.52	72.24	482.96	437.24
OW3	OW3A-08		Dry	A047166	71-06057	561273	4886844	504.47	1.41	505.88	12.80	491.67	2.44	3.96	502.03	500.51
OW3	OW3B-08		Active	A047166	71-06057	561273	4886844	504.47	1.41	505.88	12.80	491.67	9.75	12.80	494.72	491.67
OW3-C	OW3C-07		Active	A049601	70-45010	561271	4886844	504.04	0.37	504.41	15.54	488.50	12.49	15.54	491.55	488.50
OW4	OW4A-08		Active	A047165	71-06048	561355	4886425	505.52	0.63	506.15	13.72	491.80	5.14	7.92	500.38	497.60
OW4	OW4B-08		Active	A047165	71-06048	561355	4886425	505.52	0.63	506.15	13.72	491.80	10.54	13.72	494.98	491.80
OW4-C	OW4C-07		Active	A049604	70-45013	561359	4886425	505.38	0.56	505.94	17.06	488.32	13.41	16.46	491.97	488.92
OW5	OW5A-08		Active	A047164	71-06047	561738	4886523	493.51	0.65	494.16	10.67	482.84	2.50	5.70	491.01	487.81
OW5	OW5B-08		Active	A047164	71-06047	561738	4886523	493.51	0.65	494.16	10.67	482.84	7.00	10.05	486.51	483.46
OW5-C	OW5-C		Active	A049603	70-45012	561738	4886520	493.61	0.69	494.30	13.10	480.51	10.00	13.10	483.61	480.51
OW6	OW6-A		Active	A146152	72-21960	561663	4886939	494.13	0.62	494.75	7.90	486.23	1.80	7.80	492.33	486.33
OW7-A	OW7-A		Active	A146161	72-21961	561771	4886674	497.18	0.64	497.82	10.15	487.03	2.13	10.05	495.05	487.13
OW7-C	OW7-C		Active	A133144	72-21962	561773	4886668	496.98	0.78	497.76	30.60	466.38	18.00	30.60	478.98	466.38
OW8	OW8-A		Active	A172376	72-39322	561282	4887057	504.93	0.94	505.87	12.60	492.33	4.00	12.00	500.93	492.93
OW9	OW9A-08		Dry	A047160	71-06055	561798	4887451	496.51	0.42	496.93	18.59	477.92	3.40	6.40	493.11	490.11
OW9	OW9B-08		Active	A047160	71-06055	561798	4887451	496.51	0.42	496.93	18.59	477.92	15.20	18.20	481.31	478.31
OW10	OW10A-08		Dry	A047162	71-06053	561632	4887297	495.45	0.57	496.02	19.51	475.94	2.00	3.00	493.45	492.45
OW10	OW10B-08		Active	A047162	71-06053	561632	4887297	495.45	0.57	496.02	19.51	475.94	16.00	19.20	479.45	476.25
OW11-A	OW11-A		Destroyed	A133145	72-21963	561574	4886478	494.70	1.20	495.90	16.50	478.20	2.90	8.60	491.80	486.10
OW11-C	OW11-C		Destroyed	A133145	72-21964	561578	4886480	494.80	1.20	496.00	16.50	478.30	13.50	16.50	481.30	478.30
OW12-A	OW12A-08		Active	A047149	71-06054	561882	4887192	495.70	0.87	496.57	7.62	488.08	4.57	7.62	491.13	488.08
OW12-B	OW12B-08		Active	A047149	71-06054	561882	4887190	495.13	0.53	495.66	21.64	473.49	17.98	21.03	477.15	474.10
OW13	OW13-A	MW1A	Active			561140	4887598	506.78	0.75	507.53	19.00	487.78	11.34	14.34	495.44	492.44
OW13	OW13-C	MW1B	Active			561140	4887598	506.78	0.75	507.53	19.00	487.78	15.94	18.94	490.84	487.84
OW14	OW14-A	MW2A	Dry	A006815	17-06268	561763	4887841	496.82	1.01	497.83	20.10	476.72	9.60	12.40	487.22	484.42
OW14	OW14-C	MW2B	Active	A006815	17-06268	561763	4887841	496.82	1.01	497.83	20.10	476.72	17.00	20.00	479.82	476.82
OW15	OW15-A	MW5A	Destroyed	A006826	17-06274	561431	4887669	510.48	1.13	511.61	30.80	479.68	18.00	20.50	492.48	489.98
OW15	OW15-C	MW5B	Destroyed	A006826	17-06274	561431	4887669	510.48	1.13	511.61	30.80	479.68	26.87	29.87	483.61	480.61
OW16-A	OW16-A		Active	A115091	71-85600	561726	4887994	497.06	0.56	497.62	11.81	485.25	10.29	11.81	486.77	485.25
OW16-C	OW16-C	MW8B	Active	A115091	71-85600	561726	4887993	497.11	0.56	497.67	27.30	469.81	8.00	27.30	489.11	469.81
OW17	OW17-B		Destroyed	A193020	72-79229	561472	4887382	502.61	1.00	503.61	27.50	475.11	20.40	23.60	482.21	479.01
OW17	OW17-C		Destroyed	A193020	72-79229	561472	4887382	502.61	1.00	503.61	27.50	475.11	24.30	27.50	478.31	475.11
OW18	OW18-A		Active	A193021	72-79230	561653	4887685	501.21	0.66	501.87	23.70	477.51	17.00	19.80	484.21	481.41
OW18	OW18-C		Active	A193021	72-79230	561653	4887685	501.21	0.66	501.87	23.70	477.51	20.40	23.70	480.81	477.51
OW19	OW19-A		Active	A218812	72-88078	561036	4888192	510.32	1.12	511.44	35.50	474.82	11.20	14.40	499.12	495.92
OW19	OW19-C		Active	A218813	72-88079	561036	4888192	510.32	1.12	511.44	35.50	474.82	34.00	35.50	476.32	474.82

Current Well Nest ID	Current Well Monitor ID	2016 Pit Name	Status	Well Tag Number	MECP ID	Easting	Northing	Survey Elevation (masl) ¹	Stick up (m)	Top of Casing (masl)	Borehole Depth (m)	Borehole Bottom Elevation (masl)	Top Monitor Depth (m)	Bottom Monitor Depth (m)	Top Monitor Elevation (masl)	Bottom Monitor Elevation (masl)
OW20	OW20-A		Dry	A218820	72-88077	561544	4888333	509.30	1.18	510.48	26.40	482.90	20.12	21.64	489.18	487.66
OW20	OW20-C		Active	A218819		561544	4888333	509.30	1.18	510.48	26.40	482.90	25.00	26.40	484.30	482.90
OW21	OW21-A		Dry	A218822	72-88038	561593	4888680	511.41	0.95	512.36	25.30	486.11	20.80	22.20	490.61	489.21
OW21	OW21-C		Active	A218823	72-88076	561593	4888680	511.41	0.95	512.36	25.30	486.11	23.60	25.30	487.81	486.11
OW22	OW22-A		Dry	A218821	A-218821	561384	4888890	513.66	1.01	514.67	27.50	486.16	22.80	24.30	490.86	489.36
OW22	OW22-C		Active	A218818	A-218818	561384	4888890	513.66	1.01	514.67	27.50	486.16	26.00	27.50	487.66	486.16
OW23	OW23-A		Dry	A218815	72-88037	560938	4888787	510.31	0.75	511.06	29.50	480.81	18.90	20.40	491.41	489.91
OW23	OW23-C		Active	A218816	72-88036	560938	4888787	510.31	0.75	511.06	29.50	480.81	27.90	29.50	482.41	480.81
Core #3	OW24-H		Inactive	A353622	A-353622	560965	4888558	508.90	0.41	509.31	71.02	437.88	25.00	71.02	483.90	437.88
Core #3	OW24-A		Active	A353622	A-353622	560965	4888558	508.90	0.41	509.31	71.02	437.88	27.52	30.57	481.38	478.33
Core #3	OW24-C		Active	A353622	A-353622	560965	4888558	508.90	0.41	509.31	71.02	437.88	63.64	66.69	445.26	442.21
Core #1	OW25-H		Inactive	A266920	17-04295	561648	4888161	490.62	0.68	491.30	50.47	440.15	4.00	50.47	486.62	440.15
Core #1	OW25-A		Active	A266920	17-04295	561648	4888161	490.62	0.68	491.30	50.47	440.15	16.18	19.23	474.44	471.39
Core #1	OW25-C		Active	A266920	17-04295	561648	4888161	490.62	0.68	491.30	50.47	440.15	43.03	46.08	447.59	444.54
Core #2	OW26-H		Inactive	A353621	A-353621	561231	4887427	499.22	0.40	499.62	62.41	436.81	25.00	62.41	474.22	436.81
Core #2	OW26-A		Active	A353621	A-353621	561231	4887427	499.22	0.40	499.62	62.41	436.81	27.36	30.41	471.86	468.81
Core #2	OW26-C		Active	A353621	A-353621	561231	4887427	499.22	0.40	499.62	62.41	436.81	51.83	54.88	447.39	444.34
OW27-C	OW27-C		Active	A391976	A-391976	560927	4888785	510.26	0.61	510.87	71.88	438.38	68.83	71.88	441.43	438.38
OW28-A	OW28-A		Active	A391975	A-391975	561602	4888675	511.51	1.05	512.56	37.18	474.33	34.13	37.18	477.38	474.33
OW28-C	OW28-C		Active	A391972	A-391972	561602	4888678	510.98	0.35	511.33	67.59	443.39	64.54	67.59	446.44	443.39
OW29-A	OW29-A		Active	A391974	A-391974	561413	4886532	499.80	0.98	500.78	25.96	473.84	22.91	25.96	476.89	473.84
OW29-C	OW29-C		Active	A391973	A-391973	561412	4886533	499.90	0.93	500.83	62.76	437.14	59.71	62.76	440.19	437.14
OW30	OW30-C		Active	A374686	A-374686	561634	4886901	494.35	0.60	494.95		437.73	53.57	56.62	440.78	437.73
Leaacy wells in	cluded in comp	liance reports (datina back t	2007. Groun	d elevation do	es not corresi	oond to LiDAR	nor to the m	ost current	survey but	to elevations	taken from a	ompliance r	eports.		
MW3	MW3A-04	MW3A	Dry	A006796	17-06273	561740	4887987	508.33	0.70	509.03	22.86	485.47	23.39	26.43	484.94	481.90
MW3	MW3B-04	мwзв	Dry	A006796	17-06273	561740	4887987	508.33	0.70	509.03	22.86	485.47	29.18	32.23	479.15	476.10
MW4	MW4A-04	MW4A	Destroyed	A006827	17-06272	561230	4888243	510.28	0.91	511.19		486.21	13.64	16.40	496.64	493.88
MW4	MW4B-04	MW4B	Dry	A006827	17-06272	561230	4888243	510.28	0.91	511.19	24.07	486.21	18.53	21.58	491.75	488.70
MW7	MW7A-07		Destroyed	A047147	71-06065	561284	4887645	507.00			18.28		4.20	7.25	502.80	499.75
MW7	MW7B-07		Destroyed	A047147	71-06065	561284	4887645	507.00			18.28		14.26	17.31	492.74	489.69
MW9	MW9-A	MW9A	Destroyed	A115096	71-85598	561634	4887857	498.35			8.23		1.46		496.89	493.84
MW9	MW9-B	MW9B	Destroyed	A115096	71-85598	561634	4887857	498.35			8.23		4.81	7.86	493.54	490.49
MW10	MW10-A	MW10A	Destroyed	A115117	71-78110	561271	4887681	500.63	0.80	501.43		489.83	4.13	6.13	496.50	494.50
MW10	MW10-B	MW10B	Destroyed	A115117	71-78110	561271	4887681	500.63	0.80	501.43		489.83	7.63	10.43	493.00	490.20
	s currently invol		,		1							.00100		20.40		
DW1	DW1		Active	A000438	17-06362	562951	4886286	479.67			11.60					
DW2	DW2		Active	A104771	71-99024	562704	4888248	482.36			44.80					
DW3	DW3		Active			562373	4887677	493.92								
DW4	DW4		Active	A051672	71-22047	562197	4890008	495.92			24.40					
												-	-	-		
DW5	DW5		Active			559538	4889095	517.26								

Notes: ¹ Originally surveyed on the vertical datum CGVD28, then converted to CGVD13 using the Canada Geoid Model HT2_2010v70 (CGVD28), and the NAD83 Canada Molodensky Transformation.

² The ground elevations of destroyed monitoring locations were assumed to be in the CGVD28 datum and a gross conversion factor of (0.37m) was applied to the original elevations.

³ (-H) Suffix refers to initial open hole condition at the borehole. A water level timeseries was measured during this period and labeled -H as well.

4 Maximum Predicted Water Table Elevation

A Predicted Maximum Groundwater Level map was prepared utilizing the highest groundwater elevations measured on-site to date. The highest groundwater elevations are shown on Figure 13.

The high groundwater in both the A/B and C Series wells range from 500.0 m asl towards the western limits of the property to 483.0 m asl towards the eastern limits of the property.

The quarry floor will be graded in a generally westerly direction with a maximum elevation 441.5 m asl to the west and 437.9 m asl to the east.

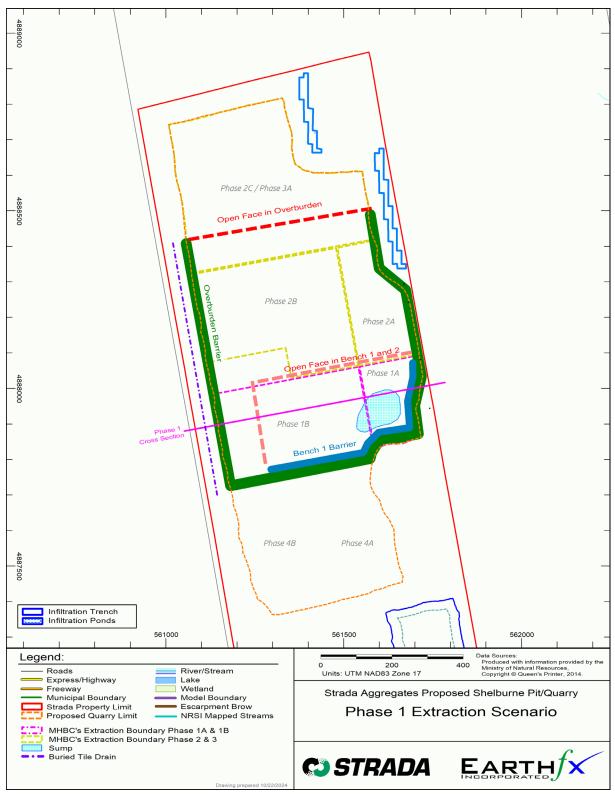


Figure 1: Proposed Strad Pit/Quarry Phase 1 Extraction Scenario

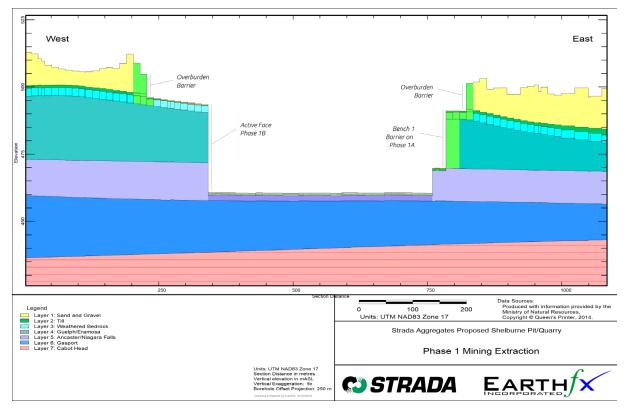


Figure 2: Proposed Strada Pit/Quarry Phase 1 Extraction Scenar-W Section

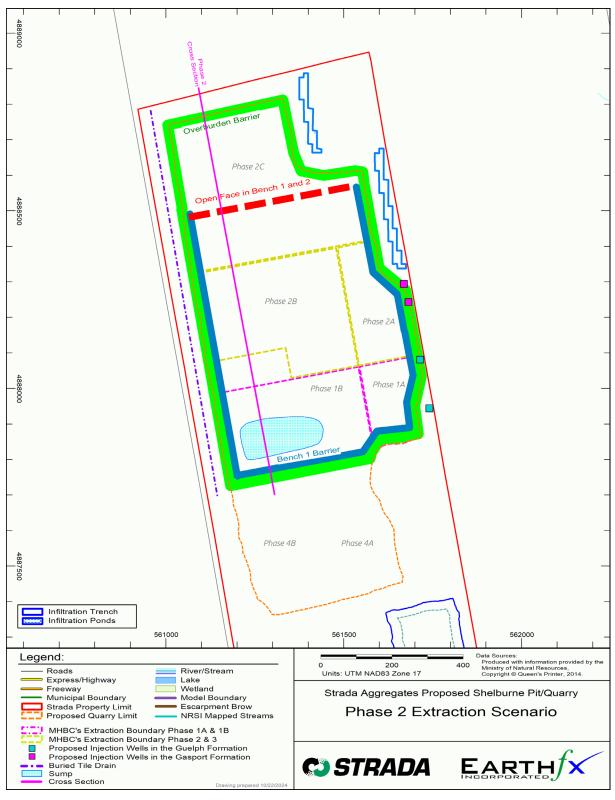


Figure 3: Proposed Strada Pit/Quarry Phase 2C Extraction Scenario

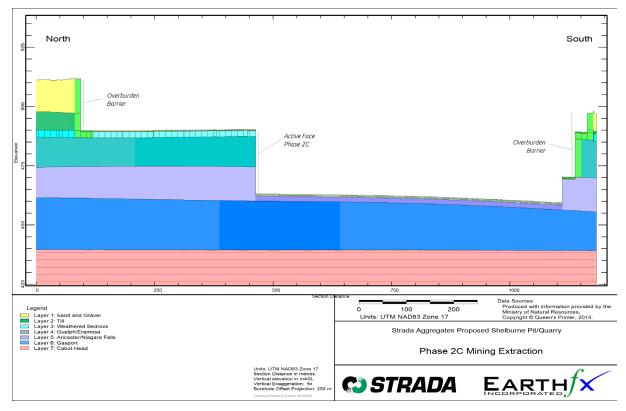


Figure 4: Proposed Strada Pit/Quarry Phase 2C Extraction Scenario N-S Section

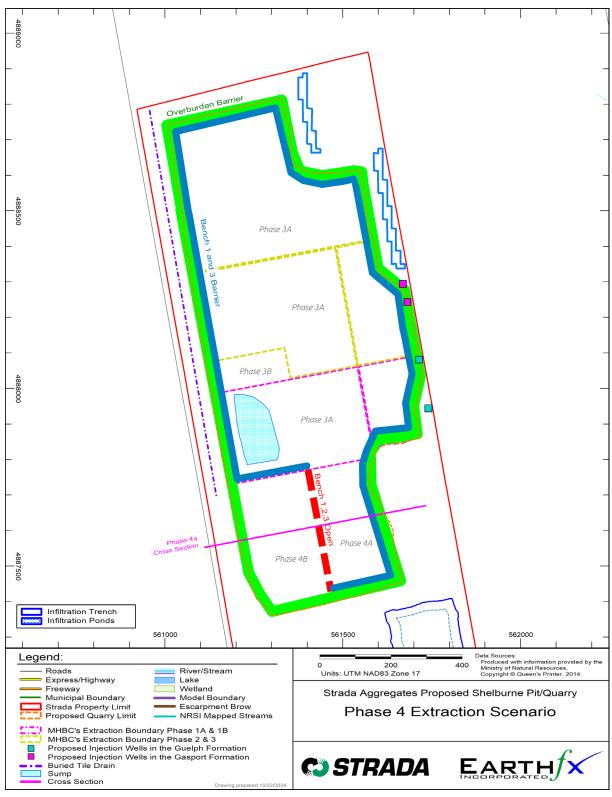


Figure 5: Proposed Strada Pit/Quarry Phase 4A Extraction Scenario

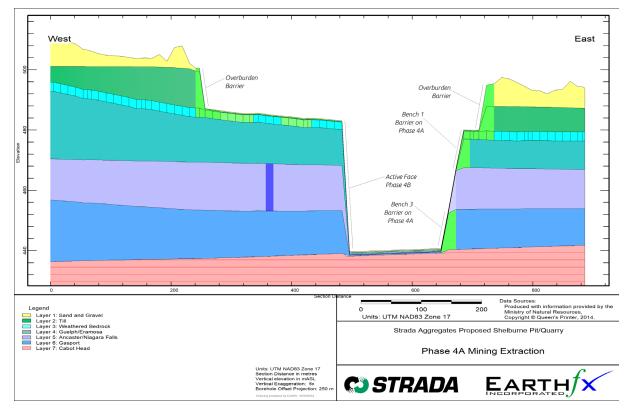


Figure 6: Proposed Strada Pit/Quarry Phase 4A Extraction Scenario N-S Section

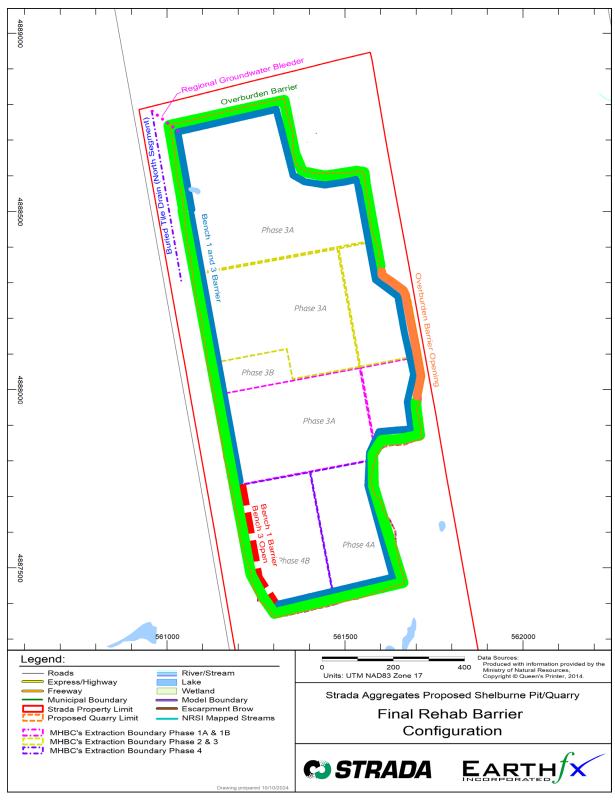


Figure 7: Proposed Strada Pit/Quarry Rehabilitation (Rehab) Scenario

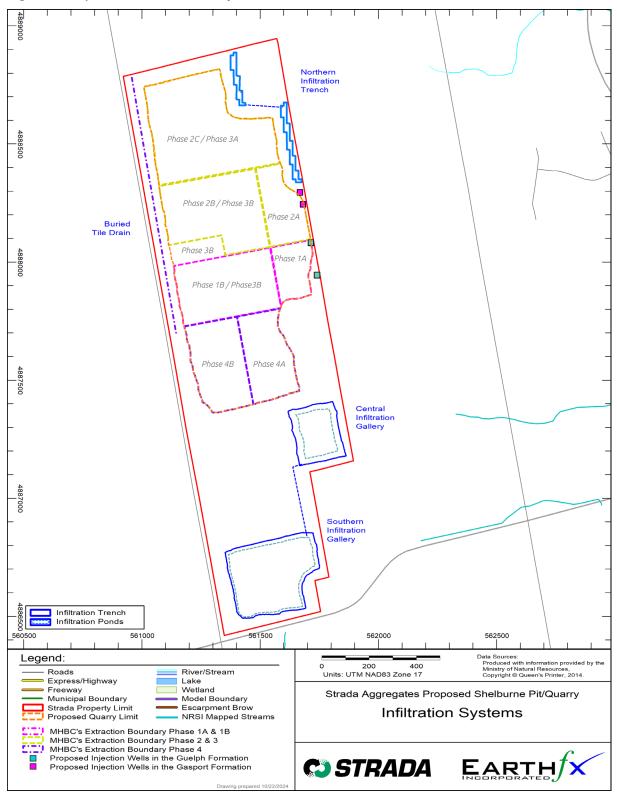


Figure 8: Proposed Strada Pit/Quarry Infiltration Features

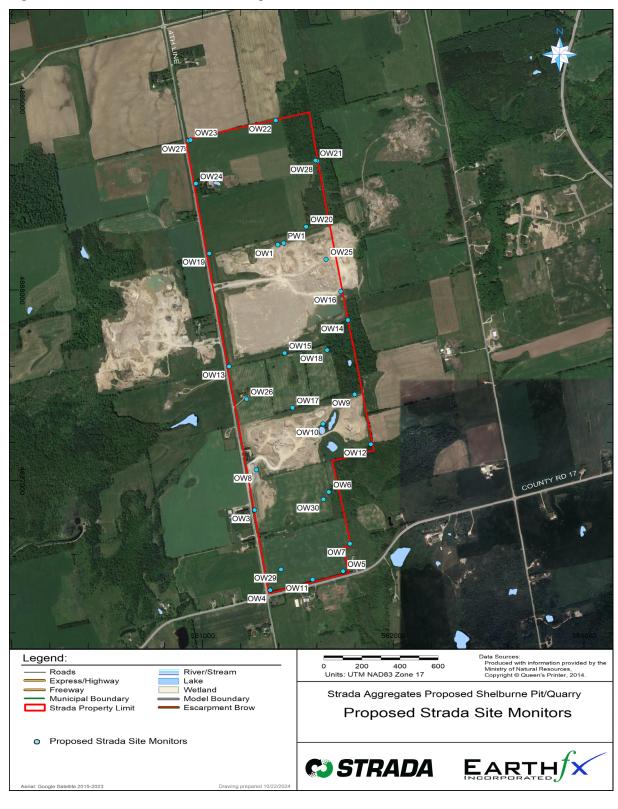


Figure 9: On-Site Groundwater Monitoring Wells

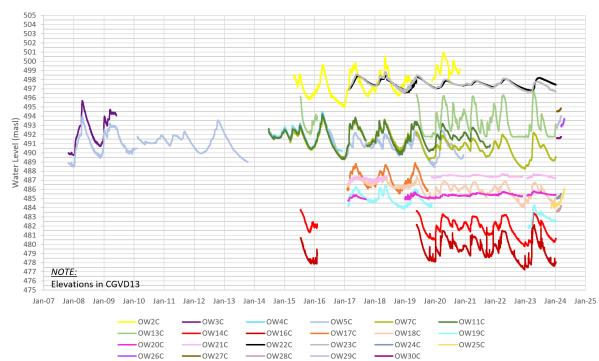


Figure 10: Hydrograph of Bedrock Water Levels (C Series) Across the Site

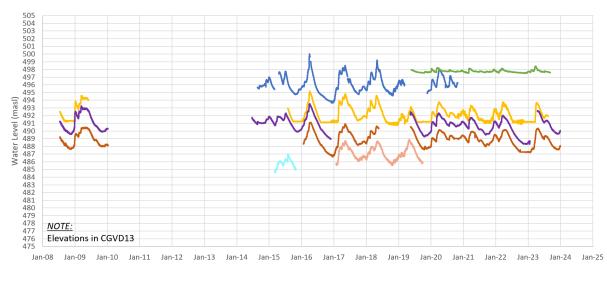


Figure 11: Hydrograph of Intermediate Series "B" Wells Across the Site

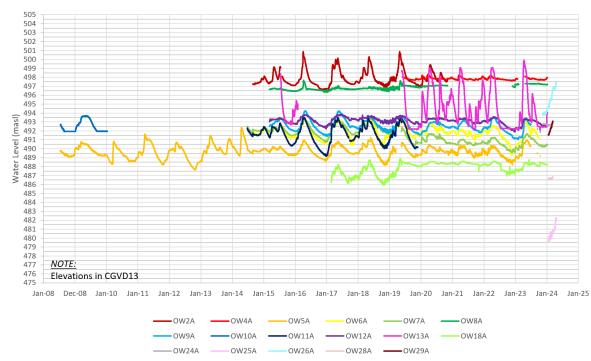
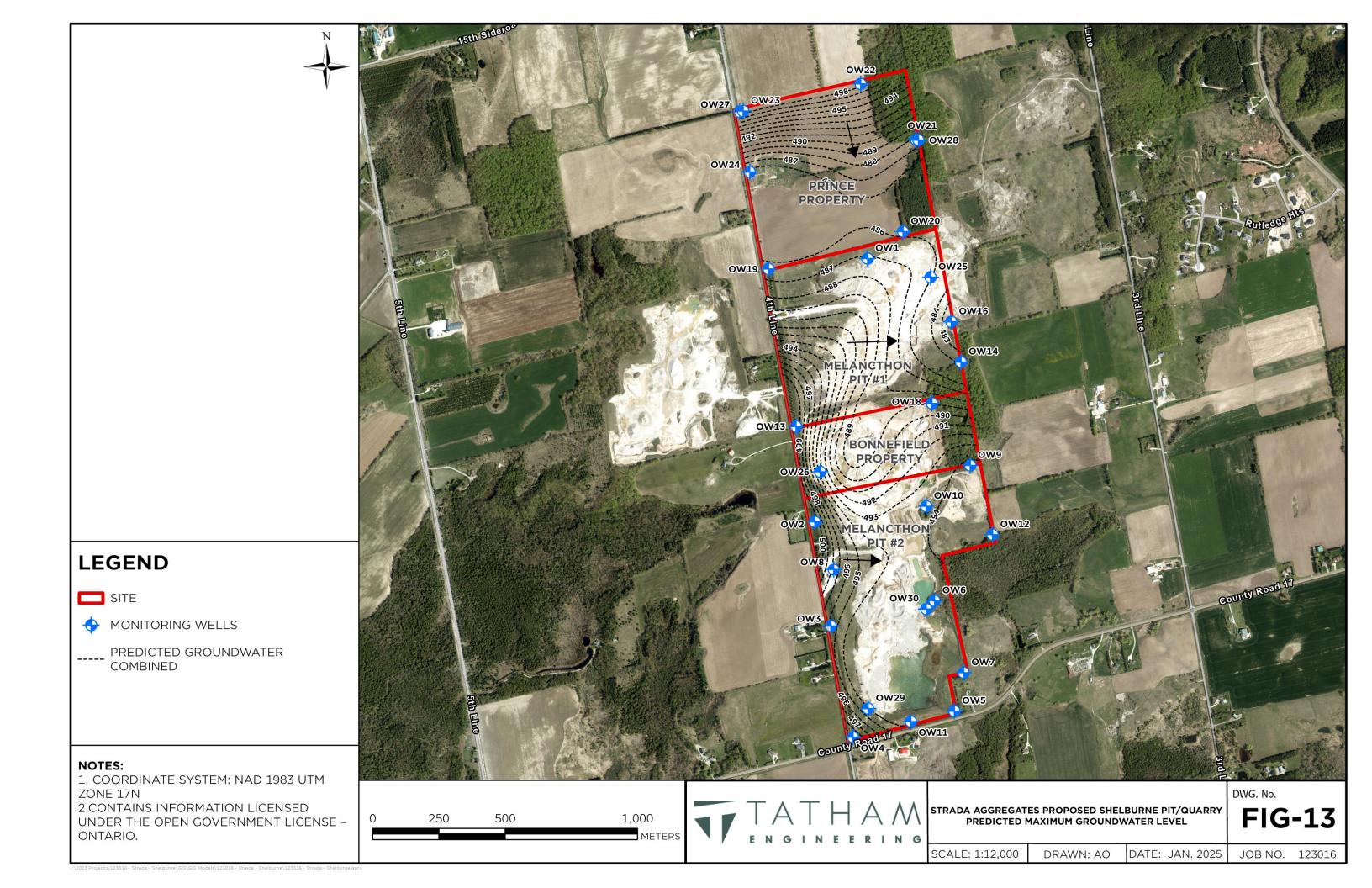


Figure 12: Hydrograph of Intermediate Series "A" Wells Across the Site



Appendix A: Borehole Logs

		<u></u> д і и	H A M E E R I N G	Project Name: Melancthon Pit #2 Well ID: OW2
Depth (m)	Elevation (masl)	Lithology	Lithology Description	Well Construction Diagram
-4 0 4 8 12 16 20 24	508 504 500 496 492 488 484		TOP SOIL SILTY SAND: Brown, occassional stone, loose, dry SAND AND GRAVEL: Brown, angular to subangular gravel, loose, dry to wet TAVISTOCK TILL: Grey, clay with stones, dense to soft, damp	
28 32 36 40 44 48 52 56 60 64 68	480 476 472 468 464 460 456 452 448 444 440		GUELPH FORMATION: Dolostone, buff to white, fossiliferous	A Oben Hole
72 — 76 —	436		CABOT HEAD SHALE: Green, soft, damp	B

Location: Township of Melancthon Easting: 561,689 Northing: 4,887,097



Page 1 of 1

		Д Т с і	Project Name: Melancthon Pit #2 Well ID: OW3	
Depth (m)	Elevation (masl)	Lithology	Lithology Description	Well Construction Diagram
-2 —	506			В
0 —	504	1611 (1614)	TOP SOIL	
2 —	502		SAND AND GRAVEL: Brown, angular to subangular gravel, loose, dry to wet	
4 —	500	0.000		
6 — 8 —	498		TAVISTOCK TILL: Grey, clay with stones, dense to soft, damp	
10 —	494			
12 — 	492		GUELPH FORMATION: Dolostone, buff to white, fossiliferous, weathered upper surface	
14 —	490		of bedrock	
16 —	488			
18 —	486			
20 —				

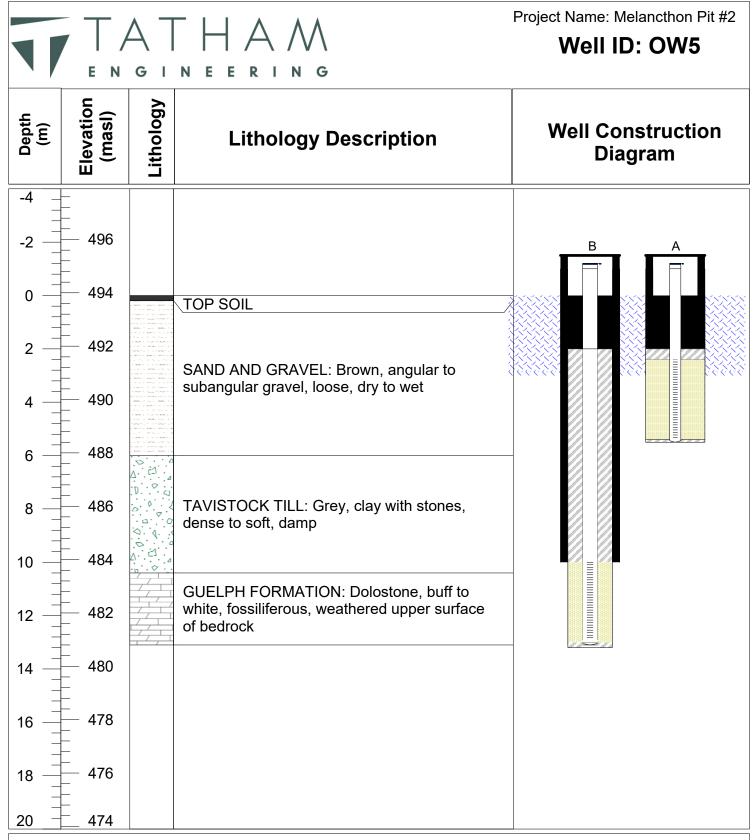
Location: Township of Melancthon Easting: 561,272 Northing: 4,886,849



TATHAM			Project Name: Melancthon Pit #2 Well ID: OW4	
Depth (m)	Elevation (masl)	Lithology	Lithology Description	Well Construction Diagram
-2 — 	508			
0	506		TOP SOIL	
2 —	504			
4 —	502		SAND AND GRAVEL: Brown, angular to subangular gravel, loose, dry to wet	
6	500			
8	498 	0. 0.		
10	496 		SILTY SAND: Brown, occassional stone, loose, dry	
12 —	494 		loose, dry	
14 —	492		GUELPH FORMATION: Dolostone, buff to	
16	490 		white, fossiliferous, weathered upper surface of bedrock	
18	488 			
20 —	486			

Location: Township of Melancthon Easting: 561,313 Northing: 4,886,400





Location: Township of Melancthon Easting: 561,742 Northing: 4,886,523



TATHAM ENGINEERING				Project Name: Melancthon Pit #2 Well ID: OW6
Depth (m)	Elevation (masl)	Lithology	Lithology Description	Well Construction Diagram
-2 - -1 - 0 -	497 496 495			
	494		SILTY SAND: Brown, occassional stone, loose, dry	
2	493 492			
4	491		SAND AND GRAVEL: Brown, angular to subangular gravel, loose, dry to wet	
6 7	489			
8	487			
9 —	486			
10	485 			
12	404			

Drilling Date: Jun-15 Drilling Company: Keith Lang Drilling

Location: Township of Melancthon Easting: 561,660 Northing: 4,886,939



Page 1 of 1

			Project Name: Melancthon Pit #2 Well ID: OW7	
Depth (m)	Elevation (masl)	Lithology	Lithology Description	Well Construction Diagram
-2	498			
0	496		SILTY SAND: Brown, occassional stone, loose, dry	
4	492	· · · · · · · · · · · · · · · · · · ·		
6	490	0 0 0 0 0 0	SAND AND GRAVEL: Brown, angular to subangular gravel, loose, dry to wet	
8	488	0 0 0 0 0 0 0		
	486			A
12	484		TAVISTOCK TILL: Grey, clay with stones,	
	482	∆. [] _ 4	dense to soft, damp	
	480			_
20 —	478			
22 —	476			
24 —	474		GUELPH FORMATION: Dolostone, buff to white, fossiliferous, weathered upper surface	Hade
26 —	472		of bedrock	Open Hole
28 —	468			
30 -	466			
32 -				C

Drilling Date: Jun-15 Drilling Company: Keith Lang Drilling

Location: Township of Melancthon Easting: Northing:



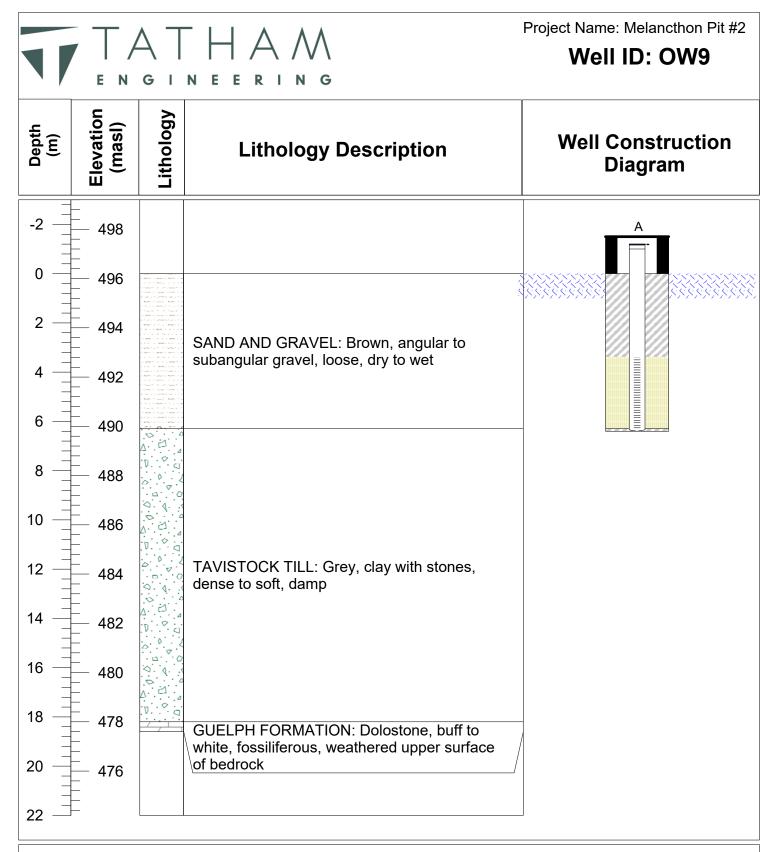
		<u>с</u> і	- H A M N E E R I N G	Project Name: Melancthon Pit #2 Well ID: OW8
Depth (m)	Elevation (masl)	Lithology	Lithology Description	Well Construction Diagram
-2 -1 0	497			
1	495		SILTY SAND: Brown, occassional stone, loose, dry	
3	493			
5 –	491			
7	489		SAND AND GRAVEL: Brown, angular to subangular gravel, loose, dry to wet	
9 10	487			
11	485			
12 — 13 —	484			
14 -	482			

Drilling Date: Jun-15 Drilling Company: Lantech Drilling Services

Location: Township of Melancthon Easting: 561,881 Northing: 4,887,192



Page 1 of 1



Drilling Date: March 2007 / April 2008 Drilling Company: Keith Lang Drilling

Location: Township of Melancthon Easting: 561,806 Northing: 4,887,468



		Д Т с і	Project Name: Melancthon Pit #2 Well ID: OW10	
Depth (m)	Elevation (masl)	Lithology	Lithology Description	Well Construction Diagram
-2 0	496			
2	494 		SAND AND GRAVEL: Brown, angular to subangular gravel, loose, dry to wet	
4 —	492		SILTY CLAY: Brown, compact, moist	
8	488		SILTY SAND: Brown, occassional stone, loose, dry	
10	484 482 480 480		TAVISTOCK TILL: Grey, clay with stones, dense to soft, damp	
20	476		GUELPH FORMATION: Dolostone, buff to white, fossiliferous, weathered upper surface of bedrock	

Drilling Date: March 2007 / April 2008 Drilling Company: Keith Lang Drilling Location: Township of Melancthon Easting: 561,628

Northing: 4,887,239

STRADA

		<u>с і</u>	Project Name: Melancthon Pit #2 Well ID: OW11	
Depth (m)	Elevation (masl)	Lithology	Lithology Description	Well Construction Diagram
498	498			ВА
496 —	496			
494	494		SILTY SAND: Brown, occassional stone, loose, dry	
492 —	492			
490 —	490		SAND AND GRAVEL: Brown, angular to subangular gravel, loose, dry to wet	
488 —	488			
486 — 484 —	486		TAVISTOCK TILL: Grey, clay with stones, dense to soft, damp	
482 —	482		GUELPH FORMATION: Dolostone, buff to white, fossiliferous, weathered upper surface of bedrock	Open Hole
480 —	480			
478	478			
476 —	476			
Drilling	g Date: Ju	n-15		

Drilling Company: Keith Lang Drilling

Location: Township of Melancthon Easting: 561,571 Northing: 488,477



		д — с і		Project Name: Melancthon Pit #2 Well ID: OW12
Depth (m)	Elevation (masl)	Lithology	Lithology Description	Well Construction Diagram
-2				A
-1	507			
0	506			
	505		SILTY SAND: Brown, occassional stone, loose, dry	
2	504			
3 —	503			
4	502			
5	501			
6	500		SAND AND GRAVEL: Brown, angular to	
7	499		subangular gravel, loose, dry to wet	
8	498			
9 —	497			
10	496			
	495			
12	494			
13				

Drilling Date: Jun-15 Drilling Company: Lantech Drilling Services

Location: Township of Melancthon Easting: 561,282 Northing: 4,887,057



		Д с і	H A M N E E R I N G	Project Name: Melancthon Pit #1 Well ID: OW13
Depth (m)	Elevation (masl)	Lithology	Lithology Description	Well Construction Diagram
-2 — —	508			A B
0	506 		TOP SOIL SAND AND GRAVEL: Brown, angular to	
4	502		subangular gravel, loose, dry to wet	
6 — — 8 —	500 498			
10	496		TAVISTOCK TILL: Grey, clay with stones, dense to soft, damp	
12	494			
16	492		GUELPH FORMATION: Dolostone, buff to white, fossiliferous	
18	488 			

Drilling Date: Dec-01 Drilling Company: Keith Lang Drilling

Location: Township of Melancthon Easting: 561,145 Northing: 4,887,604



1	E N	<u>с</u> і	Project Name: Melancthon Pit #1 Well ID: OW14	
Depth (m)	Elevation (masl)	Lithology	Lithology Description	Well Construction Diagram
-2 — —	498			A B
0	496 		TOP SOIL	
4	492 			
6 — 8 — 8 —	490 488		SAND AND GRAVEL: Brown, angular to subangular gravel, loose, dry to wet	
10	486			
12	484	······································		
16	482 480		GUELPH FORMATION: Dolostone, buff to white, fossiliferous, weathered upper surface	
18 —	478		of bedrock	
20 — 22 —	476			

Drilling Date: Aug-04 Drilling Company: Keith Lang Drilling

Location: Township of Melancthon Easting: 561,769 Northing: 4,887,847



	T	$ \land \top $	- HAM	Project Name: Melancthon Pit #1 Well ID: OW15	
Depth (m)	Elevation (masl)	Lithology	Lithology Description	Well Construction Diagram	
-2	512			B. A.	
0 -	510		TOP SOIL		
2	508				
4	506				
6	504				
8	502				
10 -	500				
12	498		SAND AND GRAVEL: Brown, angular to subangular gravel, loose, dry to wet		
14	496				
16	494				
18	492				
20 —	490				
22 —	488				
24	486				
26	484		GUELPH FORMATION: Dolostone, buff to		
28	482		white, fossiliferous, weathered upper surface of bedrock		
30 -	480				

Drilling Date: Aug-04 Drilling Company: Keith Lang Drilling

Location: Township of Melancthon Easting: 561,431 Northing: 4,887,669



	А Т _{с і}	THAM NEERING	Project Name: Melancthon Pit #1 Well ID: OW16
Depth (m) Elevation (masl)	Lithology	Lithology Description	Well Construction Diagram
-4 500 -2 498 0			B
2 — 496 2 — 494 4 — 492		SAND AND GRAVEL: Brown, angular to subangular gravel, loose, dry to wet	
6 490 8 488 10 486 12 484 14 482 16 480 18 478 20 476 22 474 26 470		GUELPH FORMATION: Dolostone, buff to white, fossiliferous, weathered upper surface of bedrock	
28 — 468			

Drilling Company: Keith Lang Drilling

Location: Township of Melancthon Easting: Northing:



	EN	G I	THAM Neering	Project Name: Bonnefiel Pit #3 Well ID: OW17
Depth (m)	Elevation (masl)	Lithology	Lithology Description	Well Construction Diagram
-4	506			АВ
-2 —	504			
0	502		TOP SOIL	
2 —	500			
4 —	498			
6 —	496		SAND AND GRAVEL: Brown, angular to subangular gravel, loose, dry to wet	
8 —	494			
10 -	492			
12 -	490			
14	488			
16 —		0.01		
18 —	486		TAVISTOCK TILL: Grey, clay with stones, dense to soft, damp	
20 —	484	0.0.7		
22 —	482	A. [] 4		
24 —	480			
	478		GUELPH FORMATION: Dolostone, buff to	
26 — 28 —	476		white, fossiliferous	

Drilling Date: 28-Sep

Drilling Company: Keith Lang Drilling

Location: Township of Melancthon Easting: 561,472 Northing: 4,887,382



1		<u>с</u> і	Project Name: Bonnefiel Pit #3 Well ID: OW18	
Depth (m)	Elevation (masl)	Lithology	Lithology Description	Well Construction Diagram
-4 -2	504			A B
0	502 500 498		TOP SOIL	
4	498			
6 — 8 —	494		SAND AND GRAVEL: Brown, angular to subangular gravel, loose, dry to wet	
10	492			
	488	P 7		
14 — 16 —	486		TAVISTOCK TILL: Grey, clay with stones,	
18 —	484		dense to soft, damp	
20	480		GUELPH FORMATION: Dolostone, buff to white, fossiliferous	
24	478			

Drilling Date: 28-Sep Drilling Company: Keith Lang Drilling

Location: Township of Melancthon Easting: 561,653 Northing: 4,887,686



	EN	<u>с</u> і	N E E R I N G	Project Name: Prince Pit #4 Well ID: OW19
Depth (m)	Elevation (masl)	Lithology	Lithology Description	Well Construction Diagram
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	512 510 508 506 504 502 500 498 496 494 492 490 488 486 484 482 480 484 482 480 478 476 474		TOP SOIL SAND AND GRAVEL: Brown, angular to subangular gravel, loose, dry to wet TAVISTOCK TILL: Grey, clay and silt with stones, dense to soft, damp GUELPH FORMATION: Dolostone, buff to white, fossiliferous	

Location: Township of Melancthon Easting: 561,035 Northing: 4,888,193



		Д] с і	Project Name: Prince Pit #4 Well ID: OW20	
Depth (m)	Elevation (masl)	Lithology	Lithology Description	Well Construction Diagram
-4	512			
-2	510			B , A ,
0	508		TOP SOIL	
2	506			
4 —	504			
6	502			
8 —	500			
10 —	498		SAND AND GRAVEL: Brown, angular to subangular gravel, loose, dry to wet	
12 —	496			
14	494			
16 —	492			
18	490			
20 —	488			
22 —	486			
24 —	484		GUELPH FORMATION: Dolostone, buff to white, fossiliferous	
26 — 28 —	482			

Location: Township of Melancthon Easting: 561,544 Northing: 4,888,334



		<u>с</u> і	Project Name: Prince Pit #4 Well ID: OW21	
Depth (m)	Elevation (masl)	Lithology	Lithology Description	Well Construction Diagram
-4 -2 -	514 512 512			A B
0 -	510		TOP SOIL	
2 -	508			
6 -	504			
8 -	502			
12 -	500 498		SAND AND GRAVEL: Brown, angular to subangular gravel, loose, dry to wet, some silt	
14 -	496			
16 -	494			
20 -	492 492 490			
22 –	488		GUELPH FORMATION: Dolostone, buff to	
24 – 26	486		white, fossiliferous	

Location: Township of Melancthon Easting: 561,593 Northing: 4,888,681



		Д Т с і	THAM NEERING	Project Name: Prince Pit #4 Well ID: OW22
Depth (m)	Elevation (masl)	Lithology	Lithology Description	Well Construction Diagram
-4 -2 0	516			B A
2 4 6 8	512 510 508 506 504		TOP SOIL SAND AND GRAVEL: Brown, angular to subangular gravel, loose, dry to wet, some silt	
10 12 14 16	502 500 498		Subangular graver, ioose, dry to wet, some sit	
18 – 20 – 22 – 24 –	496 494 492 492 490		TAVISTOCK TILL: Grey, clay and silt with stones, dense to soft, damp, silt and gravel layer at base	
24 26 28	488		GUELPH FORMATION: Dolostone, buff to white, fossiliferous	

Drilling Date: Feb-17

Drilling Company: Highland Water Well Drilling

Location: Township of Melancthon Easting: 561,384 Northing: 4,888,891



		4 T 6 I	THAM NEERING	Project Name: Prince Pit #4 Well ID: OW23
Depth (m)	Elevation (masl)	Lithology	Lithology Description	Well Construction Diagram
-4 -2	512			B A
0	510		TOP SOIL	
2	508			
4	506		SAND AND CRAVEL : Brown, angular to	
6	504		SAND AND GRAVEL: Brown, angular to subangular gravel, loose, dry to wet, some silt	
8	502			
10	500	0		
12	498			
14	496	0.0	TAVISTOCK TILL: Grey, clay and silt with	
16	494	∆. ⊡. ⊿ 	stones, dense to soft, damp,	
18 —	492			
20 —	490			
22 —	488			
24	486		GUELPH FORMATION: Dolostone, buff to	
26	484		white, fossiliferous	
28	482			
30	480			

Location: Township of Melancthon Easting: 560,938 Northing: 4,888,788



	Lot: Con:										Location Name: OW24 Location ID: -2147483403 Master ID: -2147483403 Original Name/ID: Alt Name: Core #3 Location: E: 560965.02 N: 4888558.315 QA: 1						
Rgn/C Muni. Gnd E	Rgn/Cnty:									Pump test rate: Test Start: to Recommended Rate: at Depth m Purpose: , BH Diameter: Drill Method:							
Metres		Pic	ks	M	DE Material 1	M	OE Materi	al 2	MCE Material 3	Sc	reens	Ge	eo Description				
500_				4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	TILL		SAND SILT	r	وي مي				OVERBURDEN (TILL): mix of sand, silt, boulders, gravel (detailed lognot obtained)				
490	490.24		Top of Bedrock - Guelph		DOLOSTONE		CRYSTALL	LINE			SCREEN OW24-A		Guelph: Dolostone, white to greyish pink on drill surface on broken surface white, fine crystalline and sucrosic, medium to thick bedded, porous quickly soaking up water drop, small vugs 1-2 mm and occasional large vugs to 30 mm, sometimes filed with poorly cemented dolomite xtals, and sometimes empty. Absence of natural breaks that have a black styloittic shale surface. 64 - 65 and 72 - 74 many large vugs incipient reef/ biohermal?. 92 - 82' 6" and 100 'breccia/collapse Bottom contact marked by start of styloittic leafs and gradational colour change.				
470_	477.31 476.81		Eramosa Goat Island - Ancaster		DOLOSTONE		CHERT						Eramosa Goat Island, Ancaster Member, (chert beds): Dolostone, light grey on drill surface and light brownish grey on broken surface fine crystalline, medium to thick bedded, natural breaks have black stybilitis chale surface, less porous than overlying Guelph based on rate of water absorption. Frequent vugs to 30 nm filled either with chert or soft weakly cemented dolomite and at 105° 10° 3 inch vug filled with coarse crystalline calcite. Faint bituminous smell on freshly broken surfaces.				
460	461.5		Goat Island - Niagara Falls Lions Head Gasport		DOLOSTONE		CRYSTALL	LINE			SCREEN OW24-H (Orig- inal open hole)		grey on drill surface and pinkish grey on broken surface with medium bluish grey coloured bands, fine crystalline but finer than Ancaster, thick to massive bedded, low porosity and general absence of vugs. Gasport: Dolostone, very light grey on drill surface and pinkish grey on broken surface with medium bluish grey coloured bands wider but less defined than in overlying Niagara, fine crystalline, thick to massive bedded, porous, vugs 1-3 mm. 155 °5 to 183° (approximate) possible incipient reef /				
450					DOLOSTONE		POROUS						bioherm, large vugs with partial dolomite filling or contai- ning well formed calcite crystals to 5-10 mm. Below this typical Gasport encrinite texture Note: Gasport section in hole 3 is thicker than in hole 2 due to possible reef formation.				
440	442.01		Irondequoit Cabot Head		DOLOSTONE	,	SHALE \ <u>SOFT</u>				SCREEN OW24-C		IRM-Dolostone. Pinkish grey with medium bluish grey on wet broken surface, fine crystalline, thick bedded, occ irregular stylolitic seams, porous and vugs. Contact is defined by marked increase in bluish grey banding going downwards. 230 °5° 3 inch shale. Note shale seams in URM are rip up clasts of underlying Cabot Head shale. Cabot Head: Shale, dark grey, soft, aphanitic, fissile and soft.				

Earthfx

Location Name: OW25

Location ID: -2147483405 Master ID: -2147483405 Original Name/ID: Alt Name: Core #1 Location: E: 561647.683 N: 4888161.257 QA: 1

Lot: Con: Rgn/Cnty: Muni. Gnd Elev: 490.62 masl Elev. QA Code: Depth: 50.47 m Drill Date:								Tes Rec Pur	t St om	test rate: :tart: to nmended Rate: at Depth m se: , ameter: Drill Method:					
Metres		Pic	ks	M	DE Material 1	terial 1 MOE Materia		al 2	MOE Material 3	Sc	creens		Geo Description		
490	-			\otimes		╞			N			\otimes	Overburden (no recovery)		
-	486.61		Top of Bedrock - Guelph		OVERBURDEN							×	Guelph Formation: Dolostone, light brown grey to pinkish		
480	-				DOLOSTONE		CRYSTALLI	INE					grey, fine crystalline, vuggy- (due to fossil), strong, porcus with water easily soaking into surface, thick to medium bedded.		
-	472.28		Eramosa		DOLOSTONE		CRYSTALL	INE		+	SCREEN OW25-A		Eramosa Formation: Dolostone, light brownish grey to		
470	470.93		Goat Island - Ancaster		DOLOSTONE	,	BEDDED				SCREEN		greyish orange pink, fine- crystalline, vuggy (due to fossils), strong, less porous than above, thick to medium bedded. Gradational change to underfying Eramosa with decreased porosity and increased stiviolites on acing deeper, Good RQD. Goat Island Formation Chert Beds: Dolostone as above. Colour change to pale yellowish brown and oil- smell when freshly broken. Bedding planes have soft black surfaces. Upper Goat Island? Lower porosity below here based on water absorption on drill core surface. It is an encrinite i.e. composed largely of crinoid debris that has recrystallized.		
460	455.92		Goat Island - Niagara Falls		DOLOSTONE						OW25-H (Orig- inal open hole)		Niagara Falls		
450			Gasport		DOLOSTONE		CRYSTALLI	INE			SCREEN OW25-C		Gasport Formation: Delostone, light brownish grey to light grey with medium grey mottling (on drill surface this looks like a blue grey colour but on broken surface is medium grey), fine crystalline (not as sugary texture as Guejph), thick bedded, occ. stylolites. Pale brown in upper 1 ft. Mottling due to bioturbation (trace fossils). Stronger than overlying beds and less provus. Excellent RQD: Encrinite with >50% crinoid fossil debris. Same rock as Duntroon, Acton and Milton Qry's. Highly bioturbated.		
-	444.63		Irondequoit			╞				+			Irondequoit Formation: Strong mottling (photo)or biotur-		
	441.62		Cabot Head	F];	DOLOSTONE	\perp							Fossil Hill Formation: Dolostone, finer grained calcisiltite (Rockway Member?) Cabot Head Formation: Shale, fissile leafs, reddish at top		
440	-			F	SHALE	+							becoming grey with depth. Trace micro pyrite		

Earth	
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Location Name: OW26

Location ID: -2147483404 Master ID: -2147483404 Original Name/ID: Alt Name: Core #2 Location: E: 561230.697 N: 4887427.22 QA: 1

Rgn/Cr Muni. Gnd El	Gnd Elev: 499.22 masI Elev. QA Code: Depth: 62.41 m Drill Date:							Pump test rate: Test Start: to Recommended Rate: at Depth m Purpose: , BH Diameter: Drill Method:					
Metres		Pic	(S	мс	DE Material 1	М	OE Materia	al 2	Material 3	Sc	reens	Ge	eo Description
490 480 470 460	481.4 469.65 468.35		Top of Bedrock Guelph Eramosa Goat Island - Ancaster		SAND DOLOSTONE DOLOSTONE DOLOSTONE		SAND SILT				SCREEN OW26-A		OVERBURDEN: mix of sand, silt, boulders, gravel (deta- iled log notobtained) Guelph, Upper Member: Dolostone, white to greyish pink on drill surface on broken surface white, fine crystalline and sucrosic, medium to thick bedded, porous quickly soaking up water drop, small vugs 1-2 mm and occasi- onal large vugs to 30 mm, sometimes filled with poorly cemented dolomite xtals, and sometimes empty. Origina- lity a bioturbated mud. Recrystallization has destroyed most fossils but mold of gastropod found at 61'. Absence of natural breaks that have a black styloitic shale surface. Lower member, reefal in nature is missing Botom contact marked by start of styloitic leafs and gradational colour change Eramosa Goat Island, Ancaster Member. (chert beds): Contact at 101'6' at start of first significant styloitic leafs. Dolostone, light grey on drill surface and light brownish grey on broken surface, fine crystalline, modium to thick bedded, natural breaks hat we black styloitic shale surface, less porous than overlying Guelph based on rate of water absorption. Frequent vugs to 30 mm filled either with chert or soft weakly cemented dolomite. Faint bituminous
450	456.14 451.6 442.53		Goat Island - Niagara Falls Gasport		DOLOSTONE		CRYSTALL CRYSTALL				SCREEN OW26-H (Orig- inal open hole) SCREEN OW26-C		smell on froshly broken surfaces. Goat Island, Niagara Falls Member: Dolostone, very light grey on drill surface and pinkish grey on broken surface with medium bluish grey coloured bands, fine crystalline but finer than overkrijng Anceaster, thick to massive bedded, low porosity and general absence of vugs. Gasport: Dolostone, very light grey on drill surface and pinkish grey on broken surface with medium bluish grey coloured bands wider but less defined than in overlying Niagara, fine crystalline, thick to massive bedded, porous, vugs 1-3 mm, some discrete areas high concen- tration of vugs resulting in weak, porous and brittle rock. A grain stone. Extensive bioturbation giving a mottled fabric.
440	437.38		Irondequoit Cabot Head		DOLOSTONE ISHALE	_	CRYSTALL	INE					IRM: Contact with Irondequoit Formation. Dolostone, Pinkish grey with medium bluish grey on wet broken surface, fine crystalline, thick bedded, occ irregular stylo- litic seams, porcus and vugs. Upper contact is defined by marked increase in bluish grey banding going downwards. At 1910° contact with Rockway Formation. At 199° 11° contact with Merriton Formation (aka Fossii Hill). 203°2° 1 inch shale. Note shale seams in IRM are rip up clasts of underlying Cabot Head shale. Cabot Head: Shale, dark grey, soft, aphanitic, fissile and soft

Earth	C
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Location Name: OW27-C

Location ID: -902854379 Master ID: -902854379 Original Name/ID: Alt Name: A391976 Location: E: 560927.286 N: 4888784.544 QA:

Pump test rate: Test Start: to Recommended Rate: at Depth m

Purpose: , BH Diameter: Drill Method:

Lot: Con: Rgn/Cnty: Muni. Gnd Elev: 510.26 masl Elev. QA Code: Depth: 71.88 m Drill Date:

					-		
Metres		Picks	MOE Material 1	MOE Material 2	MOE Materi	creens	Geo Description
510			OVERBURDEN		~		Overburden
490	487.59	Top of Bedrock - Guelph			$\left \right $		Guelph Formation: Dolostone, white to light grey. Finely crystalline to sucrosic, medium to thick bedded. Porous, quickly soaking up water on surface.
480	482.87	Eramosa					Small vugs 1-2 mm and occasional large vugs to 30 mm, sometimes filled with poorly cemented dolomite crystals. Complete absence of natural breaks that exhibit black stylolitic shale surface. Eramosa Formation: Dolostone, light to medium brown- ish grey, fine crystalline, vuggy (due to fossils), strong, thick to medium bedded. Unlike the overlying Guelph, stylolites are common, and the colour is more
470	475.32	Goat Island - Ancaster					brown-grey. Less porous than above, with a clear reflective sheen when wet, unlike the Guelph, which readily absorbs applied water. Good RQD. Goat Island, Ancaster Member. Dolostone, finely crystalline, medium to dark ash grey, thin to medium bedded. Occasional vugs to 40 mm filled either with chert or weakly cemented dolomite. Faint bituminous smell on freshly broken surfaces. Zones with numerous dark stylolites. Tight, with very low porosity – water applied to surface is not absorbed and remains
460	464.15	Niagara Falls Lions Head Gasport					as a sheen. Goat Island, Niagara Falls Member: Dolostone, very light bluish grey on drill surface and pinkish grey on broken surface. Medium bluish grey, thin, wavy bands that give a distinctive pin-striped appearance, with occasional bluish specks. Very fine crystalli- ne. Thick to massive bedded, very low porcosity and absence of vugs. Very tight – water applied to surface is not absorbed and remains as a sheen. Gasport: Dolostone, thick- to massive-bedded, fine- to coarse-grained, blue-grey to white in a frequently banded pattern. Vugs, 1 to 4 mm in size are common.
450			77 (2) 77				More porous than the overlying Niagara Falls, but water applied to surface still remains as a sheen. Lighter in color and less mottled than the underlying IRM.
440	442.24	Irondequoit Cabot Head	DOLOSTONE			SCREEN OW27-C	IRM: Dolostone, pinkish grey with medium bluish grey on wet broken surface, fine crystalline, thick bedded, occasional irregular stylolitic seams. Porous with vugs up to 4mm. Darker, less banded and more mottled than the overlying Gasport. Becoming brownish coloured with depth. Cabot Head: Shale, dark grey, soft, aphanitic, fissile.
				1 1		1	1 1

	J		Ea	ſ		x	•	Loc Ma Orig Alt	Location Name: OW28-C Location ID: 1602548740 Master ID: 1602548740 Original Name/ID: Alt Name: Location: E: 561602 N: 4888678 QA: 1								
Rgn/Cr Muni. Gnd El	Lot: Con: Rgn/Cnty: Muni. Gnd Elev: 510.98 mas! Elev. QA Code: Depth: 67.59 m Drill Date:								Pump test rate: Test Start: to Recommended Rate: at Depth m Purpose: , BH Diameter: Drill Method:								
Metres		Pic	ks	М	DE Material 1	M	DE Mate	rial 2	MOE Materia	Sc	reens	Ge	o Description				
510					OVERBURDEN								Overburden				
490	484.47					,											
480	472.84		(Top of B <u>edrock</u>) Eramosa		DOLOSTONE								Eramosa Formation: Dolostone, light to medium brown- ish grey, fine crystalline, vuggy (due to fossiis), strong, thick to medium bedded. Unlike the overlying Guelph, stylolites are common, and the colour is more brown-grey. Less porous than above, with a clear reflective sheen when wet, unlike the Guelph, which readily absorbs applied water. Good RQD.				
470	462.09		Goat Island - Ancaster	HHHHHH	DOLOSTONE								Goat Island, Ancaster Member. Dolostone, finely crystalline, medium to dark ash grey, thin to medium bedded. Occasional vugs to 40 mm filled either with chert or weakly cemented dolomite. Faint bituminous smell on freshly broken surfaces. Zones with numerous dark stylolites. Tight, with very low porosity – water applied to surface is not absorbed and remains as a sheen.				
460	457.61	~ ~	Niagara Falls Lions Head Gasport	FFFFFFFFFFF	DOLOSTONE								Goat Island, Niagara Falls Member: Dolostone, very light bluish grey on drill surface and pinkish grey on broken surface. Medium bluish grey, thin, wavy bands that give a distinctive pin-striped appearance, with occasional bluish specks. Very fine crystalli- ne. Thick to massive bedded, very low porosity and absence of vugs. Very tight – water applied to surface is not absorbed and remains as a sheen. Gasport: Dolostone, thick to massive-bedded, fine-				
450	444.72				DOLOSTONE					ŧ	SCREEN OW28-C		to coarse-grained, blue-grey to white in a frequently banded pattern. Vugs, 1 to 4 mm in size are common. More porous than the overlying Niagara Falls, but water applied to surface still remains as a sheen. Lighter in color and less motified than the underlying IRM.				
440	441.07		Irondequoit Cabot Head	H- H-	DOLOSTONE	/				+			IRM: Dolostone, pinkish grey with medium bluish grey on wet broken surface, fine crystalline, thick bedded, occasional irregular stylolitic seams. Porous with vugs up to 4mm. Darker, less banded and more mottled than the overlying Gasport. Becoming brownish coloured with depth. Cabot Head: Shale, dark grey, soft, aphanitic, fissile.				

Earth	fx
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Location Name: OW29-C

Location ID: 1369143902 Master ID: 1369143902 Original Name/ID: Alt Name: Location: E: 561411.76 N: 4886532.7 QA: 1

Lot: Con: Rgn/Cnty: Muni. Gnd Elev: 499.9 masl Elev. QA Code: Depth: 62.76 m Drill Date: Pump test rate: Test Start: to Recommended Rate: at Depth m Purpose: , BH Diameter: Drill Method:

MOE Material 1 MOE Material 2 Metres Picks Screens Geo Description Ë 500 Overburden OVERBURDEN 490 488.3 Top of Bedrock - Guelph Guelph Formation: Dolostone, white to light grey. Gaejnir romitation: Jouosoie, medium to thick bedded. Porous, quickly soaking up water on surface. Small vugs 1-2 mm and occasional large vugs to 30 mm, sometimes filled with poorly cemented dolomite crystals. Complete absence of natural breaks that exhibit black stylolitic shale surface. 480 DOLOSTONE 472.85 Framosa Eramosa Formation: Dolostone, light to medium brown-ish grey, fine crystalline, vuggy (due to fossils), strong, thick to medium bedded. Unlike the overlying Guelph, stylolites are common, and the colour is more 470 brown-grey. Less porous than above, with a clear reflective sheen when wet, unlike the Guelph, which DOLOSTONE readily absorbs applied water. Good RQD. 460 460.13 Goat Island - Ancaste Goat Island, Ancaster Member. Dolostone, finely Goat island, AnCaster Member. Diolostone, Inely crystalline, medium to dark sah grey, thin to medium bedded. Occasional vugs to 40 mm filled either with chert or weakly cemented dolomite. Faint bituminous smell on freshly broken surfaces. Zones with numerous dark stylolites. Tight, with very low porosity – water applied to surface is not absorbed and remains las a sheen. DOLOSTONE 454. Niagara Falls Lions Head DOLOSTONE 451.5 as a sheen. Goat Island, Niagara Falls Member: Dolostone, very Gasport Goat Island, Niagara Falls Member: Dolostone, very light bluish grey on drill surface and pinkish grey on broken surface. Medium bluish grey, thin, wavy bands that give a distinctive pin-striped appearance, with occasional bluish specks. Very fine crystalli-ne. Thick to massive bedded, very low porosity and absence of vugs. Very tight – water applied to surface is not absorbed and remains as a sheen. Gasport: Dolostone, thick- to massive-bedded, fine-to coarse-grained, blue-grey to white in a frequently banded pattern. Yugs. 1 to 4 mm in size are common. More porous than the overlying Niagara Falls, but water applied to surface still remains as a sheen. Lighter in color and less mottled than the underlying IRM. 450. DOLOSTONE 441.3 440 Irondequoit DOLOSTONE SCREEN OW29-C 438. Cabot Head SHALE Lighter in color and reservices. IRM. IRM: Dolostone, pinkish grey with medium bluish grey on wet broken surface, fine crystalline, thick bedded, occasional irregular styloitic seams. Porous with vugs up to 4mm. Darker, less banded and more mottled than the overlying Gasport. Becoming brownish coloured with deoth. 430 coloured with depth. Cabot Head: Shale, dark grey, soft, aphanitic, fissile.

Earthfx	
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Location Name: OW30

Location ID: -1130319958 Master ID: -1130319958 Original Name/ID: A374686 Alt Name: Location: E: 561634.341 N: 4886900.777 QA: 1

Lot: Con: Rgn/Cnty: Muni. Gnd Elev: 494.35 masl Elev. QA Code: Depth: 56.62 m Drill Date:

Pump test rate: Test Start: to Recommended Rate: at Depth m Purpose: , BH Diameter: Drill Method:

Metres		Picks	MOE Material 1	MOE Material 2	MOE Materi	creens	Geo Description
490			OVERBURDEN				Overburden
480	481.26	Top of Bedrock Eramosa					Eramosa Formation: Dolostone, light to medium brown- ish grey, fine crystalline, vuggy (due to fossils), strong, thick to medium bedded. Unlike the overlying Guelph, styloiltes are common, and the colour is more brown-grey. Less porcus than above, with a clear reflective sheen when wet, unlike the Guelph, which readily absorbs applied water. Good RQD.
470			H H H H H H H H H H H H H H H H H H H				
460	461.55	Goat Island - Ancaster					Goat Island, Ancaster Member. Dolostone, finely crystalline, medium to dark ash grey, thin to medium bedded. Occasional vugs to 40 mm filled either with chert or weakly cemented dolomite. Faint bituminous smell on freshly broken surfaces. Zones with numerous dark stylolites. Tight, with very low porosity – water applied to surface is not absorbed and remains
450	450.47	Gasport					as a sheen. Goat Island, Niagara Falls Member: Dolostone, very light bluish grey on drill surface and pinkish grey on broken surface. Medium bluish grey, thin, wavy bands that give a distinctive pin-striped appearance, with occasional bluish specks. Very fine crystalli- ne. Thick to massive bedded, very low porosity and absence of vugs. Very tight – water applied to surface is not absorbed and remains as a sheen. Gasport: Dolostone, thick- to massive-bedded, fine- to coarse-grained, blue-grey to white in a frequently
440	441,65	Irondequoit				SCREEN OW30-C	Lighter in color and less mottled than the underlying IRM: Dolostone, pinkish grey with medium bluish grey on wet broken surface, fine crystalline, thick bedded, occasional irregular stylolitic seams. Porous with vugs up to 4mm. Darker, less banded and more mottled than the overlying Gasport. Becoming brownish
430							coloured with depth. Cabot Head: Shale, dark grey, soft, aphanitic, fissile.

Appendix B: Hydrographs



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tathameng.com

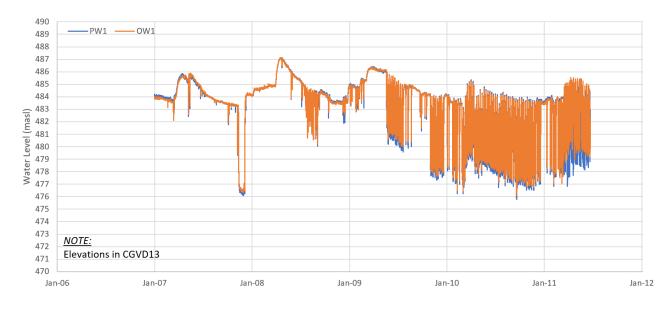


Figure B.1: Hydrograph of water levels at PW1 and OW1, in masl

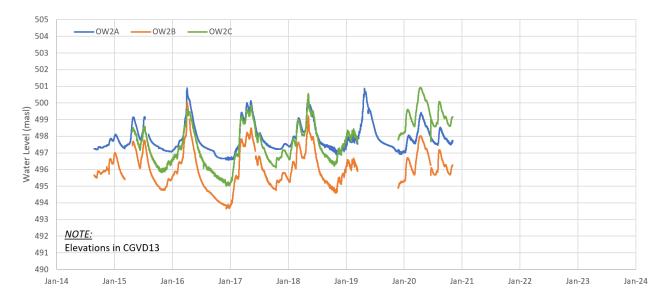


Figure B.2: Hydrograph of water levels at Well Nest OW2, in masl.

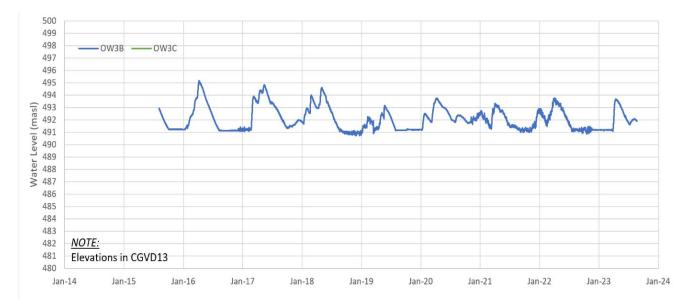


Figure B.3: Hydrograph of water levels at Well Nest OW3, in masl, 2008 to 2009.

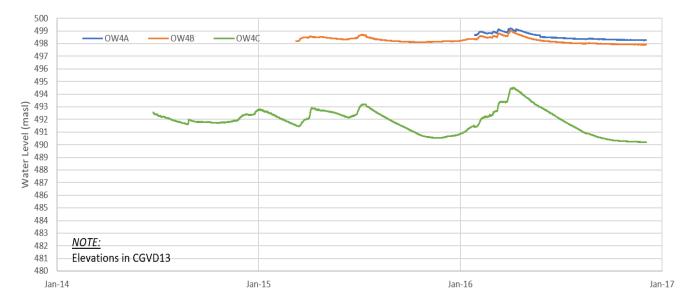
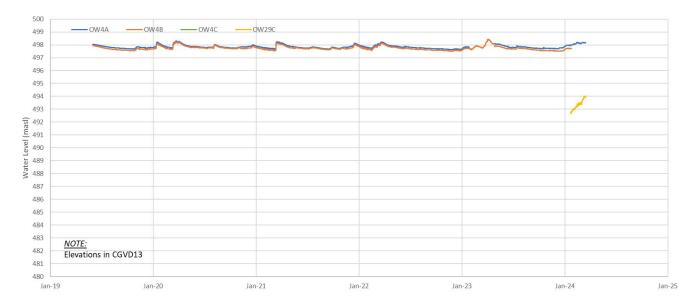


Figure B.4: Hydrograph of water levels at Well Nest OW4, in masl., 2014 to 2016



OW5A ____OW5B -OW5C Water Level (masl) 868 + 664 884 + 664 884 + 664 + 6 NOTE: **Elevations in CGVD13**

Jan-07 Jan-08 Jan-09 Jan-10 Jan-11 Jan-12 Jan-13 Jan-14 Jan-15 Jan-16 Jan-17 Jan-18 Jan-19 Jan-20 Jan-21 Jan-22 Jan-23 Jan-24

Figure B.5: Hydrograph of water levels at Well Nest OW4 and OW29C, in masl.

Figure B.6: Hydrograph of water levels at Well Nest OW5, in masl.

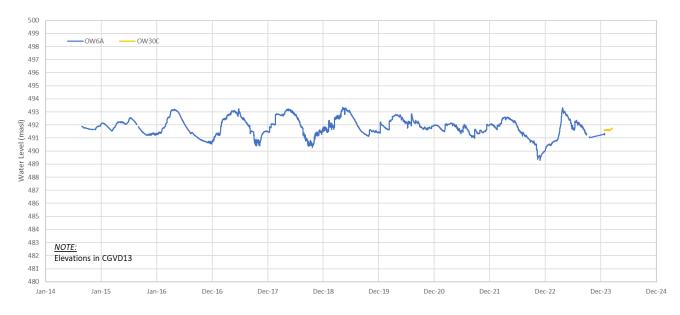


Figure B.7: Hydrograph of water levels at OW6A, in masl, 2014 to 2024.

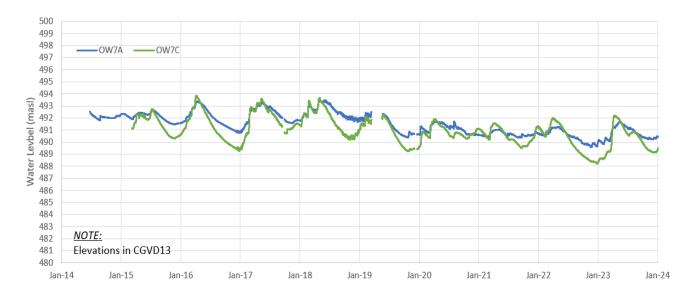


Figure B.8: Hydrograph of water levels at Well Nest OW7, in masl.

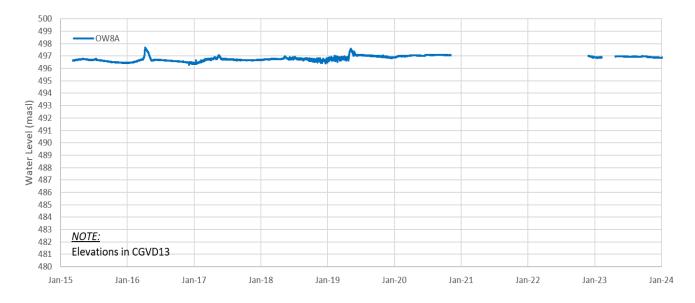


Figure B.9: Hydrograph of water levels at OW8A, in masl.

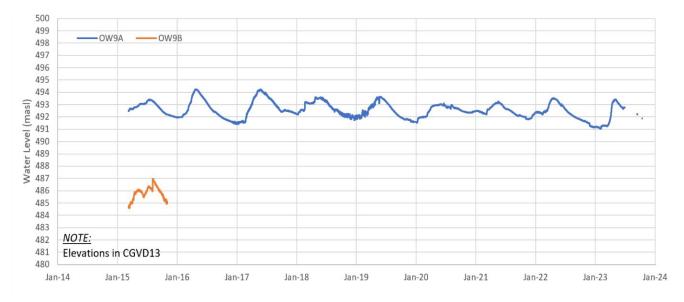


Figure B.10: Hydrograph of water levels at Well Nest OW9, in masl.

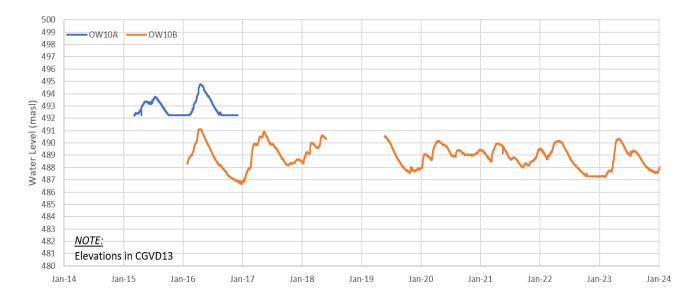


Figure B.11: Hydrograph of water levels at Well Nest OW10, in masl.

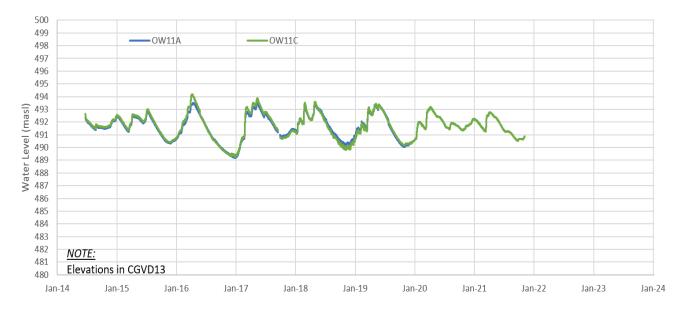


Figure B.12: Hydrograph of water levels at Well Nest OW11, in masl.

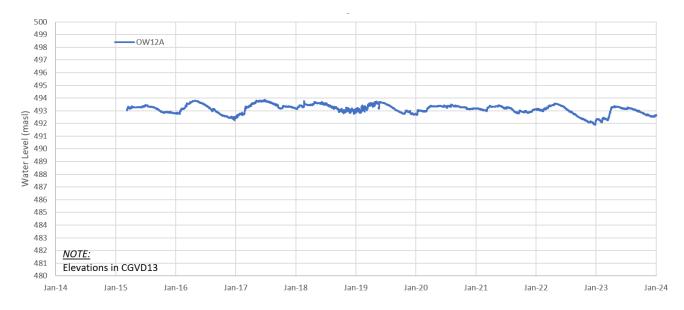


Figure B.13: Hydrograph of water levels at Well OW12A, in masl.

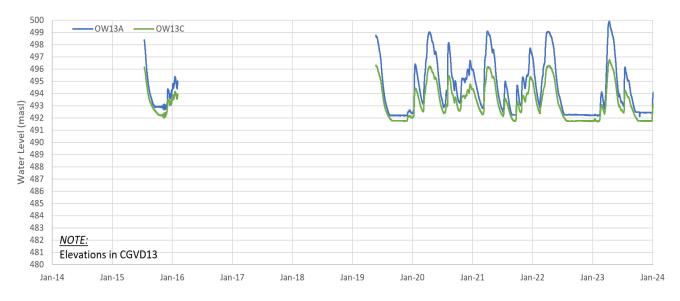


Figure B.14: Hydrograph of water levels at Well Nest OW13, in masl.

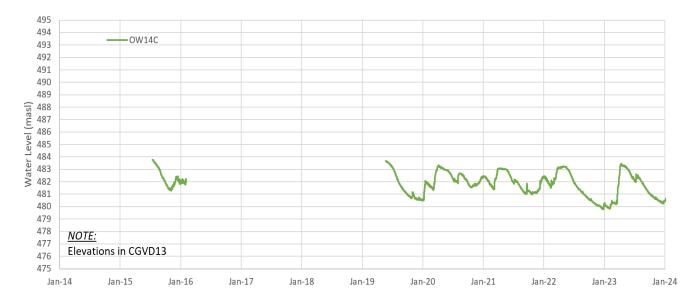


Figure B.15: Hydrograph of water levels at Well OW14C, in masl.

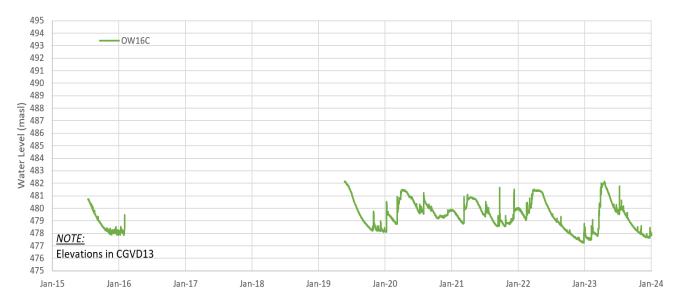


Figure B.16: Hydrograph of water levels at Well OW16C, in masl.

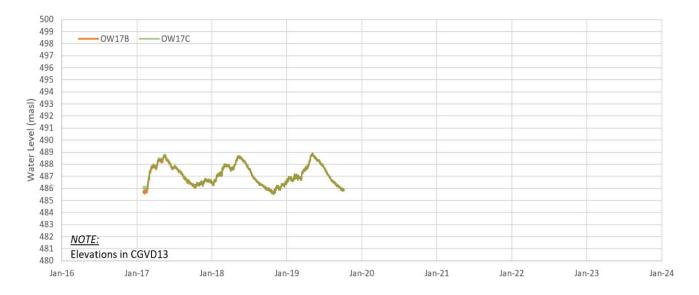


Figure B.17: Hydrograph of water levels at Well Nest OW17, in masl.

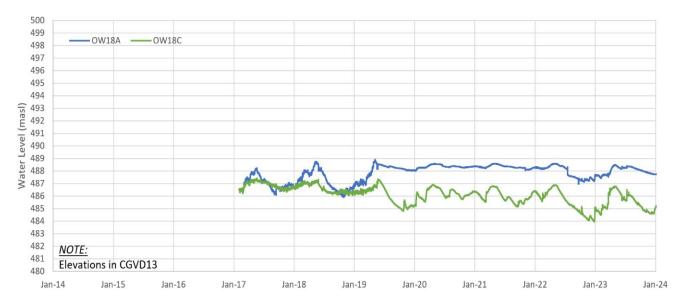


Figure B.18: Hydrograph of water levels at Well Nest OW18, in masl.

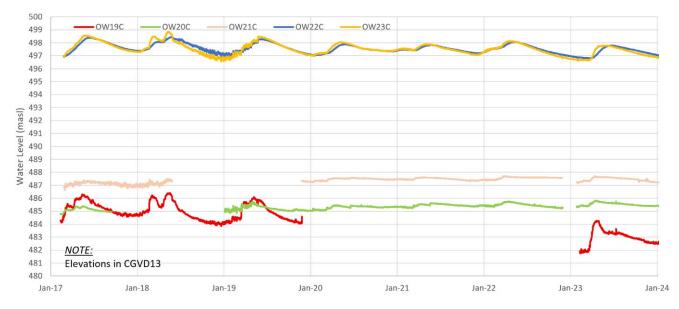


Figure B.19: Hydrograph of water levels at Well Nests OW19, OW20, OW21, OW22, and OW23.

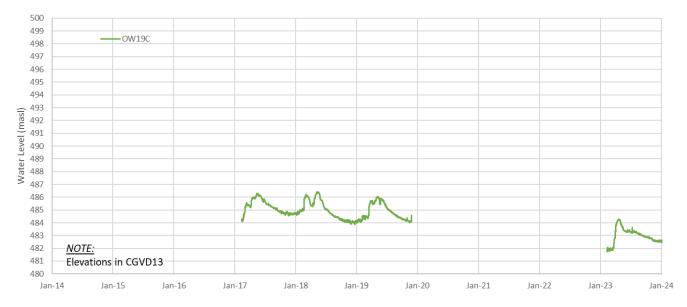


Figure B.20: Hydrograph of water levels at Well Nest OW19C, in masl

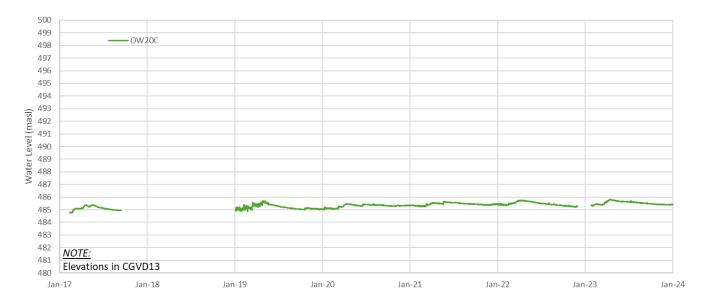


Figure B.21: Hydrograph of water levels at Well Nest OW20C, in masl.

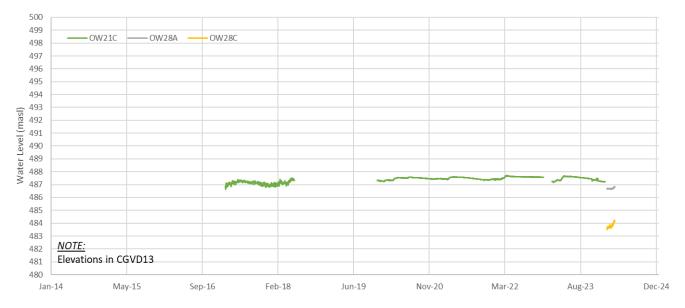


Figure B.22: Hydrograph of water levels at Well Nests OW21 and OW28, in masl.

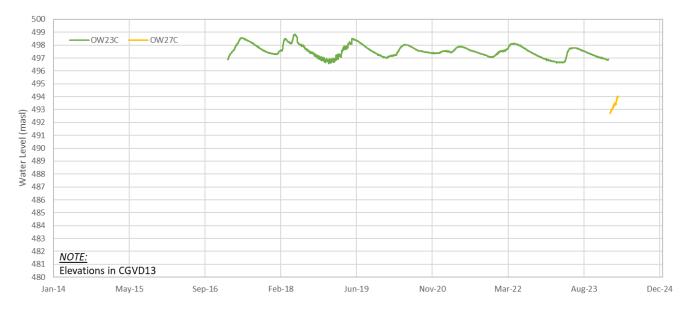


Figure B.23: Hydrograph of water levels at Well Nests OW23 and OW27, in masl.

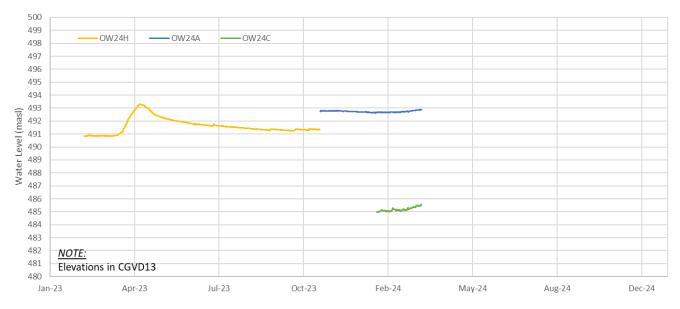


Figure B.24: Hydrograph of water levels at Well Nest OW24, in masl.



Figure B.25: Hydrograph of water levels at Well Nest OW25, in masl.

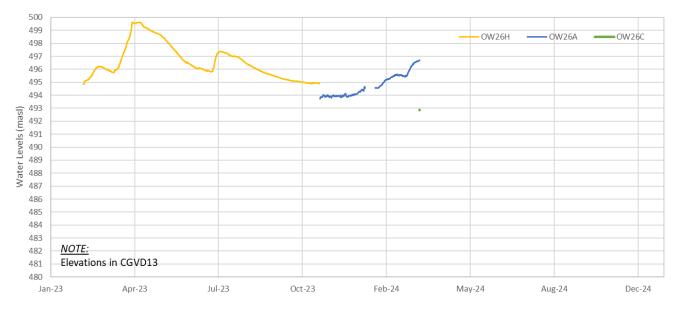


Figure B.26: Hydrograph of water levels at Well Nest OW26, in masl.

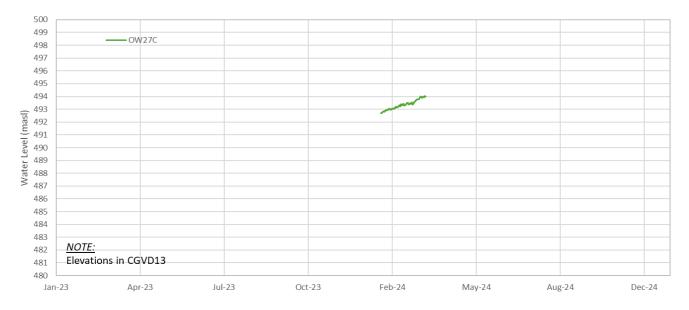


Figure B.27: Hydrograph of water levels at Well Nest OW27, in masl.

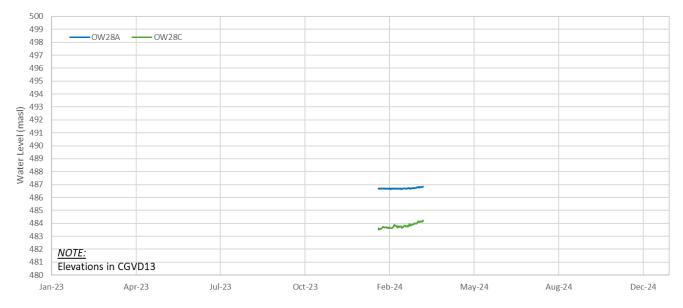


Figure B.28: Hydrograph of water levels at Well Nest OW28, in masl.

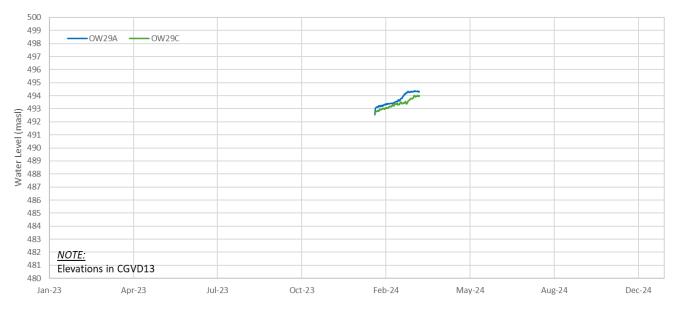


Figure B.29: Hydrograph of water levels at Well Nest OW29, in masl.



Figure B.30: Hydrograph of water levels at Well Nest OW30, in masl.