

August 7, 2024
Project No. 2402452

ATTN: Carley Dixon
R.J. Burnside & Associates Limited
15 Townline
Orangeville, ON L9W 3R4

**Re: Plan of Subdivision S2-22 and Zoning By-Law Amendment Z7-22
Marsville South Subdivision
Township of East Garafraxa
Hydrogeological Study Addendum Letter**

Dear Ms. Dixon,

GEI Consultants Canada Ltd. (formerly GM BluePlan Engineering Limited) has been retained by Thomasfield Homes to provide hydrogeological services in regards to the proposed development of lands into a residential subdivision (referred to as the Marsville South Subdivision).

On behalf of Thomasfield Homes, we provide this hydrogeological study addendum letter in response to select comments, received on September 30, 2022, which addressed hydrogeology and groundwater considerations at the Site. Specifically, the comments requested that groundwater level monitoring be continued to verify seasonally high groundwater levels to finalize the grading as part of the detailed design.

Additionally, it is noted that the Draft Plan of Subdivision has been revised now include 91 residential lots, whereas the GM BluePlan Hydrogeological Study (GMBP, 2022) had considered a previous plan consisting of 90 lots.

Therefore, this hydrogeological study addendum letter also provides the supporting rationale and assessment (in accordance with Procedure D-5-4) to determine the suitability of the subject site to support private sewage servicing for 91 lots.

Background

The proposed subdivision is anticipated to consist of 91 residential lots, park space, a stormwater management block, and associated roadways.

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The subject Site is located within the Township of East Garafraxa and is described as Part of lot 5, Concession 13 of the Geographic Township of East Garafraxa. The Site occupies an area of approximately 28 hectares (approximately 69 acres) and is currently undeveloped agricultural lands. The reader is referred to other reports prepared by GM BluePlan and other consultants for further details regarding existing site conditions and the hydrogeological characterization of the Site.

1. Groundwater Monitoring

Between January 6 to 9, 2020, JLP Services Inc (formerly VA Wood Inc.) advanced 19 boreholes as part of the Geotechnical Investigation to support the development of the proposed residential subdivision.

Eleven (11) of these boreholes were equipped with a 2" Ø monitoring well, with four (4) of these monitoring wells being installed as a two-well nest (i.e., two monitoring wells constructed nearby each other, but at different depths in the subsurface). The locations of these monitoring wells and the associated borehole logs are provided in Appendix A.

For the purposes of supporting the development and approvals process, GEI Consultants conducted continuous groundwater level monitoring at these JLP monitoring wells. On January 22, 2020, GEI visited the Site to collect water levels and install dedicated dataloggers manufactured by Solinst Canada in select monitoring wells (MW-01S, MW-02, MW-06, MW-09, MW-13, MW-15, MW-17S, and MW-19). The dataloggers are described as self-contained pressure transducers which have been set to record the pressure of the water column above the unit at a frequency of once every four hours. The dataloggers were set to begin recording on the day of installation (i.e., February 11, 2020). The data was collected through to June 3, 2024.

The groundwater level data has been presented in the form of hydrographs enclosed within Appendix B. An updated interpreted seasonal high ground table figure has also been created using maximum groundwater levels observed at monitoring wells during the monitoring period to date included in Appendix C.

1.1. Discussion

From the data collected, the following observations have been made regarding the trends in the groundwater level:

- The trend in seasonal fluctuation is similar to what was observed in prior monitoring years, as described in the Hydrogeological Study Report (GMBP, 2022).
- During the seasonal high periods, groundwater levels were similar or were slightly higher in the prior monitoring years (i.e. 2021 and 2022).

It is noted that the datalogger at MW-15 showed no response throughout the monitoring period, indicating groundwater levels were consistently below the datalogger. This is interpreted to be due to this monitoring well being installed at the interface between the shallow silt aquitard and the underlying sand aquifer, which has water levels below the level of that interface. This indicates that perched groundwater conditions exist in the shallow silt deposit in some locations on-site.

August 7, 2024

2. Sewage System Impact Assessment

A monitoring-based assessment in accordance with Section 5.6.1 of Procedure D-5-4 was conducted in the Hydrogeological Study (GMBP 2022) to determine the suitability of the subject Site to be developed with up to 90 residential lots serviced by private individual sewage systems. The reader is referred to the Hydrogeological Study Report where the monitoring-based approach is described in detail.

Using supporting data collected from a test site with similar hydrogeological conditions and hydrostratigraphy located north of County Road 3 in Lot 6, Concession 13, it was determined that the test site exhibited high capacity to attenuate nitrogen from septic systems. Based on monitoring data, the estimated nitrogen attenuation rate was 88%.

This data from the test site was then used to support a monitoring-based assessment for the proposed Marsville South Subdivision. By assuming a more conservative (i.e., lower) nitrogen attenuation rate of 75% (as opposed to 88% indicated by data collected from the test site), as well as accounting for differences in hydrologic recharge between the two sites, it was estimated that a development consisting of 90 residential lots would result in an attenuated nitrogen concentration of 8.34 mg/L in groundwater.

Using a similar approach, the attenuated nitrogen concentration in groundwater can be calculated for the revised layout consisting of 91 residential lots. Please refer to Appendix D for a summary of the calculations used for this estimate.

The results of the predictive assessment provide an estimated attenuated nitrogen rate of 8.36 mg/L for the development of 91 lots. This is below the allowable limit of 10 mg/L. As such, it is considered feasible for the Site to support the development of up to 91 residential lots.

With respect to the potential impacts to nearby water well users, the revised estimated nitrogen concentrations remain below the Ontario Drinking Water Standards of 10 mg/L, hence maintaining the quality standard for groundwater that would be available to nearby water well users.

Lastly, the increase in the number of residential lots from 90 to 91 has not resulted in reduced lot sizing, but rather, a new residential lot was created from a portion of the Park Block. As such, the discussion pertaining to sewage system sizing in the Hydrogeological Report (GMBP, 2022) still stands: the lots appear to have sufficient size to accommodate the required components of the individual sewage systems.


August 7, 2024


Closing


We trust this hydrogeological study addendum letter provides the information that has been requested by the reviewer. Should further information be needed, please do not hesitate to contact the undersigned.

Sincerely,

GEI CONSULTANTS CANADA LTD.


Matthew Long, M.Eng., P.Eng.
Senior Project Engineer




Abdirahman Faarah, P.Geo.
Project Geoscientist

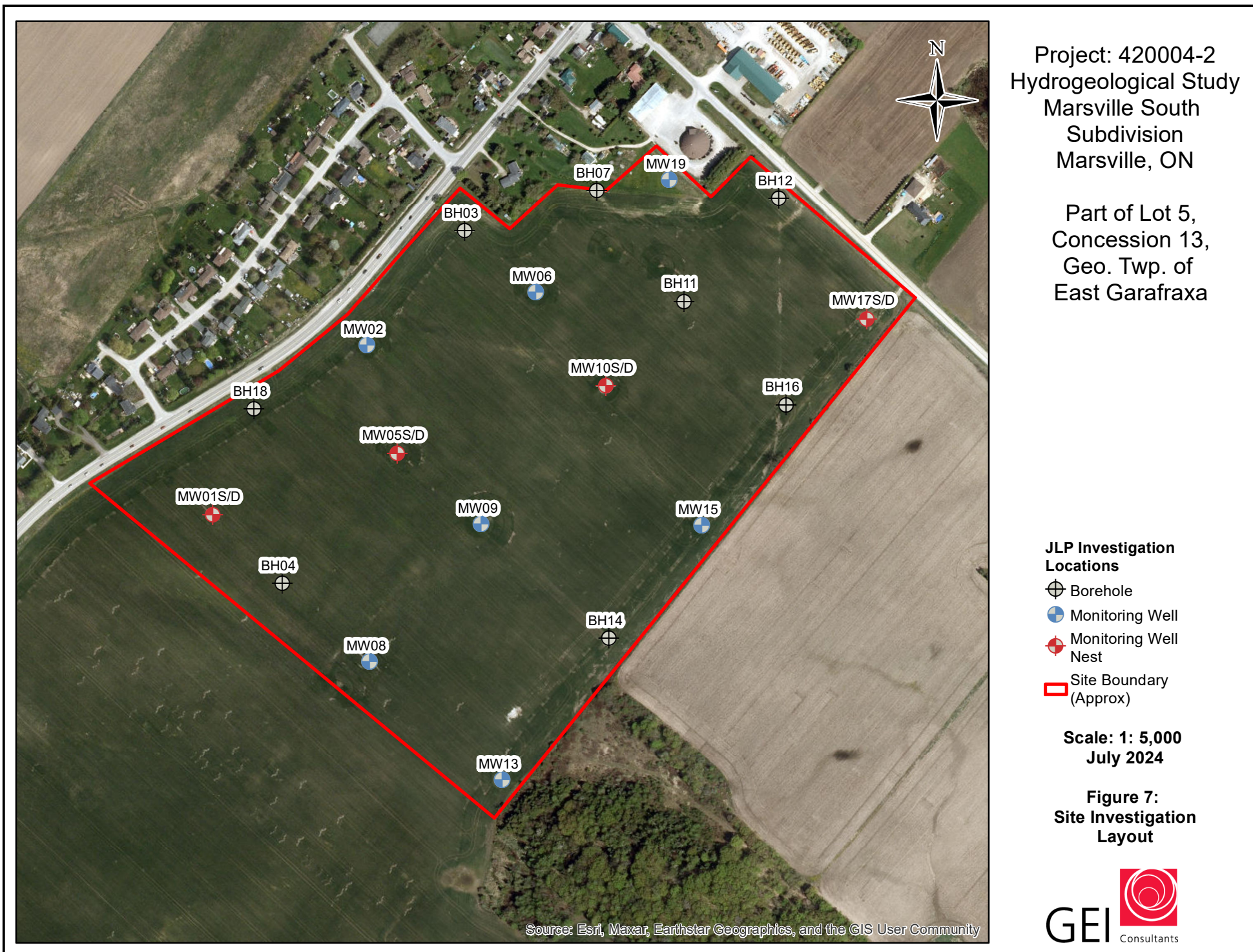
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\\geiconsultants.com\data\Data_Storage\Working\THOMASFIELD HOMES LIMITED\2402452 - 4200042 Hydrogeological Study - Marsville South\Memo - Water Level Data\2402452 - Groundwater Monitoring Letter - MRL.docx

Appendices

- Appendix A JLP Services Monitoring Well Plan Figure and Borehole Logs
- Appendix B Hydrographs
- Appendix C Interpreted Seasonal High Groundwater Level
- Appendix D Nitrogen Attenuation Calculations

Appendix A JLP Services Monitoring Well Plan Figure and Borehole Logs



REFERENCE No: G4216-20-1

MONITORING WELL No: 1

CLIENT: Thomasfield Homes Ltd

PROJECT: Blackwell Subdivision

ENCLOSURE No: 2

LOCATION: Part of Lot 5, Concession 13, Marsville, ON

SUPERVISOR: BI

V.A. WOOD (GUELPH) INC.
CONSULTING GEOTECHNICAL ENGINEERS405 YORK ROAD, GUELPH, ONTARIO N1E 3H3
PH. (519) 763-3101 FAX (519) 763-5912

SUBSURFACE PROFILE					SAMPLE			PENETRATION RESISTANCE				WATER CONTENT %					UNIT WEIGHT
DEPTH (m)	DESCRIPTION	ELEVATION	SYMBOL	MONITORING WELL	NUMBER	TYPE	N-VALUE										
0.0	Ground Surface	487.6															
0.5	500mm Topsoil	487.1															
	brown, loose to compact SILT AND SAND some clay, trace gravel, moist				1	SS	6										
					2	SS	4										
					3	SS	23										
					4	SS	11										
	wet @ 3.0m																
					5	SS	17										
	saturated @ 6.1m				6	SS	11										
7.9	seam of brown sand @7.8m	479.7			7	SS	8										
	grey, very dense SANDY CLAYEY SILT TILL wet				8	SS	50										
10.7		476.9			9	SS	39										
	brown, compact to dense SAND trace silt saturated				10	SS	16										
14.2		473.4			11	SS	20										
	End of Borehole																

DRILLED BY: LST

HOLE DIAMETER: 210mm

DRILL METHOD: Hollow-Stem Auger

DATUM: Geodetic

DRILL DATE: January 9, 2020

SHEET: 1 of 1

REFERENCE No: G4216-20-1

MONITORING WELL No: 2

CLIENT: Thomasfield Homes Ltd

PROJECT: Blackwell Subdivision

ENCLOSURE No: 3

LOCATION: Part of Lot 5, Concession 13, Marsville, ON

SUPERVISOR: BI

V.A. WOOD (GUELPH) INC.
CONSULTING GEOTECHNICAL ENGINEERS405 YORK ROAD, GUELPH, ONTARIO N1E 3H3
PH. (519) 763-3101 FAX (519) 763-5912

SUBSURFACE PROFILE					SAMPLE			PENETRATION RESISTANCE	WATER CONTENT %	UNIT WEIGHT
DEPTH (m)	DESCRIPTION	ELEVATION	SYMBOL	MONITORING WELL	NUMBER	TYPE	N-VALUE			
0.0	Ground Surface	487.4								
0.8	800mm Topsoil	486.6								
1.5	brown, loose SILT AND SAND some organics, some clay, trace gravel, moist	485.9			1	SS	8			
	brown, loose to compact SILT AND SAND some clay, trace gravel, moist to wet				2	SS	8			
4.6		482.8			3	SS	15			
					4	SS	16			
6.6	grey, loose SANDY CLAYEY SILT TILL saturated				5	SS	7			
					6	SS	7			
	End of Borehole									

DRILLED BY: LST

HOLE DIAMETER: 210mm

DRILL METHOD: Hollow-Stem Auger

DATUM: Geodetic

DRILL DATE: January 8, 2020

SHEET: 1 of 1

REFERENCE No: G4216-20-1

BOREHOLE No: 3

CLIENT: Thomasfield Homes Ltd.

V.A. WOOD (GUELPH) INC.
CONSULTING GEOTECHNICAL ENGINEERS

PROJECT: Blackwell Subdivision

ENCLOSURE No: 4

405 YORK ROAD, GUELPH, ONTARIO N1E 3H3
PH. (519) 763-3101 FAX (519) 763-5912

LOCATION: Part of Lot 4, Concession 13

SUPERVISOR: BI

SUBSURFACE PROFILE					SAMPLE			PENETRATION RESISTANCE BLOWS/0.3m				WATER CONTENT %					UNIT WEIGHT
DEPTH (m)	DESCRIPTION	ELEVATION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' BLOWS/0.3m										
0.0	Ground Surface	488.4															
0.3	300mm Topsoil	488.1															
3.0	brown, compact to dense SILT AND SAND some clay, trace gravel, moist to wet			DRY (8-JAN-20)	1	SS	37										
					2	SS	14										
					3	SS	15										
					4	SS	12										
6.6	grey, compact to dense SANDY CLAYEY SILT TILL moist to wet	481.8			5	SS	15										
					6	SS	39										
	End of Borehole																

DRILLED BY: LST

HOLE DIAMETER: 210mm

DRILL METHOD: Hollow-Stem Auger

DATUM: Geodetic

DRILL DATE: January 8, 2020

SHEET: 1 of 1

REFERENCE No: G4216-20-1

BOREHOLE No: 4

CLIENT: Thomasfield Homes Ltd.

V.A. WOOD (GUELPH) INC.
CONSULTING GEOTECHNICAL ENGINEERS

PROJECT: Blackwell Subdivision

ENCLOSURE No: 5

405 YORK ROAD, GUELPH, ONTARIO N1E 3H3
PH. (519) 763-3101 FAX (519) 763-5912

LOCATION: Part of Lot 4, Concession 13

SUPERVISOR: BI

SUBSURFACE PROFILE					SAMPLE			PENETRATION RESISTANCE BLOWS/0.3m				WATER CONTENT %					UNIT WEIGHT
DEPTH (m)	DESCRIPTION	ELEVATION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' BLOWS/0.3m										
0.0	Ground Surface	487.5															
0.3	300mm Topsoil	487.2															
2.3	brown, loose to compact SAND trace silt, moist to wet	485.2			1	SS	9										
					2	SS	16										
					3	SS	4										
					4	SS	6										
6.1	brown, loose to compact SILT AND SAND some clay, trace gravel, wet saturated @ 4.6m	481.4			5	SS	21										
					6	SS	17										
6.6	grey @ 6.0m	480.9															
	End of Borehole																

DRILLED BY: LST

HOLE DIAMETER: 210mm

DRILL METHOD: Hollow-Stem Auger

DATUM: Geodetic

DRILL DATE: January 9, 2020

SHEET: 1 of 1

REFERENCE No: G4216-20-1

MONITORING WELL No: 5

CLIENT: Thomasfield Homes Ltd

PROJECT: Blackwell Subdivision

ENCLOSURE No: 6

LOCATION: Part of Lot 5, Concession 13, Marsville, ON

SUPERVISOR: BI

V.A. WOOD (GUELPH) INC.
CONSULTING GEOTECHNICAL ENGINEERS405 YORK ROAD, GUELPH, ONTARIO N1E 3H3
PH. (519) 763-3101 FAX (519) 763-5912

SUBSURFACE PROFILE					SAMPLE			PENETRATION RESISTANCE	WATER CONTENT %	UNIT WEIGHT
DEPTH (m)	DESCRIPTION	ELEVATION	SYMBOL	MONITORING WELL	NUMBER	TYPE	N-VALUE			
0.0	Ground Surface	490.0						20 40 60 80	5 10 15 20 25	
0.5	500mm Topsoil	489.5								
	brown, loose to compact SILT AND SAND some clay, trace gravel, moist to wet				1	SS	7			
					2	SS	7			
					3	SS	15			
					4	SS	24			
6.1		483.9			5	SS	18			
	grey, loose to dense SANDY CLAYEY SILT TILL wet saturated @ 7.6m				6	SS	10			
					7	SS	5			
11.1		478.9			8	SS	32			
					9	SS	28			
	End of Borehole									

DRILLED BY: LST

HOLE DIAMETER: 210mm

DRILL METHOD: Hollow-Stem Auger

DATUM: Geodetic

DRILL DATE: January 9, 2020

SHEET: 1 of 1

REFERENCE No: G4216-20-1

MONITORING WELL No: 6

CLIENT: Thomasfield Homes Ltd

V.A. WOOD (GUELPH) INC.
CONSULTING GEOTECHNICAL ENGINEERS

PROJECT: Blackwell Subdivision

ENCLOSURE No: 7

LOCATION: Part of Lot 5, Concession 13, Marsville, ON

SUPERVISOR: BI

405 YORK ROAD, GUELPH, ONTARIO N1E 3H3
PH. (519) 763-3101 FAX (519) 763-5912

SUBSURFACE PROFILE					SAMPLE			PENETRATION RESISTANCE				WATER CONTENT %					UNIT WEIGHT
DEPTH (m)	DESCRIPTION	ELEVATION	SYMBOL	MONITORING WELL	NUMBER	TYPE	N-VALUE										
0.0	Ground Surface	489.2		<p>Protective Well Casing</p> <p>51mm OD Riser Pipe</p> <p>Bentonite</p> <p>Filter Sand</p> <p>51mm OD Screen</p> <p>W.L. @ El 488.2± (22-JAN-20)</p>													
0.8	800mm Topsoil	488.4															
1.5	brown, loose SILT AND SAND some organics, some clay, trace gravel, moist	487.7			1	SS	6										
	brown, loose to compact SILT AND SAND some clay, trace gravel, moist to wet				2	SS	5										
					3	SS	11										
					4	SS	14										
4.7		484.5			5	SS	9										
6.4	grey, loose SANDY CALVEY SILT TILL wet	482.8			6	SS	14										
6.6	grey, compact SAND trace silt, saturated	482.6															
	End of Borehole																

DRILLED BY: LST

HOLE DIAMETER: 210mm

DRILL METHOD: Hollow-Stem Auger

DATUM: Geodetic

DRILL DATE: January 8, 2020

SHEET: 1 of 1

REFERENCE No: G4216-20-1

BOREHOLE No: 7

CLIENT: Thomasfield Homes Ltd.

V.A. WOOD (GUELPH) INC.
CONSULTING GEOTECHNICAL ENGINEERS

PROJECT: Blackwell Subdivision

ENCLOSURE No: 8

405 YORK ROAD, GUELPH, ONTARIO N1E 3H3
PH. (519) 763-3101 FAX (519) 763-5912

LOCATION: Part of Lot 4, Concession 13

SUPERVISOR: BI

SUBSURFACE PROFILE					SAMPLE			PENETRATION RESISTANCE BLOWS/0.3m				WATER CONTENT %					UNIT WEIGHT
DEPTH (m)	DESCRIPTION	ELEVATION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' BLOWS/0.3m										
0.0	Ground Surface	489.5															
0.3	300mm Topsoil	489.2															
1.5	brown, loose SILT AND SAND some organics, some clay, trace gravel, moist	488.0			1	SS	5										
4.6	brown, loose to compact SILT AND SAND some clay, trace gravel moist to wet	484.9			2	SS	6										
					3	SS	12										
					4	SS	19										
					5	SS	16										
6.6	grey, compact SANDY CLAYEY SILT TILL wet	482.9			6	SS	25										
	End of Borehole																

W.L. @ El. 483.7m± (8-JAN-20)

DRILLED BY: LST

HOLE DIAMETER: 210mm

DRILL METHOD: Hollow-Stem Auger

DATUM: Geodetic

DRILL DATE: January 8, 2020

SHEET: 1 of 1

REFERENCE No: G4216-20-1

MONITORING WELL No: 8

CLIENT: Thomasfield Homes Ltd

PROJECT: Blackwell Subdivision

ENCLOSURE No: 9

LOCATION: Part of Lot 5, Concession 13, Marsville, ON

SUPERVISOR: BI

V.A. WOOD (GUELPH) INC.
CONSULTING GEOTECHNICAL ENGINEERS405 YORK ROAD, GUELPH, ONTARIO N1E 3H3
PH. (519) 763-3101 FAX (519) 763-5912

SUBSURFACE PROFILE					SAMPLE			PENETRATION RESISTANCE				WATER CONTENT %					UNIT WEIGHT
DEPTH (m)	DESCRIPTION	ELEVATION	SYMBOL	MONITORING WELL	NUMBER	TYPE	N-VALUE										
0.0	Ground Surface	487.1		<p>Protective Well Casing</p> <p>51mm OD Riser Pipe</p> <p>Filter Sand</p> <p>51mm OD Screen</p> <p>W.L. @ EL 485.7 ± (22-JAN-20)</p> <p>Bentonite</p>													
0.8	800mm Topsoil	486.3			1	SS	6										
1.7	brown, loose SILT AND SAND some organics, some clay, trace gravel, moist	485.4			2	SS	5										
6.1	brown, loose to compact SILT AND SAND some clay, trace gravel, wet saturated @ 4.6m				3	SS	5										
					4	SS	6										
					5	SS	10										
6.6	brown, dense SILT AND SAND TILL some clay, wet	480.5		6	SS	47											
	End of Borehole																

DRILLED BY: LST

HOLE DIAMETER: 210mm

DRILL METHOD: Hollow-Stem Auger

DATUM: Geodetic

DRILL DATE: January 7, 2020

SHEET: 1 of 1

REFERENCE No: G4216-20-1

MONITORING WELL No: 9

CLIENT: Thomasfield Homes Ltd

PROJECT: Blackwell Subdivision

ENCLOSURE No: 10

LOCATION: Part of Lot 5, Concession 13, Marsville, ON

SUPERVISOR: BI

V.A. WOOD (GUELPH) INC.
CONSULTING GEOTECHNICAL ENGINEERS405 YORK ROAD, GUELPH, ONTARIO N1E 3H3
PH. (519) 763-3101 FAX (519) 763-5912

SUBSURFACE PROFILE					SAMPLE			PENETRATION RESISTANCE	WATER CONTENT %	UNIT WEIGHT
DEPTH (m)	DESCRIPTION	ELEVATION	SYMBOL	MONITORING WELL	NUMBER	TYPE	N-VALUE			
0.0	Ground Surface	490.0								
0.8	800mm Topsoil	489.2								
1.5	brown, loose SILT AND SAND some organics, some clay, trace gravel, moist	488.5			1	SS	5			
	brown, loose to compact SILT AND SAND some clay, trace gravel, wet				2	SS	6			
	saturated @ 4.6m				3	SS	19			
4.6		485.4			4	SS	13			
	grey, very loose to compact SANDY CLAYEY SILT TILL saturated				5	SS	4			
6.6		483.4			6	SS	12			
	End of Borehole									

DRILLED BY: LST

HOLE DIAMETER: 210mm

DRILL METHOD: Hollow-Stem Auger

DATUM: Geodetic

DRILL DATE: January 7, 2020

SHEET: 1 of 1

REFERENCE No: G4216-20-1

MONITORING WELL No: 10

CLIENT: Thomasfield Homes Ltd

PROJECT: Blackwell Subdivision

ENCLOSURE No: 11

LOCATION: Part of Lot 5, Concession 13, Marsville, ON

SUPERVISOR: BI

V.A. WOOD (GUELPH) INC.
CONSULTING GEOTECHNICAL ENGINEERS405 YORK ROAD, GUELPH, ONTARIO N1E 3H3
PH. (519) 763-3101 FAX (519) 763-5912

SUBSURFACE PROFILE					SAMPLE			PENETRATION RESISTANCE	WATER CONTENT %	UNIT WEIGHT
DEPTH (m)	DESCRIPTION	ELEVATION	SYMBOL	MONITORING WELL	NUMBER	TYPE	N-VALUE			
0.0	Ground Surface	489.5						20 40 60 80	5 10 15 20 25	
0.8	800mm Topsoil	488.7								
1.5	brown, loose SILT AND SAND some orgaincs, trace gravel, moist	488.0			1	SS	5			
2.5	brown, compact SILT AND SAND trace gravel, moist	487.0			2	SS	17			
	brown to grey, loose to compact SANDY CLAYEY SILT TILL moist to wet				3	SS	20			
					4	SS	18			
					5	SS	18			
					6	SS	18			
					7	SS	17			
					8	SS	9			
11.1	End of Borehole	478.4			9	SS	12			

DRILLED BY: LST

HOLE DIAMETER: 210mm

DRILL METHOD: Hollow-Stem Auger

DATUM: Geodetic

DRILL DATE: January 7, 2020

SHEET: 1 of 1

REFERENCE No: G4216-20-1

BOREHOLE No: 11

CLIENT: Thomasfield Homes Ltd.

V.A. WOOD (GUELPH) INC.
CONSULTING GEOTECHNICAL ENGINEERS

PROJECT: Blackwell Subdivision

ENCLOSURE No: 12

405 YORK ROAD, GUELPH, ONTARIO N1E 3H3
PH. (519) 763-3101 FAX (519) 763-5912

LOCATION: Part of Lot 4, Concession 13

SUPERVISOR: BI

SUBSURFACE PROFILE					SAMPLE			PENETRATION RESISTANCE BLOWS/0.3m				WATER CONTENT %					UNIT WEIGHT
DEPTH (m)	DESCRIPTION	ELEVATION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' BLOWS/0.3m										
0.0	Ground Surface	491.1															
0.5	450mm Topsoil	490.7															
1.5	brown, loose SILT AND SAND some organics, trace gravel, moist	489.6			1	SS	10										
					2	SS	6										
					3	SS	25										
					4	SS	27										
4.6	brown, loose to compact SILT AND SAND some clay, trace gravel, wet	486.5															
					5	SS	17										
6.6	grey, compact SANDY CLAYEY SILT TILL wet	484.5			6	SS	16										
	End of Borehole																

DRILLED BY: LST

HOLE DIAMETER: 210mm

DRILL METHOD: Hollow-Stem Auger

DATUM: Geodetic

DRILL DATE: January 7, 2020

SHEET: 1 of 1

REFERENCE No: G4216-20-1

BOREHOLE No: 12

CLIENT: Thomasfield Homes Ltd.

V.A. WOOD (GUELPH) INC.
CONSULTING GEOTECHNICAL ENGINEERS

PROJECT: Blackwell Subdivision

ENCLOSURE No: 13

405 YORK ROAD, GUELPH, ONTARIO N1E 3H3
PH. (519) 763-3101 FAX (519) 763-5912

LOCATION: Part of Lot 4, Concession 13

SUPERVISOR: BI

SUBSURFACE PROFILE					SAMPLE			PENETRATION RESISTANCE BLOWS/0.3m				WATER CONTENT %					UNIT WEIGHT
DEPTH (m)	DESCRIPTION	ELEVATION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' BLOWS/0.3m										
0.0	Ground Surface	492.4															
0.3	300mm Topsoil	492.1															
	brown, loose SILT AND SAND some clay, trace gravel wet																
					1	SS	4										
					2	SS	4										
					3	SS	7										
					4	SS	6										
4.6		487.8															
	brown, compact SILT AND SAND TILL some clay, wet				5	SS	18										
6.6		485.8			6	SS	15										
	End of Borehole																

DRILLED BY: LST

HOLE DIAMETER: 210mm

DRILL METHOD: Hollow-Stem Auger

DATUM: Geodetic

DRILL DATE: January 7/8, 2020

SHEET: 1 of 1

REFERENCE No: G4216-20-1

MONITORING WELL No: 13

CLIENT: Thomasfield Homes Ltd

PROJECT: Blackwell Subdivision

ENCLOSURE No: 14

LOCATION: Part of Lot 5, Concession 13, Marsville, ON

SUPERVISOR: BI

V.A. WOOD (GUELPH) INC.
CONSULTING GEOTECHNICAL ENGINEERS405 YORK ROAD, GUELPH, ONTARIO N1E 3H3
PH. (519) 763-3101 FAX (519) 763-5912

SUBSURFACE PROFILE					SAMPLE			PENETRATION RESISTANCE	WATER CONTENT %	UNIT WEIGHT
DEPTH (m)	DESCRIPTION	ELEVATION	SYMBOL	MONITORING WELL	NUMBER	TYPE	N-VALUE			
0.0	Ground Surface	488.2		<p>Protective Well Casing</p> <p>51mm OD Riser Pipe</p> <p>W.L. @ EL. 487.4m ± (22-JAN-20)</p> <p>Bentonite</p> <p>Filter Sand</p> <p>51mm OD Screen</p>						
0.4	400mm Topsoil	487.8								
1.5	brown, loose SILT AND SAND some organics, trace gravel, moist	486.7			1	SS	6			
					2	SS	11			
					3	SS	25			
					4	SS	43			
4.6	brown, compact to dense SILT AND SAND some clay, trace gravel wet	483.6			5	SS	32			
					6	SS	37			
6.6	grey, dense SANDY CLAYEY SILT TILL moist	481.6								
	End of Borehole									

DRILLED BY: LST

HOLE DIAMETER: 210mm

DRILL METHOD: Hollow-Stem Auger

DATUM: Geodetic

DRILL DATE: January 7, 2020

SHEET: 1 of 1

REFERENCE No: G4216-20-1

BOREHOLE No: 14

CLIENT: Thomasfield Homes Ltd.

V.A. WOOD (GUELPH) INC.
CONSULTING GEOTECHNICAL ENGINEERS

PROJECT: Blackwell Subdivision

ENCLOSURE No: 15

405 YORK ROAD, GUELPH, ONTARIO N1E 3H3
PH. (519) 763-3101 FAX (519) 763-5912

LOCATION: Part of Lot 4, Concession 13

SUPERVISOR: BI

SUBSURFACE PROFILE					SAMPLE			PENETRATION RESISTANCE BLOWS/0.3m				WATER CONTENT %					UNIT WEIGHT
DEPTH (m)	DESCRIPTION	ELEVATION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' BLOWS/0.3m										
0.0	Ground Surface	490.8															
0.5	450mm Topsoil	490.4															
	brown, loose to dense SILT AND SAND some clay, trace gravel, moist to wet			DRY (6-JAN-20)	1	SS	8										
					2	SS	11										
					3	SS	30										
					4	SS	18										
					5	SS	15										
6.1		484.7															
6.6	grey, very dense SANDY CLAYEY SILT TILL wet	484.2			6	SS	50				100mm						
	End of Borehole																

DRILLED BY: LST

HOLE DIAMETER: 210mm

DRILL METHOD: Hollow-Stem Auger

DATUM: Geodetic

DRILL DATE: January 6, 2020

SHEET: 1 of 1

REFERENCE No: G4216-20-1

MONITORING WELL No: 15

CLIENT: Thomasfield Homes Ltd

PROJECT: Blackwell Subdivision

ENCLOSURE No: 16

LOCATION: Part of Lot 5, Concession 13, Marsville, ON

SUPERVISOR: BI

V.A. WOOD (GUELPH) INC.
CONSULTING GEOTECHNICAL ENGINEERS405 YORK ROAD, GUELPH, ONTARIO N1E 3H3
PH. (519) 763-3101 FAX (519) 763-5912

SUBSURFACE PROFILE					SAMPLE			PENETRATION RESISTANCE	WATER CONTENT %	UNIT WEIGHT
DEPTH (m)	DESCRIPTION	ELEVATION	SYMBOL	MONITORING WELL	NUMBER	TYPE	N-VALUE			
0.0	Ground Surface	492.2		<p>Protective Well Casing</p> <p>51mm OD Riser Pipe</p> <p>Bentonite</p> <p>Filter Sand</p> <p>51mm OD Screen</p> <p>MONITORING WELL @ EL. 486.4m ± (22-JAN-20)</p>						
0.8	800mm Topsoil	491.4								
	brown, loose to dense SILT AND SAND some clay, trace gravel, moist to wet				1	SS	7			
					2	SS	6			
					3	SS	15			
					4	SS	30			
4.6		487.6								
	grey, very dense SANDY CLAYEY SILT TILL wet to saturated				5	SS	61			
6.1		486.1								
6.6	brown, dense SAND trace gravel, trace silt, saturated	485.6			6	SS	42			
	End of Borehole									

DRILLED BY: LST

HOLE DIAMETER: 210mm

DRILL METHOD: Hollow-Stem Auger

DATUM: Geodetic

DRILL DATE: January 6, 2020

SHEET: 1 of 1

REFERENCE No: G4216-20-1

BOREHOLE No: 16

CLIENT: Thomasfield Homes Ltd.

V.A. WOOD (GUELPH) INC.
CONSULTING GEOTECHNICAL ENGINEERS

PROJECT: Blackwell Subdivision

ENCLOSURE No: 17

405 YORK ROAD, GUELPH, ONTARIO N1E 3H3
PH. (519) 763-3101 FAX (519) 763-5912

LOCATION: Part of Lot 4, Concession 13

SUPERVISOR: BI

SUBSURFACE PROFILE					SAMPLE			PENETRATION RESISTANCE BLOWS/0.3m				WATER CONTENT %					UNIT WEIGHT
DEPTH (m)	DESCRIPTION	ELEVATION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' BLOWS/0.3m										
0.0	Ground Surface	492.8															
0.5	500mm Topsoil	492.3															
2.5	brown, loose SILT AND SAND some clay, trace gravel, moist to wet	490.3			1	SS	6										
					2	SS	7										
					3	SS	22										
					4	SS	18										
					5	SS	13										
6.6	grey, compact SANDY CLAYEY SILT TILL wet seam of silty sand saturated @ 6.1m	486.2		W.L. @ El.487.6m± (6-JAN-20)	6	SS	13										
	End of Borehole																

DRILLED BY: LST

HOLE DIAMETER: 210mm

DRILL METHOD: Hollow-Stem Auger

DATUM: Geodetic

DRILL DATE: January 6, 2020

SHEET: 1 of 1

REFERENCE No: G4216-20-1

MONITORING WELL No: 17

CLIENT: Thomasfield Homes Ltd

PROJECT: Blackwell Subdivision

ENCLOSURE No: 18

LOCATION: Part of Lot 5, Concession 13, Marsville, ON

SUPERVISOR: BI

V.A. WOOD (GUELPH) INC.
CONSULTING GEOTECHNICAL ENGINEERS405 YORK ROAD, GUELPH, ONTARIO N1E 3H3
PH. (519) 763-3101 FAX (519) 763-5912

SUBSURFACE PROFILE					SAMPLE			PENETRATION RESISTANCE	WATER CONTENT %	UNIT WEIGHT
DEPTH (m)	DESCRIPTION	ELEVATION	SYMBOL	MONITORING WELL	NUMBER	TYPE	N-VALUE			
0.0	Ground Surface	493.6		<p>Protective Well Casings</p> <p>Bentonite</p> <p>W.L. @ El. 492.1m± (22-JAN-20)</p> <p>Filter Sand</p> <p>Bentonite</p> <p>51mm OD Screen</p> <p>W.L. < El. 483.3m± (22-JAN-20)</p> <p>Filter Sand</p>						
0.8	800mm Topsoil	492.8			1	SS	5			
4.6	brown, loose to compact SILT AND SAND some clay, trace gravel, moist to saturated	489.0			2	SS	12			
					3	SS	19			
					4	SS	26			
					5	SS	7			
9.6	grey, loose to compact SANDY CLAYEY SILT TILL wet	484.0			6	SS	22			
					7	SS	21			
					8	SS	18			
11.1	brown, dense SAND trace silt, saturated	482.5			9	SS	41			
	End of Borehole									

DRILLED BY: LST

HOLE DIAMETER: 210mm

DRILL METHOD: Hollow-Stem Auger

DATUM: Geodetic

DRILL DATE: January 6, 2020

SHEET: 1 of 1

REFERENCE No: G4216-20-1

BOREHOLE No: 18

CLIENT: Thomasfield Homes Ltd.

V.A. WOOD (GUELPH) INC.
CONSULTING GEOTECHNICAL ENGINEERS

PROJECT: Blackwell Subdivision

ENCLOSURE No: 19

405 YORK ROAD, GUELPH, ONTARIO N1E 3H3
PH. (519) 763-3101 FAX (519) 763-5912

LOCATION: Part of Lot 4, Concession 13

SUPERVISOR: BI

SUBSURFACE PROFILE					SAMPLE			PENETRATION RESISTANCE BLOWS/0.3m				WATER CONTENT %					UNIT WEIGHT
DEPTH (m)	DESCRIPTION	ELEVATION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' BLOWS/0.3m										
0.0	Ground Surface	488.1															
0.3	300mm Topsoil	487.8															
	brown, loose to compact SILT AND SAND some clay, trace gravel, moist to wet				1	SS	12										
					2	SS	6										
					3	SS	8										
					4	SS	12										
					5	SS	8										
6.6	grey @ 6.0 m	481.5			6	SS	10										
	End of Borehole																

DRILLED BY: LST

HOLE DIAMETER: 210mm

DRILL METHOD: Hollow-Stem Auger

DATUM: Geodetic

DRILL DATE: January 9, 2020

SHEET: 1 of 1

REFERENCE No: G4216-20-1

MONITORING WELL No: 19

CLIENT: Thomasfield Homes Ltd

PROJECT: Blackwell Subdivision

ENCLOSURE No: 20

LOCATION: Part of Lot 5, Concession 13, Marsville, ON

SUPERVISOR: BI

V.A. WOOD (GUELPH) INC.
CONSULTING GEOTECHNICAL ENGINEERS405 YORK ROAD, GUELPH, ONTARIO N1E 3H3
PH. (519) 763-3101 FAX (519) 763-5912

SUBSURFACE PROFILE					SAMPLE			PENETRATION RESISTANCE				WATER CONTENT %					UNIT WEIGHT
DEPTH (m)	DESCRIPTION	ELEVATION	SYMBOL	MONITORING WELL	NUMBER	TYPE	N-VALUE										
0.0	Ground Surface	490.7															
0.8	800mm Topsoil	489.9															
1.5	brown, loose SILT AND SAND some organics, wet	489.2			1	SS	7										
					2	SS	8										
					3	SS	17										
					4	SS	23										
4.9	brown, loose to compact SILT AND SAND some clay, trace gravel, wet	485.8			5	SS	15										
					6	SS	15										
6.6	grey, compact SANDY CLAYEY SILT TILL wet	484.1															
	End of Borehole																

DRILLED BY: LST

HOLE DIAMETER: 210mm

DRILL METHOD: Hollow-Stem Auger

DATUM: Geodetic

DRILL DATE: January 8, 2020

SHEET: 1 of 1

August 7, 2024

Appendix B Hydrographs

Chart 1: MW01-S Hydrograph

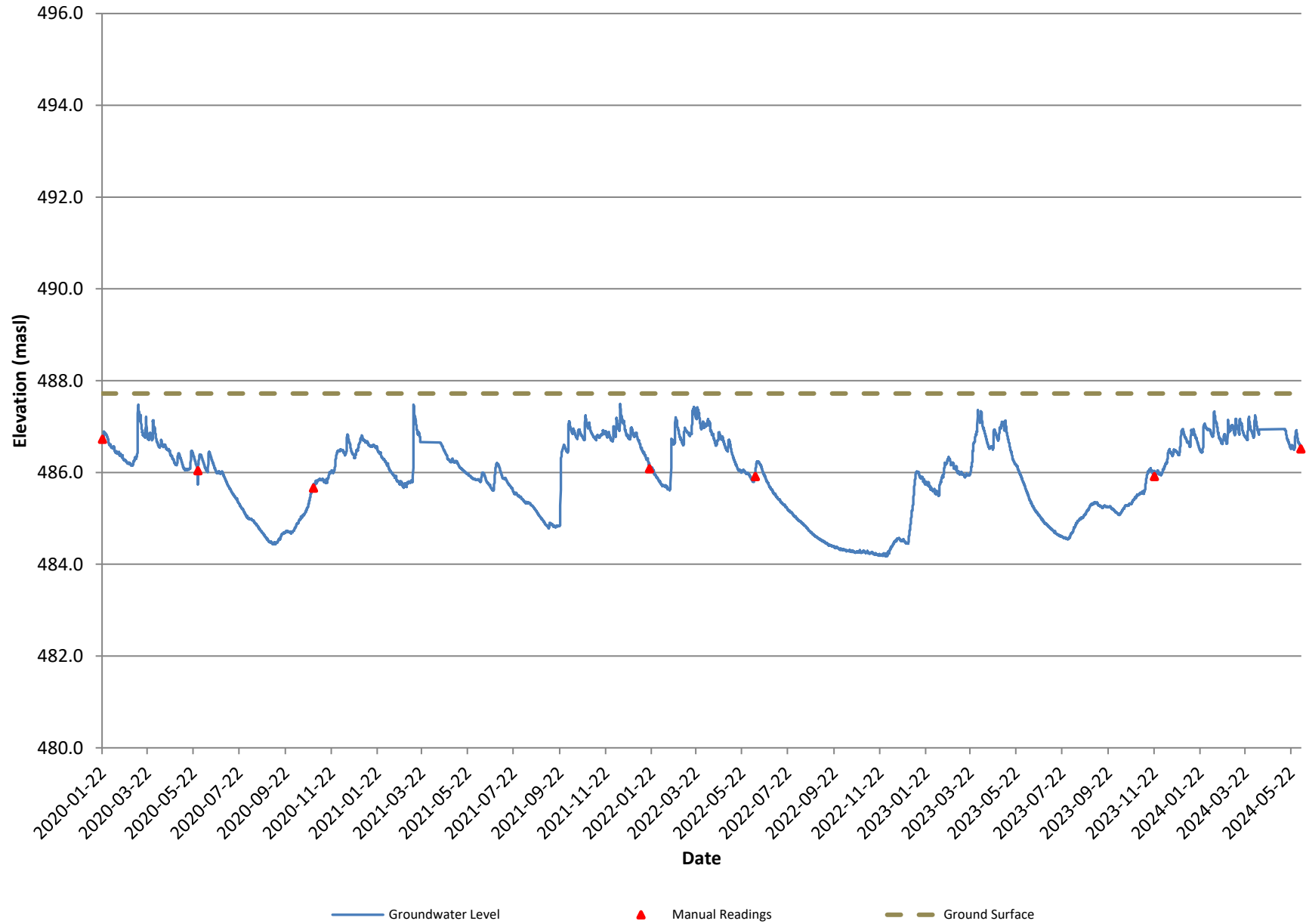


Chart 2: MW02 Hydrograph

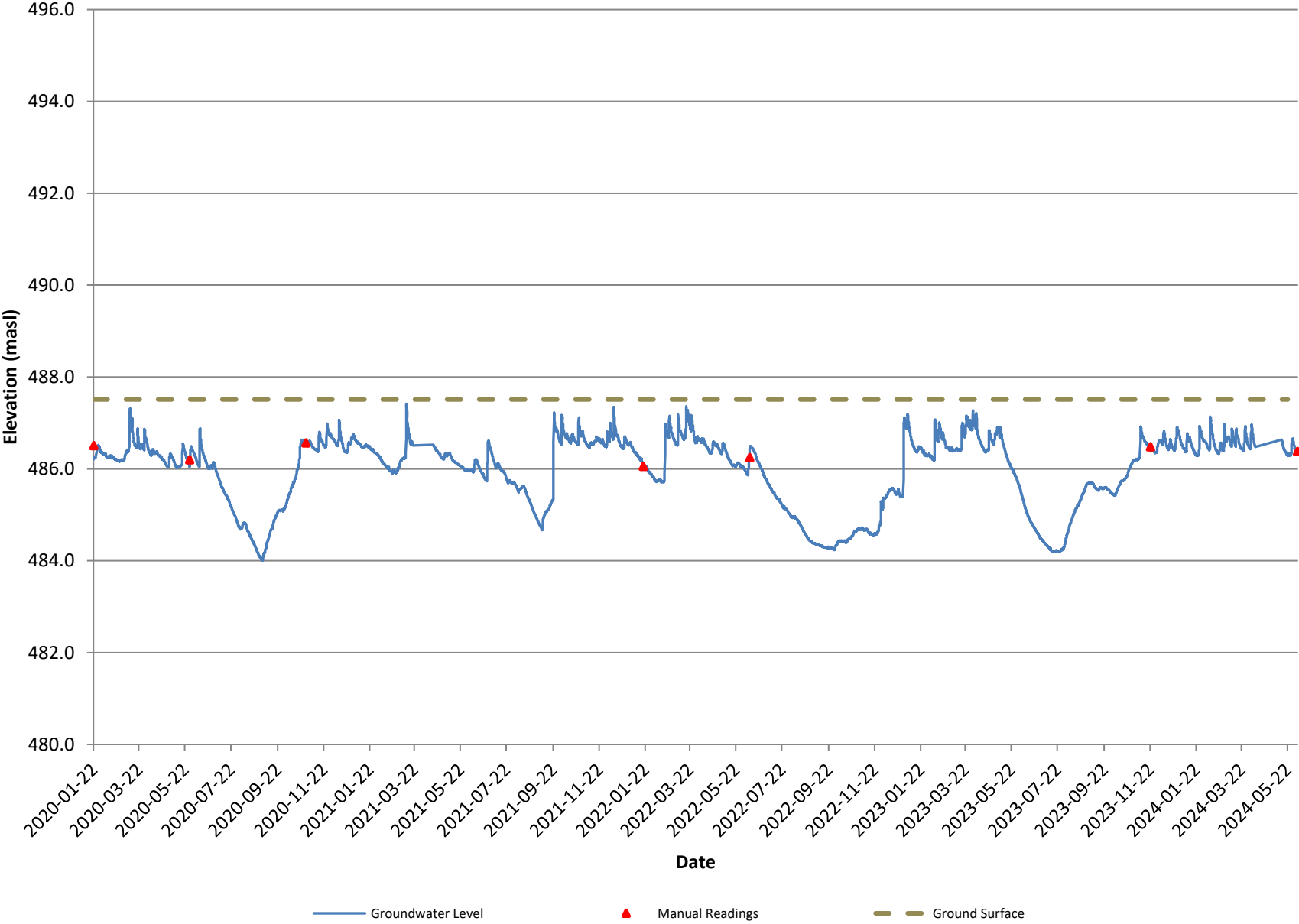


Chart 3: MW06 Hydrograph

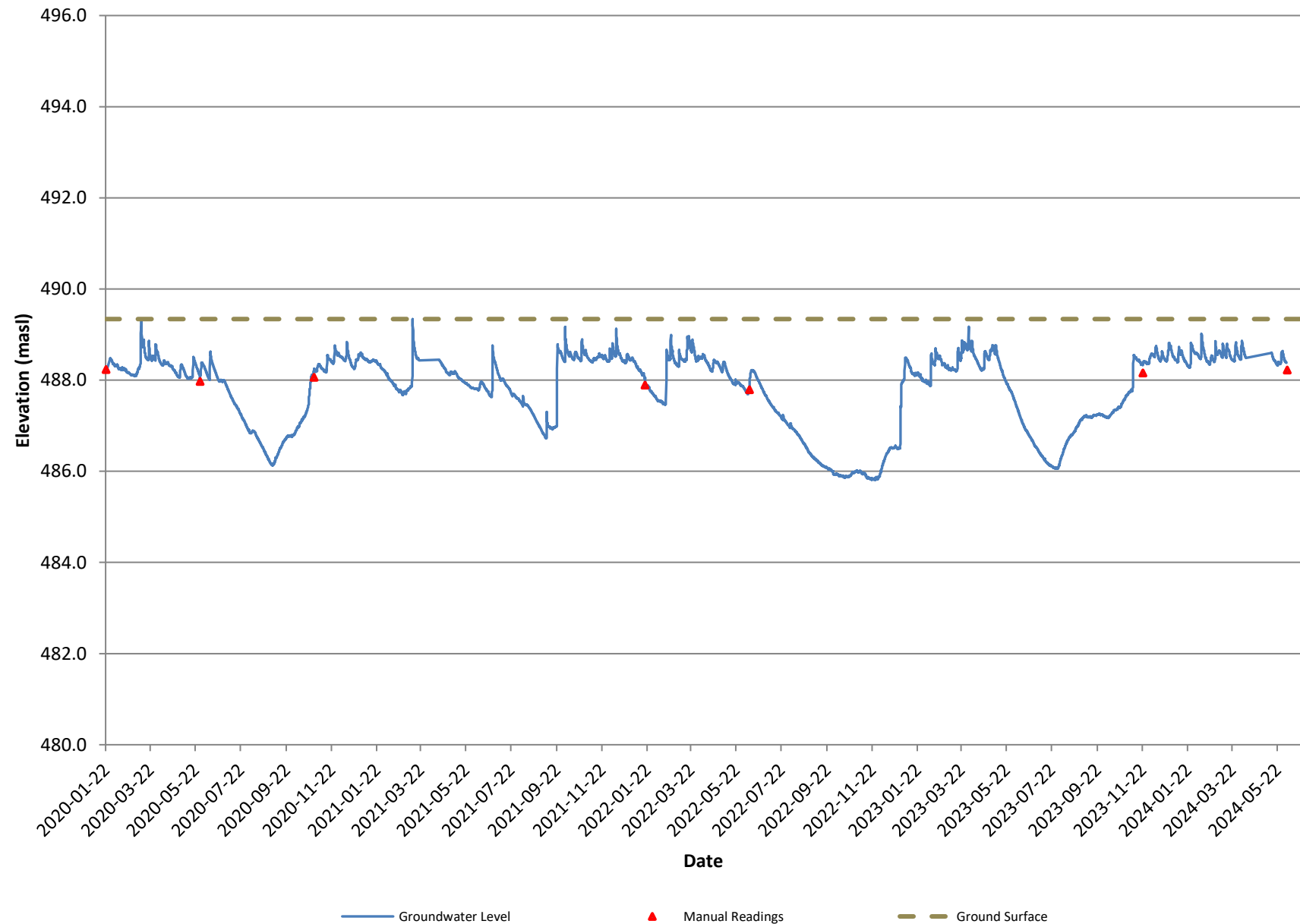


Chart 4: MW09 Hydrograph

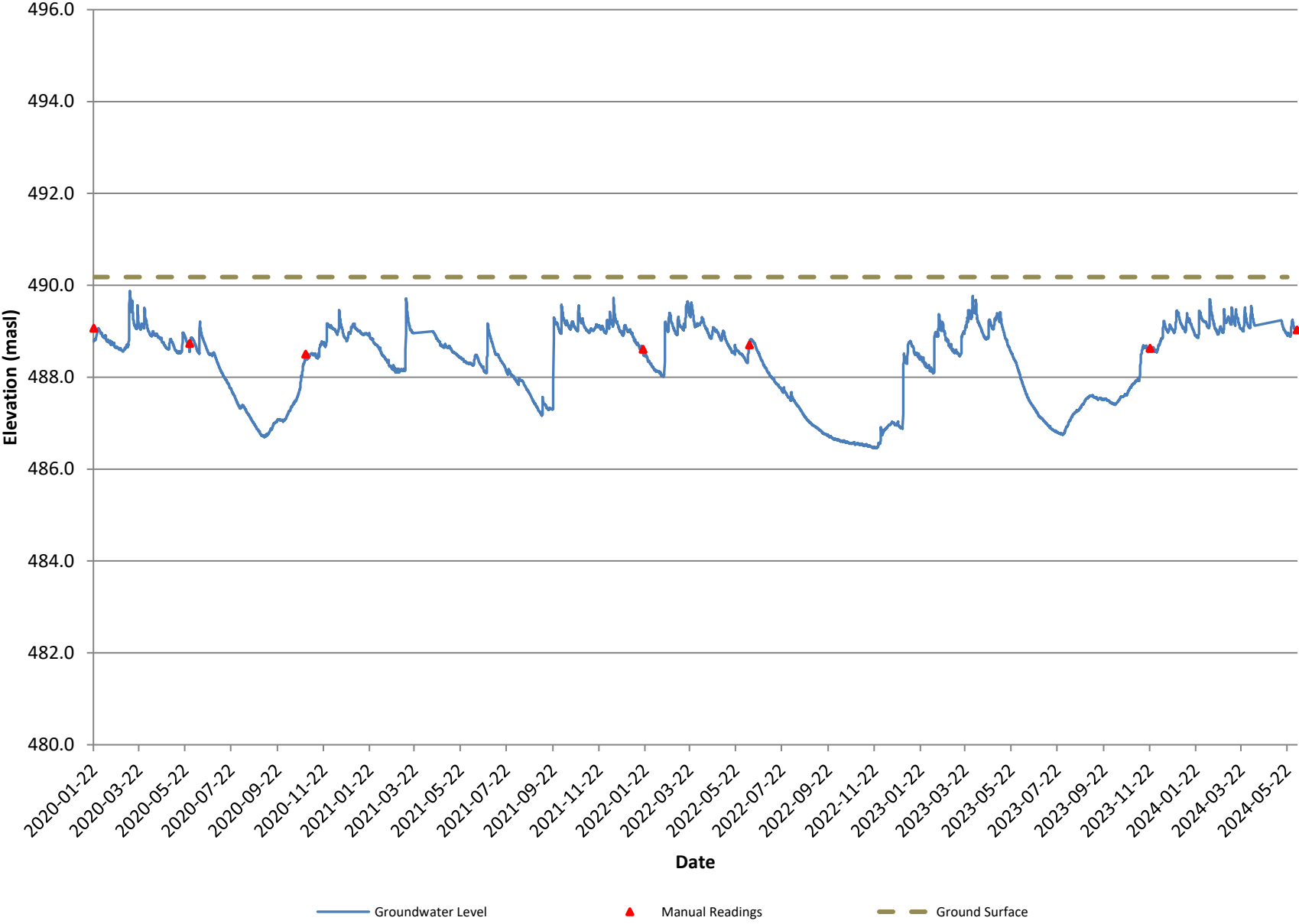


Chart 5: MW13 Hydrograph

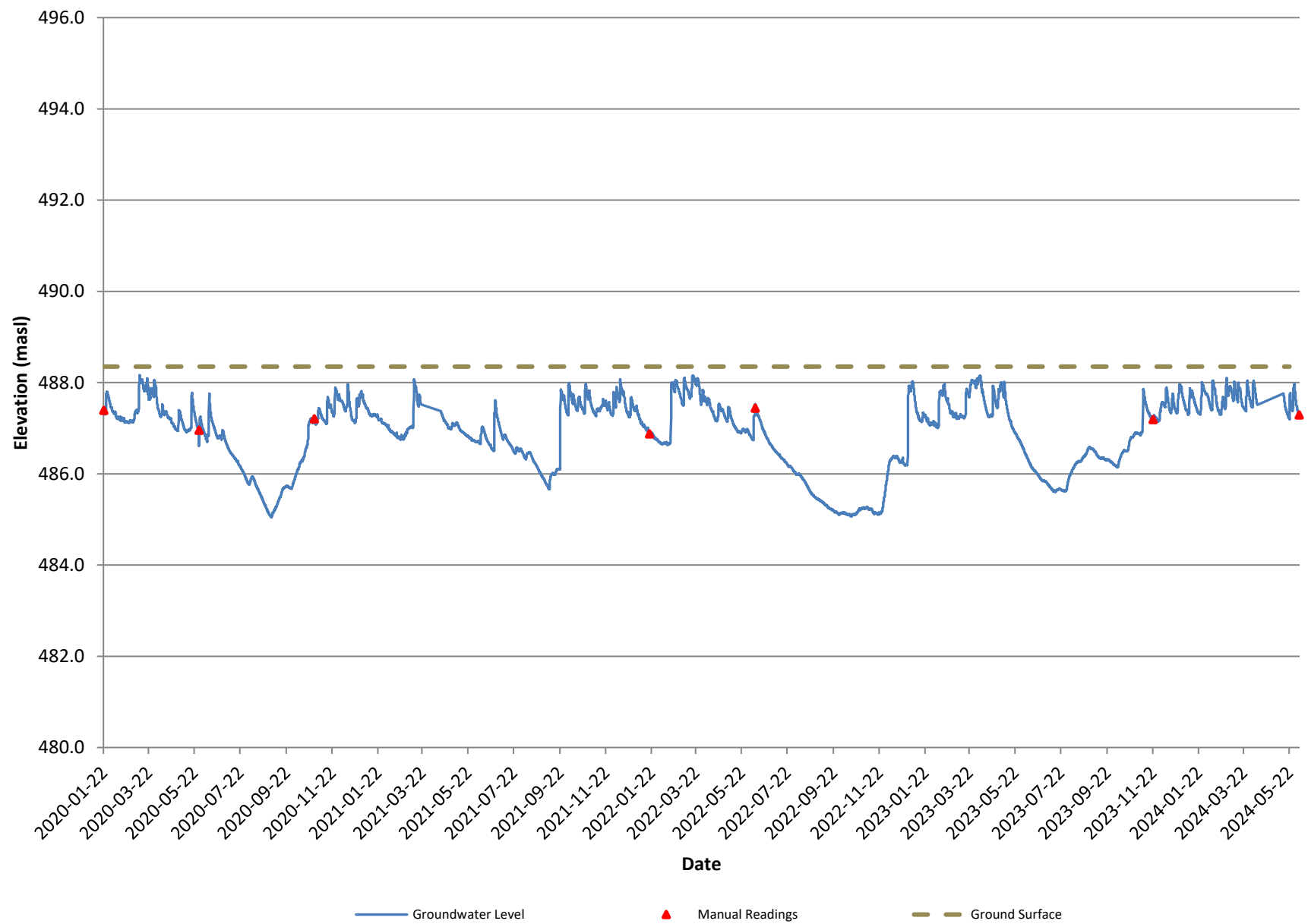


Chart 6: MW15 Hydrograph

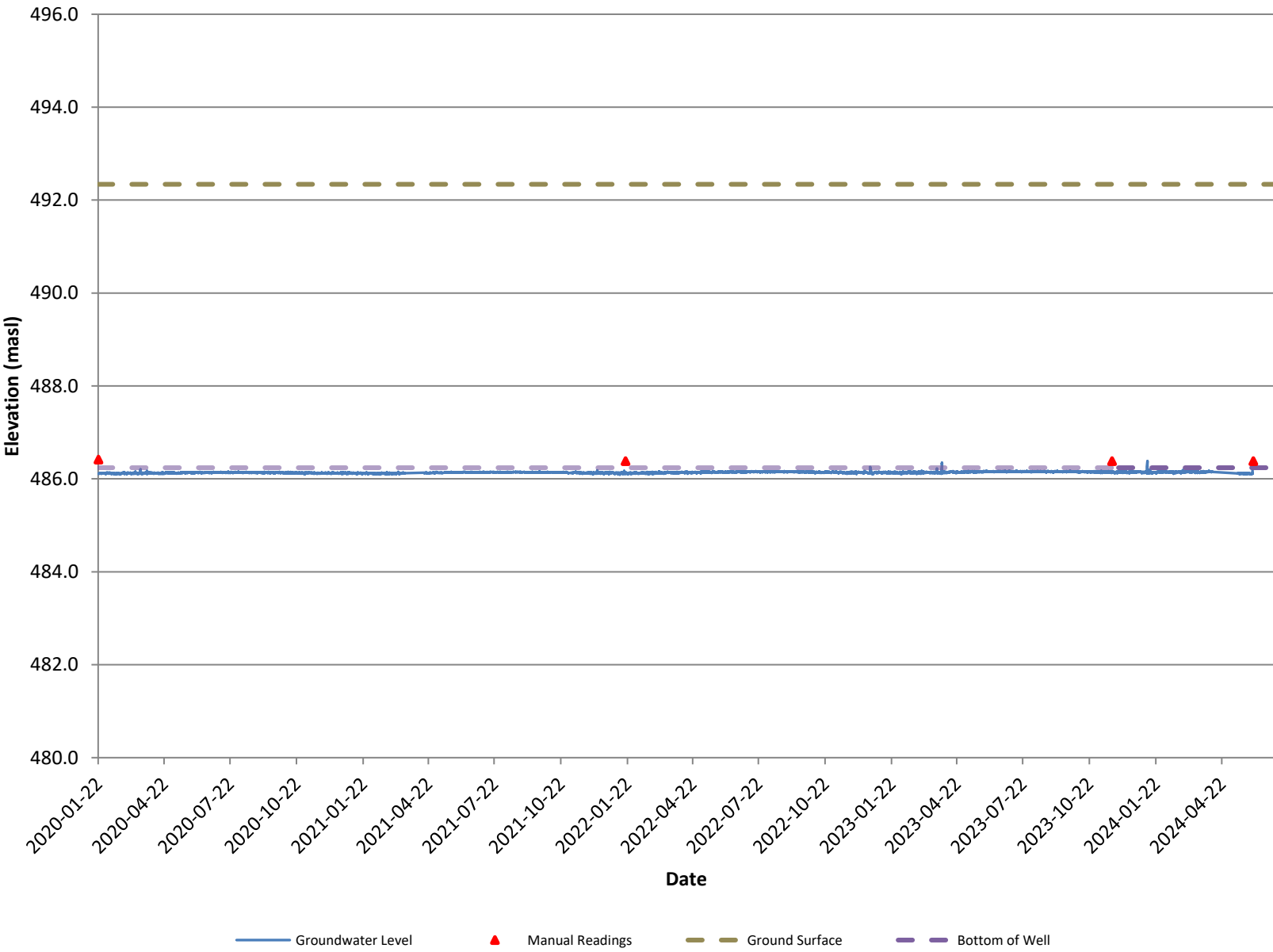


Chart 7: MW17-S Hydrograph

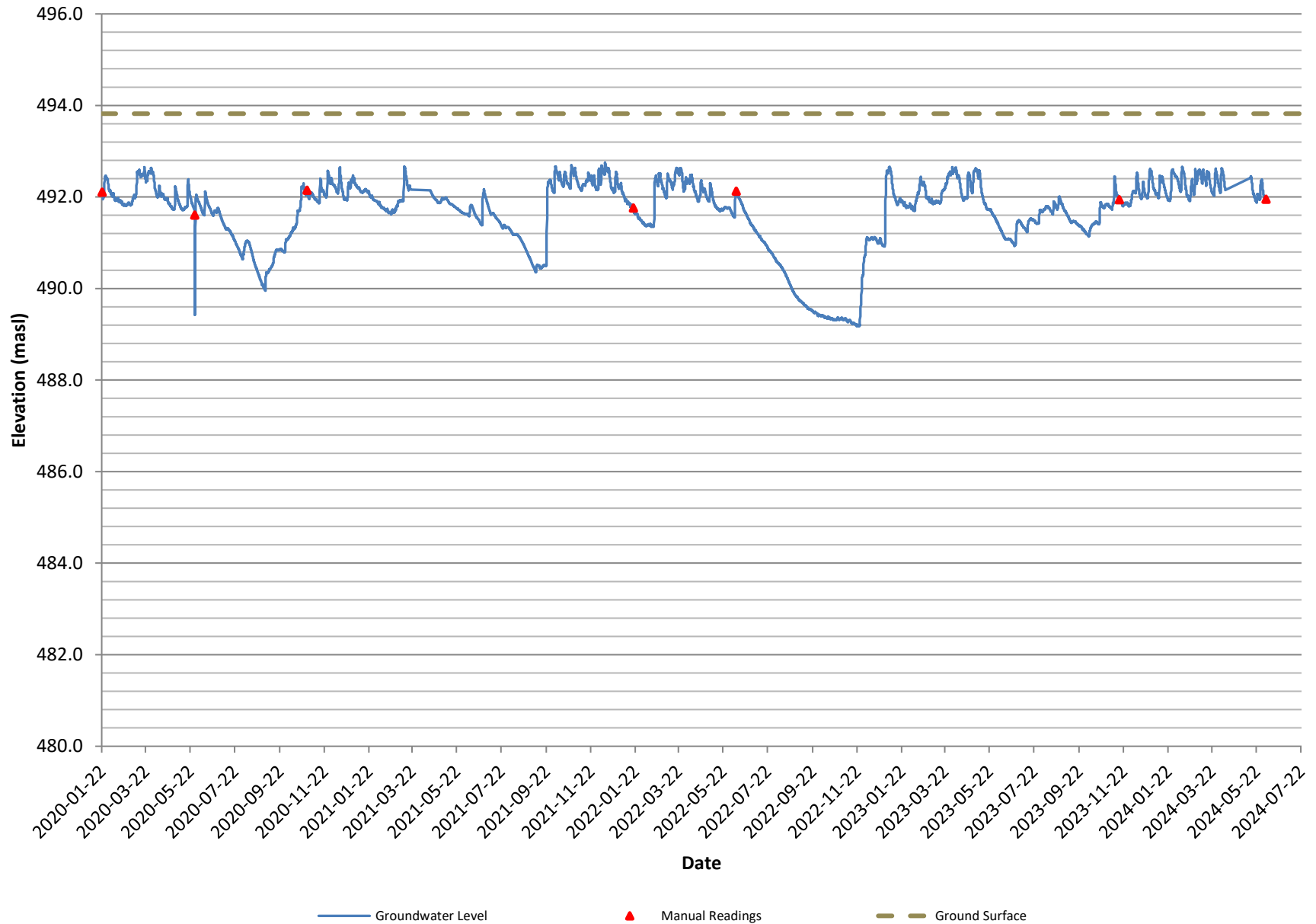
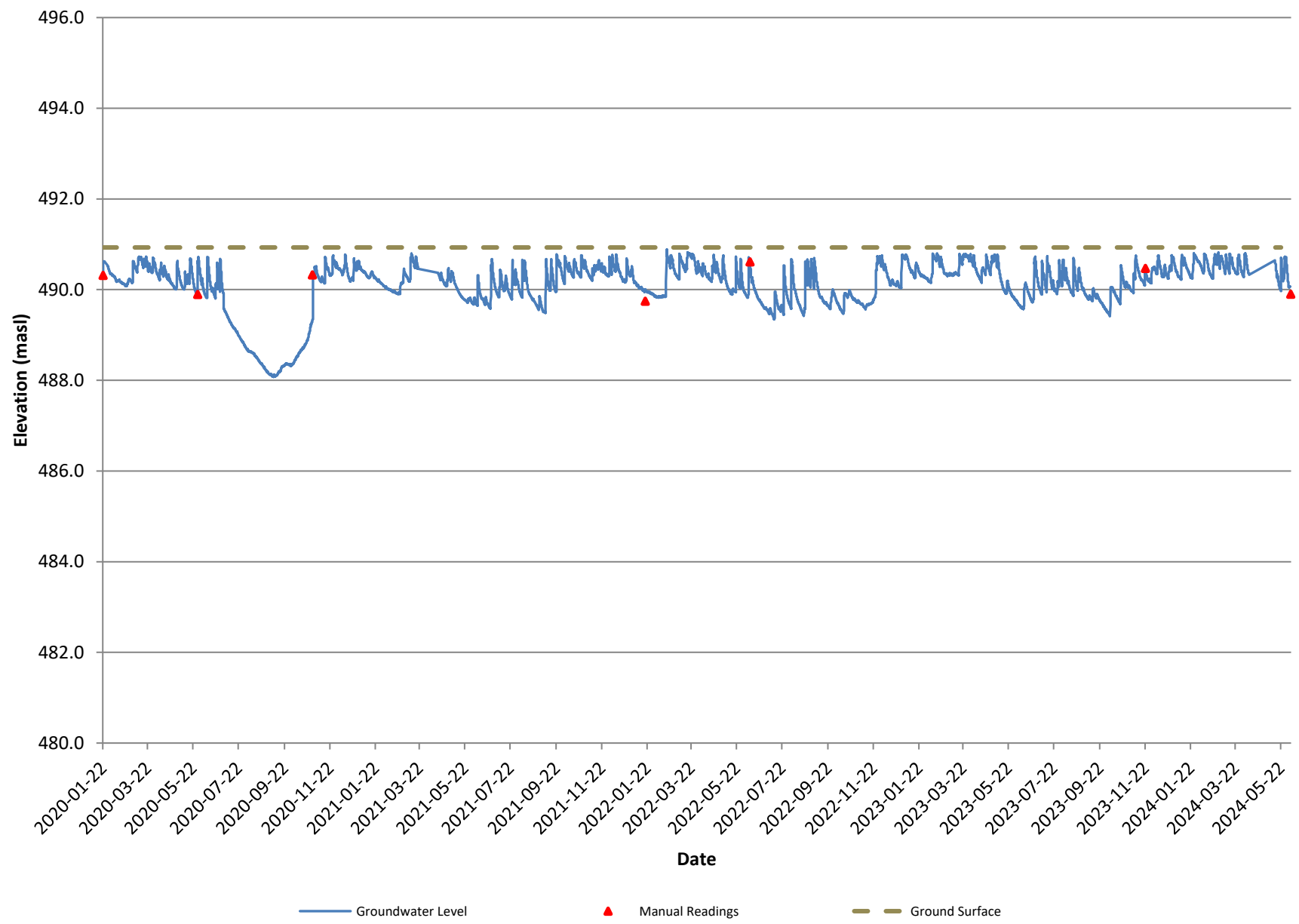
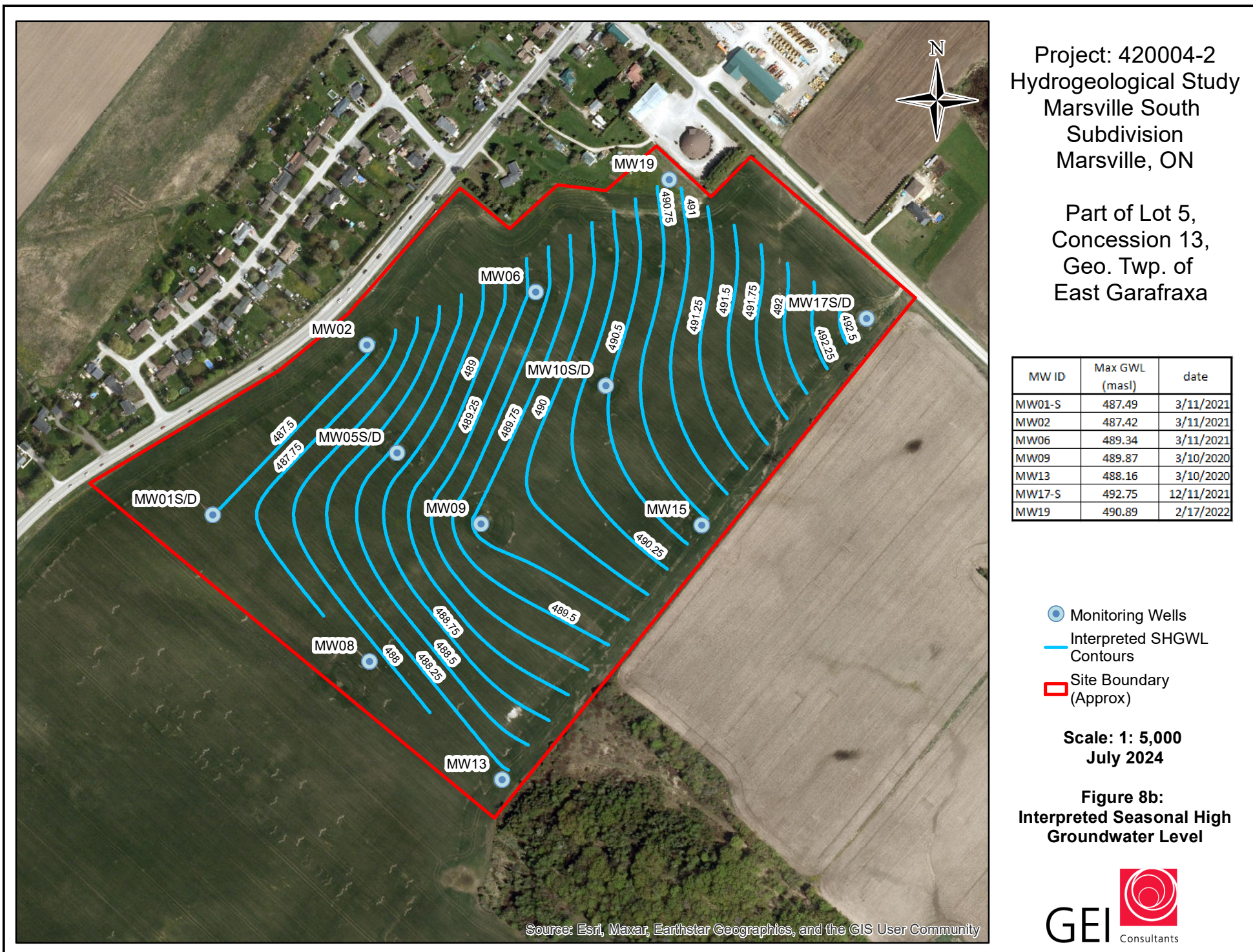


Chart 8: MW19 Hydrograph



August 7, 2024

Appendix C Interpreted Seasonal High Groundwater Level



August 7, 2024

Appendix D Nitrogen Attenuation Calculations

Appendix D: Estimates of Nitrogen Concentrations in Groundwater due to Sewage Usage

Site Details	Units	Test Site	Site (80)	Site (90)	Site (91)	
Total Area =	sq. m	103,000	281,030	281,030	281,030	From GIS
Impervious Area for each Lot =	sq. m / lot	875	875	875	875	Estimated assuming a 10 m by 25 m driveway and 25m by 25 m house
Impervious Area for Roads =	sq. m	5,525	44,400	44,400	44,400	Test Site: Estimated from GIS. Site: Estimated from Site Plan.
# Lots =	lot	40	80	90	91	From Parcel Map (GRCA GIS)
Gross Lot Density =	lots / ha	3.88	2.85	3.20	3.24	Calculated from Number of Lots and Total Area
Net Pervious Area of Developed Site =	sq. m	62,475	166,630	157,880	157,005	Calculated from lines above
Hydrologic Input: Estimated from GRCA Recharge						
Size of Area 1 =	sq. m	67,200	12,000	12,000	12,000	Estimated from GRCA GIS
Recharge over Area 1 =	mm/yr	27	295	295	295	Given on GRCA GIS
Size of Area 2 =	sq. m	7,970	25,000	25,000	25,000	Estimated from GRCA GIS
Recharge over Area 2 =	mm/yr	368	60	60	60	Given on GRCA GIS
Size of Area 3 =	sq. m	27,800	244,000	244,000	244,000	Estimated from GRCA GIS
Recharge over Area 3 =	mm/yr	295	27	27	27	Given on GRCA GIS
Weighted Recharge =	mm/yr	125.7	41.4	41.4	41.4	Calculated
Hydrologic Input by Recharge =	L/year	7,856,160	6,895,280	6,533,198	6,496,990	Calculated
Sewage Loading						
Effluent Per Unit (D-5-4) =	L/day	1,000	1,000	1,000	1,000	Maximum allowable by Procedure D-5-4
Nitrogen Per Unit Per Day (D-5-4) =	mg/lot/day	40,000	40,000	40,000	40,000	Equivalent of 40 g per lot per day set forth by Procedure D-5-4
Effluent Input =	L/year	14,600,000	29,200,000	32,850,000	33,215,000	Extended by number of lots and days in a year.
Nitrogen Loading =	mg/year	584,000,000	1,168,000,000	1,314,000,000	1,328,600,000	Extended by number of lots and days in a year.
Attenuation Calculations						
Predicted Nitrogen Concentration =	mg/L	26.01	32.36	33.36	33.46	
Actual Nitrogen Concentration (Approximate) =	mg/L	3.00	8.09	8.34	8.36	
Attenuation Rate =	%	88%	75%	75%	75%	