



Southern Links 1, Industrial Development Hydrogeological Effects Assessment

ASSESSMENT OF EFFECTS

WGA242463-RP-HG-0012_C

August 2026



Revision History

REV	DATE	ISSUE	ORIGINATOR	CHECKER	APPROVER
A	27/05/2026	Draft to Client	JM, JF	BS	CHO
B	19/06/2026	Draft	JF	BS	CHO
C	17/07/2026	Legal Review	JF	CHO	CHO

APPENDIX A

LITHOLOGICAL DATA AND GEOLOGICAL CROSS SECTIONS





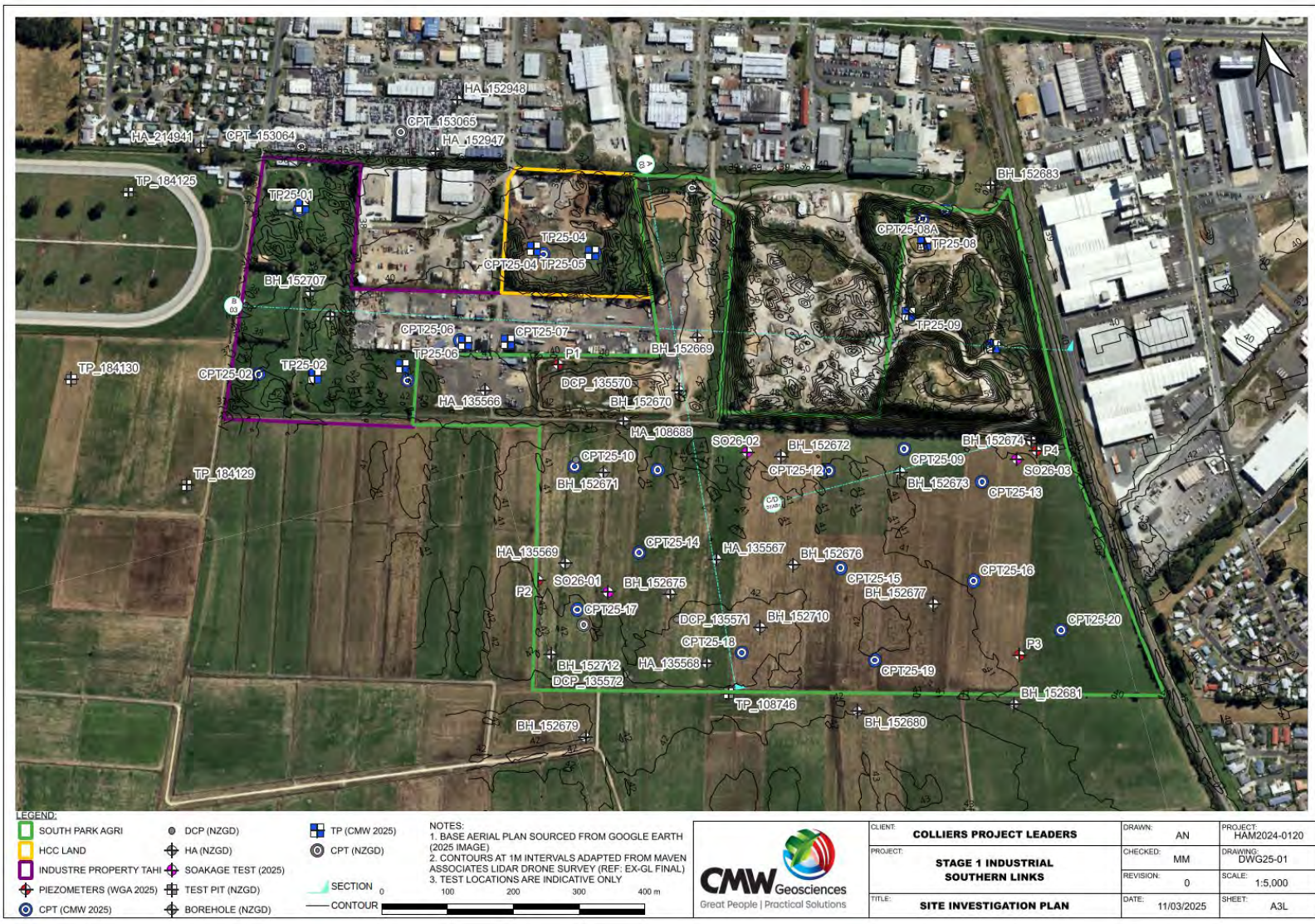
Figure A1: Piezometer P2

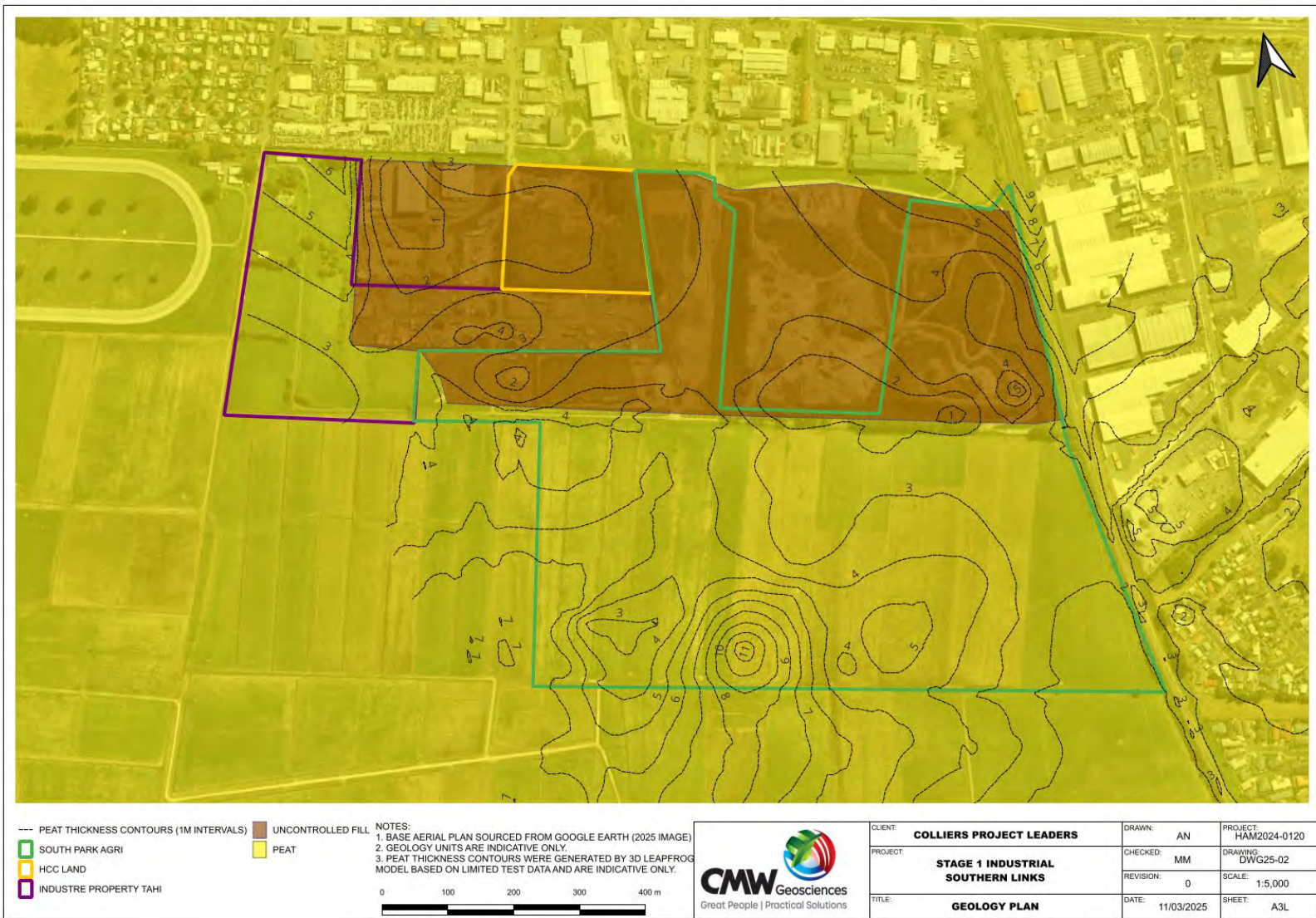
Table A1: Piezometer Construction Details

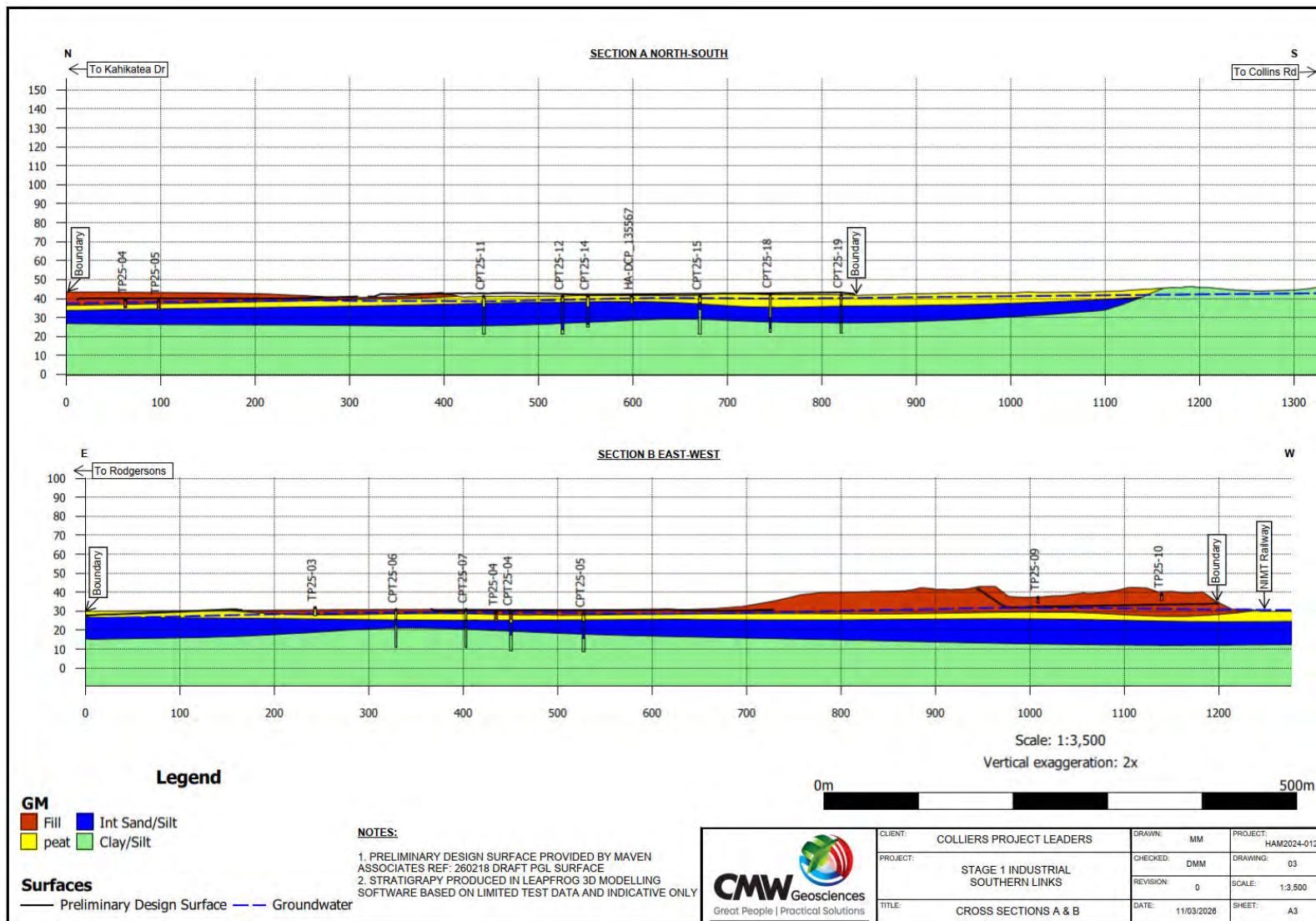
PIEZOMETER	DEPTH (m bgl)	CASING DIAMETER (mm)	SCREEN LENGTH (m)	EASTING (NZTM)	NORTHING (NZTM)
P1	5.2	40	1.5	1798702	5812897
P2	6	40	1.5	1798583	5812583
P3	5.8	40	1.5	1799257	5812282
P4	5.3	40	1.5	1799363	5812570

Table A2: Drill core sample photos, piezometer P1 and P4

Drill Core Photo	Comment
	Holocene Swamp Deposits in P1
	Holocene Swamp Deposits drilled through to Hinuera Formation in P4







BOREHOLE LOG - P1

Client: Colliers Project Leaders
Project: Southern Links - Industrial Block
Site Location: Wickham Street, Hamilton
Project No.: HAM2024-0120
Date: 19/12/2025
Borehole Location: Refer to Site Plan



Logged by: PM Checked by: MM Scale: 1:40 Sheet 1 of 1

Position: 443410.0mE; 696673.8mN Projection: Mount Eden 2000 Datum: Survey Source: Hand Held GPS

Well	Groundwater	Samples & Insitu Tests		RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/ Relative Density	Weathering						Recovery	RQD	Estimated Strength						Defect Spacing (mm)						Drilling Method/ Support	Structure & Other Observations Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks	
		Depth	Type & Results							RS	CW	HW	MW	SW	UW			EW	VW	W	MS	SS	VS	ES	<20	20-60	60-200	200-600	600-2000			>2000
							OL: Organic SILT: dark brown. No plasticity. (Topsoil) SW: Gravelly fine to coarse SAND: with some silt; brown mottled grey. Well graded, angular. (Uncontrolled Fill)		TP							67																
					1		Pt: PEAT: dark brown. Low plasticity, fibrous. Wood fragments. (Piako Subgroup) ... at 0.90m, Piece of cloth.																									
					2			M									100															
					3			F																								
					4		... from 3.90m to 4.20m, Brown fine to medium SAND lens									53																
					5		SW: Fine to coarse SAND: grey. Well graded, sub rounded. (Piako Subgroup) Pt: PEAT: dark brown. Low plasticity, fibrous. Poor recovery. (Piako Subgroup)	W	LP																							
					6			S	S							53																
					8		Borehole terminated at 6.00 m																									
					7																											
					8																											

Termination Reason: Target Depth Reached
Shear Vane No: DCP No:
Remarks: Piezometer installed with a screen depth between 3.7m and 5.2m.

BOREHOLE LOG - P2

Client: Colliers Project Leaders
Project: Southern Links - Industrial Block
Site Location: Wickham Street, Hamilton
Project No.: HAM2024-0120
Date: 18/12/2025
Borehole Location: Refer to Site Plan



Logged by: OP Checked by: MM Scale: 1:40 Sheet 1 of 1

Position: 443295.9mE; 696365.5mN Projection: Mount Eden 2000 Datum: Survey Source: Hand Held GPS

Well	Groundwater	Samples & Insitu Tests		RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/ Relative Density	Weathering					Recovery	RQD	Estimated Strength					Defect Spacing (mm)					Drilling Method/ Support	Structure & Other Observations Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
		Depth	Type & Results							RS	CW	HW	MW	SW			UW	EW	LV	W	MS	S	VS	ES	<20	20-60			60-200	200-600	600-2000	>2000																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
							OL: Organic SILT: black. Low plasticity (Topsoil) Pt: Amorphous PEAT: with trace wood fragments; black. Low plasticity. No recovery. (Peat)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													

Termination Reason: Target Depth Reached
Shear Vane No: DCP No:
Remarks: Piezometer installed with a screen depth between 4.5m and 6.0m.

BOREHOLE LOG - P3

Client: Colliers Project Leaders
Project: Southern Links - Industrial Block
Site Location: Wickham Street, Hamilton
Project No.: HAM2024-0120
Date: 19/12/2025
Borehole Location: Refer to Site Plan



Logged by: PM Checked by: MM Scale: 1:40 Sheet 1 of 1

Position: 443973.3mE; 696066.3mN Projection: Mount Eden 2000 Datum: Survey Source: Hand Held GPS

Well	Groundwater	Samples & Insitu Tests		RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/Relative Density	Weathering						Recovery	RQD	Estimated Strength						Defect Spacing (mm)				Drilling Method/Support	Structure & Other Observations Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks
		Depth	Type & Results							RS	CW	HW	MW	SW	UW			SW	W	MS	S	VS	ES	<20	20-60	60-200	200-600	600-2000	>2000
					1		OL: Organic SILT. : Dark brown. No plasticity. (Topsoil) PT: PEAT: black. Low plasticity. No recovery. (Peat)		S																				
					2		SM: Silty fine to medium SAND: grey. Well graded, sub rounded. Very poor retrieval. (Piako Subgroup)		LP							17													
					3			W																					WS
					4		ML: SILT: with some organics; dark greyish brown streaked black. Low plasticity. Organics: amorphous. (Piako Subgroup)		F							100													
					5		SW: Fine to coarse SAND: greyish brown. Well graded, sub rounded. (Hinuera Formation) ... at 4.50m, Becoming grey		TP																				
					6		ML: SILT: grey. Low plasticity. Dilatant. (Hinuera Formation) ... from 3.70m to 3.80m, Becoming brown		F							100													
					6		Borehole terminated at 6.00 m																						
					7																								
					8																								

Termination Reason: Target Depth Reached
Shear Vane No: DCP No:
Remarks: Piezometer installed with a screen depth between 4.3m and 5.8m.

BOREHOLE LOG - P4

Client: Colliers Project Leaders
Project: Southern Links - Industrial Block
Site Location: Wickham Street, Hamilton
Project No.: HAM2024-0120
Date: 18/12/2025
Borehole Location: Refer to Site Plan



Logged by: OP Checked by: MM Scale: 1:40 Sheet 1 of 1

Position: 444078.5mE; 696359.5mN Projection: Mount Eden 2000 Datum: Survey Source: Handheld GPS

Well	Groundwater	Samples & Insitu Tests		RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/Relative Density	Weathering					Recovery	RQD	Estimated Strength					Defect Spacing (mm)					Drilling Method/Support	Structure & Other Observations Discontinuities: Depth; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks	
		Depth	Type & Results							RS	CW	HW	MW	SW			UW	EW	VW	W	MS	S	VS	ES	<20	20-60			60-200
18-12-2025					0		OL: Organic SILT: dark greyish brown. No plasticity. (Topsoil)	D																					
					1		Pt: Amorphous PEAT: with trace wood fibres; black. Low plasticity. (Peat)	M to W									40												
					2		CL: Silty CLAY: dark yellowish brown. Low plasticity. (Hinuera Formation)										77												
					3		ML: Sandy SILT: light brownish grey. Low plasticity. Sand, fine. (Hinuera Formation)																						
					3		SM: Silty Fine SAND: brownish grey. Uniformly graded. (Hinuera Formation)																						
					4		ML: Clayey SILT: brownish grey. Low plasticity. (Hinuera Formation)																						
					4		... at 3.75m, with some organic silt.																						
					5		SW: Fine to coarse SAND: with minor fine subrounded gravel; grey. Well graded. (Hinuera Formation)	S																					
					6		ML: Clayey SILT: brownish grey. Low plasticity. (Hinuera Formation)																						
					8		... from 6.11m to 6.15m, with some organic silt. Borehole terminated at 6.00 m																						

Termination Reason: Target Depth Reached.
Shear Vane No: DCP No:
Remarks: Piezometer installed with a screen depth between 3.8m 5.3m.

DAILY DRILLING REPORT

Phone: 07 849 2919 | Freephone 0800 533 330



DATE	18/12/25	DRILLING METHOD	Peizo's
CLIENT	NGA	BORE DIAMETER	
STREET/LOCATION	Nickern Street	DRILLING FROM	
TOWN/CITY	Hamilton	CASING FROM	
BORE #	P1/P2/P3/P4	S.W.L. (m)	
CONSENT AUTH #		BORE ID #	
LOCATION CO-ORDINATES			

METHOD	FROM	TO	RUN	RECOVERY
	P1 (40mm)	S.W.L = 2.01m		Bentonite 0.30 - 3.00m Sand = 3.00 - 3.20m K2 = 3.20 - 5.20m Blank 0.00 - 3.70m Screen = 3.70 - 5.20m
	P3 (40mm)	S.W.L = 4.41m		Bentonite = 0.30 - 3.80m Sand = 3.80 - 4.00m K2 = 4.00 - 5.80m Blank = 0.00 - 4.30m Screen = 4.30 - 5.80m
	P2 (40mm)	S.W.L = 5.40m		Bentonite = 0.30 - 4.00m Sand = 4.00 - 4.20m K2 = 4.20 - 6m Blank = 0.00 - 4.50m Screen = 4.50 - 6m
	P4 (40mm)	S.W.L = 3.10m		Bentonite = 0.30 - 3.20m Sand = 3.20 - 3.40m K2 = 3.40 - 5.30m Blank = 0.00 - 3.80m Screen = 3.80 - 5.30m

COMMENTS AND MATERIALS

<u>DRILLER</u>	<u>KILOMETRES</u>	<u>TIME</u>	<u>WORK HRS</u>	<u>TOTAL HRS</u>
Drilling Rig <u>05</u>	Drill Rig _____	Rig Working _____	Start _____	
Driller _____	Heavy Tender _____	Stand-by _____	Finish _____	
Assistant _____	Light Tender _____	Compressor _____	Total _____	
Assistant _____	Transporter _____	Travel _____		
Other _____	Utility _____	After Hours _____		
Clients Rep _____	Other _____	Other _____	Motel _____	

APPENDIX B GROUNDWATER LEVEL DATA



Table B1: Groundwater Levels Intersected in CMW CPT Holes (CM 2026)

TEST LOCATION	EASTING (MT EDEN 2000)	NORTHING (MT EDEN 2000)	ELEVATION	MAXIMUM INVESTIGATION DEPTH (m)	DEPTH TO GROUNDWATER (m bgl)	DATE
CPT25-01	443091.7	697003.31	37.32	20	2.4	17/11/2025
CPT25-02	442965.96	696777.93	40.47	20	2.9	17/11/2025
CPT25-03	443182.24	696710.01	41.95	20	0.1	17/11/2025
CPT25-04	443431.76	696841.73	39.27	20	Collapsed dry @ 1.0 m	17/11/2025
CPT25-05	443507.07	696825.15	38.50	20	Collapsed dry @ 1.8 m	17/11/2025
CPT25-06	443275.51	696748.77	40.73	20	Hole positioned in puddle	17/11/2025
CPT25-07	443345.94	696726.1	40.80	20	Hole positioned in puddle	17/11/2025
CPT25-08	444038.53	696748.18	42.60	0.1	Collapsed dry @ 0.1 m	24/11/2025
CPT25-09	443884.84	696414.28	40.81	20.2	3.4	24/11/2025
CPT25-10	443393.87	696518.01	41.45	1.7	1.0	18/11/2025
CPT25-11	443514.59	696480.29	41.14	20	1.7	18/11/2025
CPT25-12	443765.88	696412.03	41.12	20	2.5	18/11/2025
CPT25-13	443986.33	696335.19	40.37	20	2.4	18/11/2025
CPT25-14	443454.74	696366.15	41.28	16.3	0.8	18/11/2025
CPT25-15	443744.66	696264.63	41.25	20	3.0	18/11/2025
CPT25-16	443935.01	696193.22	40.87	20	1.7	18/11/2025
CPT25-17	443341.86	696307.02	42.15	20	1.8	18/11/2025
CPT25-18	443566.27	696179.26	42.18	20	2.0	18/11/2025
CPT25-19	443758.47	696115.89	41.88	20	1.5	18/11/2025
CPT25-20	444044.04	696086.28	40.41	20	0.7	18/11/2025

Notes: 1) Coordinates in Mt Eden Metric 2000 projection.

Table B2: Groundwater Levels Intersected in CMW Test Pits (CM 2026)

TEST LOCATION	EASTING (MT EDEN 2000)	NORTHING (MT EDEN 2000)	ELEVATION (M RL)	MAXIMUM INVESTIGATION DEPTH (m)	DEPTH TO GROUNDWATER (m bgl)	DATE
TP25-01	443096.23	697007.54	37.23	4.2	1.3	14/11/2025
TP25-02	443047.66	696752.84	41.39	4.3	Not encountered (1.0 on graphic log)	14/11/2025
TP25-03	443180.76	696732.39	41.81	4.4	1.0	14/11/2025
TP25-04	443419.47	696854.37	39.25	4.2	4.1	17/11/2025
TP25-05	443503.4	696824.77	38.62	4.2	2.0	17/11/2025
TP25-06	443281.9	696743.15	40.77	0.8	Not encountered	14/11/2025
TP25-07	443345.12	696727.76	40.80	1.0	0.6	14/11/2025
TP25-08	443994.97	696707.38	45.69	2.5	Not encountered	14/11/2025
TP25-09	443944.39	696610.75	47.19	3.2	Not encountered	14/11/2025
TP25-10	444056.37	696529.25	48.79	3.1	Not encountered	14/11/2025

Notes:

- (1) Data sourced from CMW test pit logs
- (2) Coordinates in Mt Eden Metric 2000 projection.

Table B3: Manual Groundwater Level Measurements from WGA Piezometers

PIEZOMETER ID	EASTING (NZTM)	NORTHING (NZTM)	ELEVATION (M RL)	DEPTH (m bgl)	SCREEN LENGTH (m)	GROUNDWATER DEPTH (m bgl)	GROUNDWATER ELEVATION (m RL)	MEASUREMENT DATE
P1	1798702	5812897	40.88	5.37	1.5	1.89	38.45	28/1/2026
						1.94	38.4	1/02/2026
						1.74	38.6	5/02/2026
						1.895	38.445	23/2/2026
P2	1798583	5812583	41.63	6.06	1.5	4.59	37.12	28/1/2026
						4.59	37.12	3/02/2026
						4.718	36.992	23/02/2026
P3	1799257	5812282	40.57	5.93	1.5	4.86	35.01	28/1/2026
						4.74	35.22	31/01/2026
						4.89	35.07	21/02/2026
						4.86	35.10	23/2/2026
P4	1799363	5812570	39.90	5.49	1.5	4.30	36.36	28/1/2026
						4.28	36.38	31/01/2026
						4.41	36.25	23/02/2026

Table B4: Nearby Bores within 1km of Proposed Site Activities from the WRC Database (March 2026).

BORE ID	TYPE	STATUS	EASTING	NORTHING	EXTERNAL CASING DIAMETER (mm)	DRILLED DEPTH
62_162	Well/Bore	Existing	1799258	5813669	50	4.5
70_388	Well/Bore	Existing	1799262	5811368	100	26.8
72_73	Well/Bore	Existing	1799358	5813769		5
62_161	Well/Bore	Existing	1799258	5813669	50	4.5
62_163	Well/Bore	Existing	1799258	5813669	50	4.5
62_164	Well/Bore	Existing	1799258	5813669	50	4.5
70_506	Well/Bore	Existing	1799262	5811268	100	28
62_82	Well/Bore	Existing	1799258	5813669	100	4.5
62_83	Well/Bore	Existing	1799258	5813669	100	4.5
62_84	Well/Bore	Existing	1799258	5813669	100	4.5
62_85	Well/Bore	Existing	1799258	5813669	100	4.5
72_71	Well/Bore	Existing	1799358	5813769		6
72_72	Well/Bore	Existing	1799358	5813769		6
70_1198	Well/Bore	Existing	1798160	5812067	150	12
72_1346	Well/Bore	Existing	1799390	5812348	200	4
72_1347	Well/Bore	Existing	1798790	5812448	200	4
72_1348	Well/Bore	Existing	1798889	5812918	200	4
72_1349	Well/Bore	Existing	1798519	5812937	200	4
72_2039	Well/Bore	Existing	1798860	5812468	50	6
72_7946	Well/Bore	Existing	1798743	5813230	100	38
72_10623	Well/Bore	Existing	1799874	5813222	100	33.6
72_10331	Well/Bore	Existing	1799636	5813468	100	8
72_10332	Well/Bore	Existing	1799680	5813385	100	6
72_10272	Well/Bore	Existing	1798061	5814143	100	24.45
72_10333	Well/Bore	Existing	1799660	5813415	100	6
70_1042	Well/Bore	Existing	1799162	5811268		
72_7114	Well/Bore	Existing	1799046	5811792	100	14
72_11019	Well/Bore	Existing	1799848	5812721		
72_11020	Well/Bore	Existing	1799721	5812825		
72_11662	Piezometer	Existing	1800153	5811891	50	15
72_11665	Well/Bore	Existing	1800145	5811864	50	13.95
72_11989	Well/Bore	Existing	1800171	5811880		16
72_11990	Piezometer	Existing	1800155	5811876	50	4
72_11992	Piezometer	Existing	1799950	5811960	50	4
72_11661	Piezometer	Existing	1800223	5811911		10.95
72_11663	Well/Bore	Decommissioned	1799658	5812063	32	3.8
72_11664	Well/Bore	Decommissioned	1799950	5811960	32	3.9
72_11666	Well/Bore	Existing	1800155	5811876	32	4
72_11667	Well/Bore	Existing	1800128	5811858		2.7

BORE ID	TYPE	STATUS	EASTING	NORTHING	EXTERNAL CASING DIAMETER (mm)	DRILLED DEPTH
72_11668	Well/Bore	Decommissioned	1800155	5811876	32	4
72_11669	Well/Bore	(unknown)	1799659	5812056		
72_11670	Well/Bore	(unknown)	1799949	5811951		
72_12408	Well/Bore	Existing	1800157	5811887	101	15.9
72_12409	Well/Bore	Existing	1800130	5811869	101	15.9
72_12410	Well/Bore	Existing	1800120	5811884	200	19
72_12411	Well/Bore	Existing	1800123	5811905	200	20
72_12412	Well/Bore	Existing	1800146	5811903		20.7
72_12413	Well/Bore	Existing	1800146	5811858		18.5
72_12414	Well/Bore	Existing	1800167	5811875		20.1
72_12527	Well/Bore	Existing	1800153	5811891		4
72_12835	Well/Bore	Existing	1800172	5811878	200	18
72_12836	Well/Bore	Existing	1800168	5811886		18
72_12837	Well/Bore	Existing	1800114	5811922	150	18
72_12838	Well/Bore	Existing	1800133	5811916	150	17
72_12839	Well/Bore	Existing	1800152	5811913		18
72_12840	Well/Bore	Existing	1800167	5811904		18
72_12841	Well/Bore	Existing	1800182	5811902	150	18
72_12842	Well/Bore	Existing	1800136	5811864		16
72_12843	Well/Bore	Existing	1800136	5811906		16
72_12844	Well/Bore	Existing	1800162	5811877		16
72_12845	Well/Bore	Existing	1800165	5811859	32	14.5
72_12846	Well/Bore	Existing	1800168	5811901	32	15
72_12847	Well/Bore	Existing	1800101	5811877	32	15
72_12848	Well/Bore	Existing	1800130	5811915	32	15
72_13192	Well/Bore	Proposed				
72_13193	Well/Bore	Proposed				
72_13194	Well/Bore	Proposed				
72_13195	Well/Bore	Proposed				
72_13203	Well/Bore	Proposed				
72_13204	Well/Bore	Proposed				
72_13205	Well/Bore	Proposed				
72_13206	Well/Bore	Proposed				
72_13207	Well/Bore	Proposed				
72_13298	Well/Bore	Proposed				
72_13299	Well/Bore	Proposed				
72_13300	Well/Bore	Proposed				
72_13301	Well/Bore	Proposed				
72_13319	Well/Bore	Proposed				
72_13320	Well/Bore	Proposed				

APPENDIX C

HYDRAULIC TESTS



Introduction

The hydraulic conductivity of the shallow geological strata underlying the Industrial Area has been tested by WGA using slug tests in piezometers. These tests and the analysis results are documented in this appendix.

Additionally, CMW has undertaken three soakage tests at the Northern Area. Copies of the CMW analysis sheets and the analysis results are provided in this appendix.

WGA Slug Tests

WGA conducted slug tests on the four piezometers installed within the Site area. These piezometers are screened within the Holocene Swamp Deposits (peat, silt and sand) or the Hinuera Formation (silt and sands). Both falling head and rising head tests were performed on each piezometer, if possible. The hydraulic test results were analysed using the Bouwer and Rice (1974) method. The AQTESOLV Pro v4.5 software package from HydroSolve Inc was used to analyse the datasets.

The analysis sheets for these hydraulic tests are provided in this appendix, below. The hydraulic conductivity results derived from these tests are summarised in Table B1. For each piezometer where more than one test was undertaken, an average of the test analysis results is also provided, and the average value has been used in the assessments documented in the body of the main report.

Table C1: Results of WGA Hydraulic Tests

Bore	Test Type	Hydraulic Conductivity (m/sec)	Average
P1 (Holocene Swamp Deposits)	FHT 1	1.85×10^{-5}	1.02×10^{-5}
	RHT 1	4.16×10^{-6}	
	FHT 2	1.49×10^{-5}	
	RHT 2	3.34×10^{-6}	
P2 (Holocene Swamp Deposits)	FHT 1	2.04×10^{-8}	2.04×10^{-8}
P3 (Hinuera Formation)	FHT 1	1.47×10^{-4}	1.26×10^{-4}
	RHT 1	1.20×10^{-4}	
	FHT 2	1.32×10^{-4}	
	RHT 2	1.25×10^{-4}	
	FHT 3	1.19×10^{-4}	
	RHT 3	1.16×10^{-4}	
P4 (Hinuera Formation)	FHT 1	1.01×10^{-5}	6.17×10^{-6}
	RHT 1	2.39×10^{-6}	
	FHT 2	9.41×10^{-6}	
	RHT 2	2.72×10^{-6}	

CMW Soakage Tests

On 6 March 2026, CMW performed falling head soakage tests in three open hand auger holes in the Industrial Area (CMW 2026). The data from the falling head tests was analysed using two methods: the CIRIA 113 method and the Hvorslev (1951) method. Although both analysis methods are widely used and accepted, the Hvorslev analyses generated significantly lower hydraulic conductivity results than the CIRIA analyses.

Table C2: Results of CMW Hydraulic Tests

SITE ID	TEST HOLE DEPTH (m)	CIRIA 113 ANALYSIS RESULT (m/s)	HVORSLEV (1951) ANALYSIS RESULT (m/s)	LITHOLOGY
SO1	1.0	2.98×10^{-6}	5.95×10^{-7}	Silt
SO2	1.0	1.0×10^{-5}	2.44×10^{-6}	Silt
SO3	2.0	1.02×10^{-5}	1.36×10^{-6}	Silt



CLIENT: Colliers Project Leaders

PROJECT: Southern Links Industrial Block

TITLE: SO1 Falling Head Permeability Test

DESIGNER: PT

CHECKED: MM

REVISION: 0

DATE: 6/03/2026

PROJECT: HAM2024-0120

Specifications - Open-Ended Tube

Length L_1 : 1 m
Diameter: 90 mm
Non-Perm L_2 : 0 m
Above Gnd L_3 : 0 m

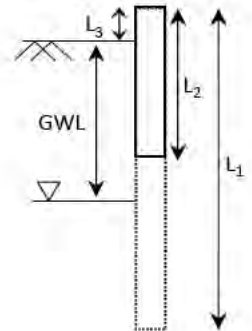
Ground Conditions

GWL: m BGL (Blank = Bottom of hole)

Permeability Anisotropy

m: 1 $m = \sqrt{k_h/k_v}$

Bottom of Test Hole: 1.00 m BGL

**Hydraulic Conductivity (k)**

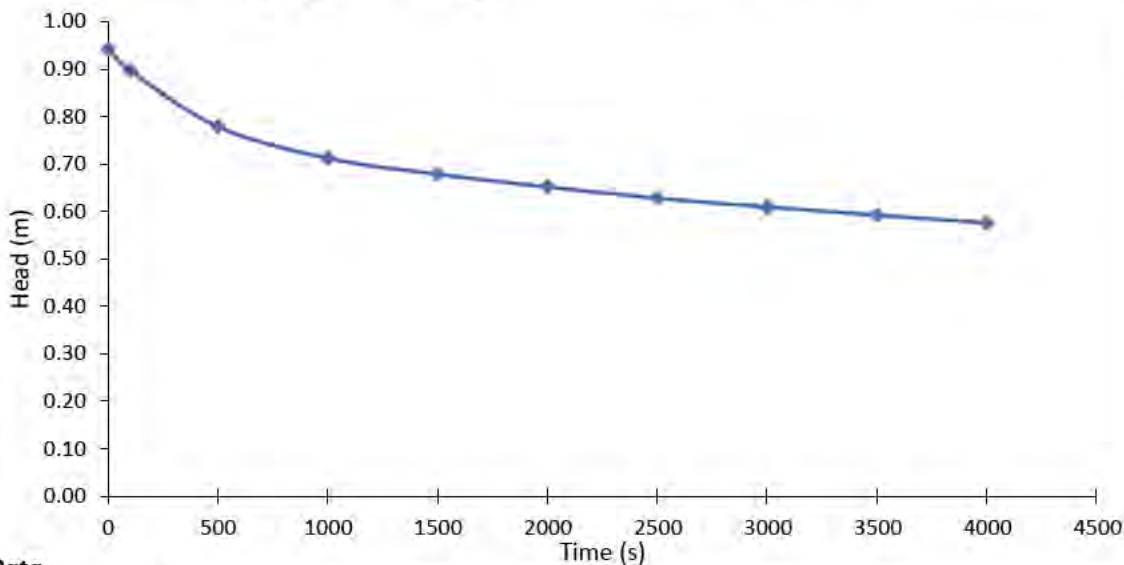
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

CIRIA 113: Somerville (1986), Control of groundwater for temporary works, CIRIA Report 113, Appendix 4

$$k = \left(\log \frac{h_1}{h_2} - \log \frac{2h_1 + d}{2h_2 + d} \right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} = 2.98\text{E-}06 \text{ ms}^{-1} = 0.26 \text{ m/day}$$

Hvorslev: Hvorslev (1951) Time Lag and Soil Permeability in Ground-Water Observations, Fig 18, p49

$$k = \frac{d^2 \ln \left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d} \right)^2 + 1} \right)}{8L(t_2 - t_1)} \ln \frac{H_1}{H_2} = 5.95\text{E-}07 \text{ ms}^{-1} = 0.05 \text{ m/day}$$

**STRATIGRAPHIC LOG**

Silt

EOH @ 1m

Data

Time (s)	Tape Avg (m)	Head (m)	Perm. Length (m)	Hvorslev 'k' Case G (ms ⁻¹)	CIRIA 113 'k' (ms ⁻¹)
0	0.058	0.942	0.920	1.63E-06	9.16E-06
100	0.103	0.897	0.838	1.25E-06	6.59E-06
500	0.221	0.779	0.745	6.82E-07	3.29E-06
1000	0.288	0.712	0.695	3.88E-07	1.79E-06
1500	0.322	0.678	0.665	3.30E-07	1.47E-06
2000	0.348	0.652	0.640	3.10E-07	1.35E-06
2500	0.372	0.628	0.619	2.60E-07	1.10E-06
3000	0.391	0.609	0.601	2.48E-07	1.03E-06
3500	0.408	0.592	0.584	2.55E-07	1.04E-06
4000	0.424	0.576			



CLIENT: Colliers Project Leaders

PROJECT: Southern Links Industrial Block

TITLE: SO₂ Falling Head Permeability Test

DESIGNER: PT

CHECKED: MM

REVISION: 0

DATE: 6/03/2026

PROJECT: HAM2024-0120

Specifications - Open-Ended Tube

Length L_1 : 1 m
Diameter: 90 mm
Non-Perm L_2 : 0 m
Above Gnd L_3 : 0 m

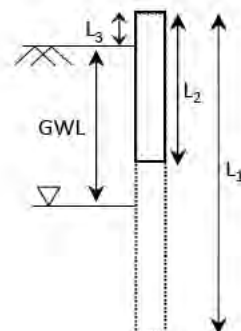
Ground Conditions

GWL: m BGL (Blank = Bottom of hole)

Permeability Anisotropy

m: 1 $m = \sqrt{k_h/k_v}$

Bottom of Test Hole: 1.00 m BGL

**Hydraulic Conductivity (k)**

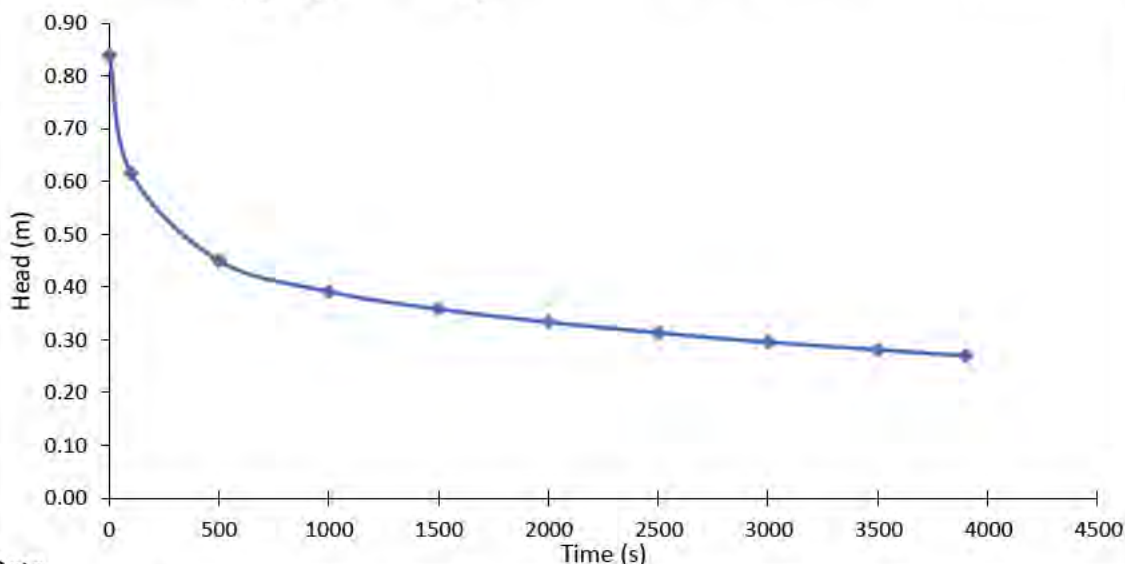
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

CIRIA 113: Somerville (1986), Control of groundwater for temporary works, CIRIA Report 113, Appendix 4

$$k = \left(\log \frac{h_1}{h_2} - \log \frac{2h_1 + d}{2h_2 + d} \right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} = 1.00\text{E-}05 \text{ ms}^{-1} = 0.87 \text{ m/day}$$

Hvorslev: Hvorslev (1951) Time Lag and Soil Permeability in Ground-Water Observations, Fig 18, p49

$$k = \frac{d^2 \ln \left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d} \right)^2 + 1} \right)}{8L(t_2 - t_1)} \ln \frac{H_1}{H_2} = 2.44\text{E-}06 \text{ ms}^{-1} = 0.21 \text{ m/day}$$

**STRATIGRAPHIC LOG**

Silt

EOH @ 1m

Data

Time (s)	Tape Avg (m)	Head (m)	Perm. Length (m)	Hvorslev 'k' Case G (ms ⁻¹)	CIRIA 113 'k' (ms ⁻¹)
0	0.160	0.840	0.728	1.20E-05	5.78E-05
100	0.384	0.616	0.533	3.69E-06	1.43E-05
500	0.550	0.451	0.421	1.51E-06	4.96E-06
1000	0.608	0.392	0.375	1.03E-06	3.11E-06
1500	0.642	0.358	0.346	8.49E-07	2.44E-06
2000	0.666	0.334	0.324	7.70E-07	2.12E-06
2500	0.686	0.314	0.305	7.68E-07	2.04E-06
3000	0.704	0.296	0.288	6.60E-07	1.69E-06
3500	0.719	0.281	0.276	6.86E-07	1.71E-06
3900	0.730	0.270			



CLIENT: Colliers Project Leaders

PROJECT: Southern Links Industrial Block

TITLE: SO3 Falling Head Permeability Test

DESIGNER: PT

CHECKED: MM

REVISION: 0

DATE: 6/03/2026

PROJECT: HAM2024-0120

Specifications - Open-Ended Tube

Length L_1 : 2 m
Diameter: 90 mm
Non-Perm L_2 : 0 m
Above Gnd L_3 : 0 m

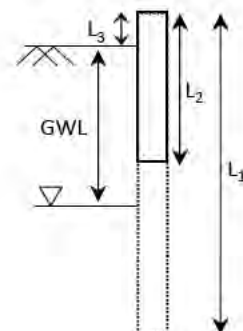
Ground Conditions

GWL: m BGL (Blank = Bottom of hole)

Permeability Anisotropy

m: 1 $m = \sqrt{k_h/k_v}$

Bottom of Test Hole: 2.00 m BGL

**Hydraulic Conductivity (k)**

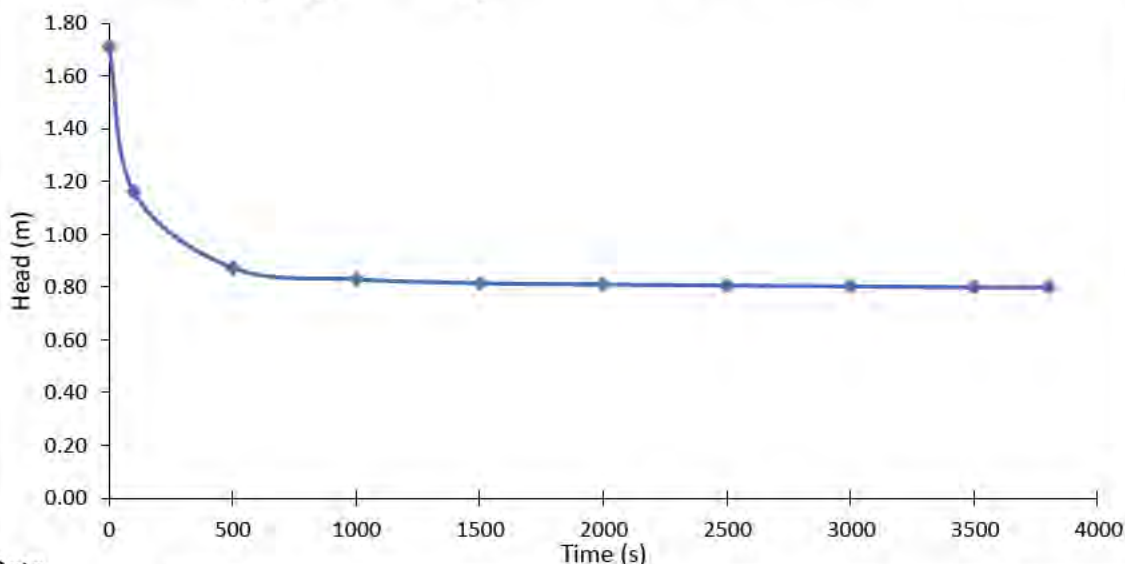
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

CIRIA 113: Somerville (1986), Control of groundwater for temporary works, CIRIA Report 113, Appendix 4

$$k = \left(\log \frac{h_1}{h_2} - \log \frac{2h_1 + d}{2h_2 + d} \right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} = 1.02\text{E-}05 \text{ ms}^{-1} = 0.88 \text{ m/day}$$

Hvorslev: Hvorslev (1951) Time Lag and Soil Permeability in Ground-Water Observations, Fig 18, p49

$$k = \frac{d^2 \ln \left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d} \right)^2 + 1} \right)}{8L(t_2 - t_1)} \ln \frac{H_1}{H_2} = 1.36\text{E-}06 \text{ ms}^{-1} = 0.12 \text{ m/day}$$

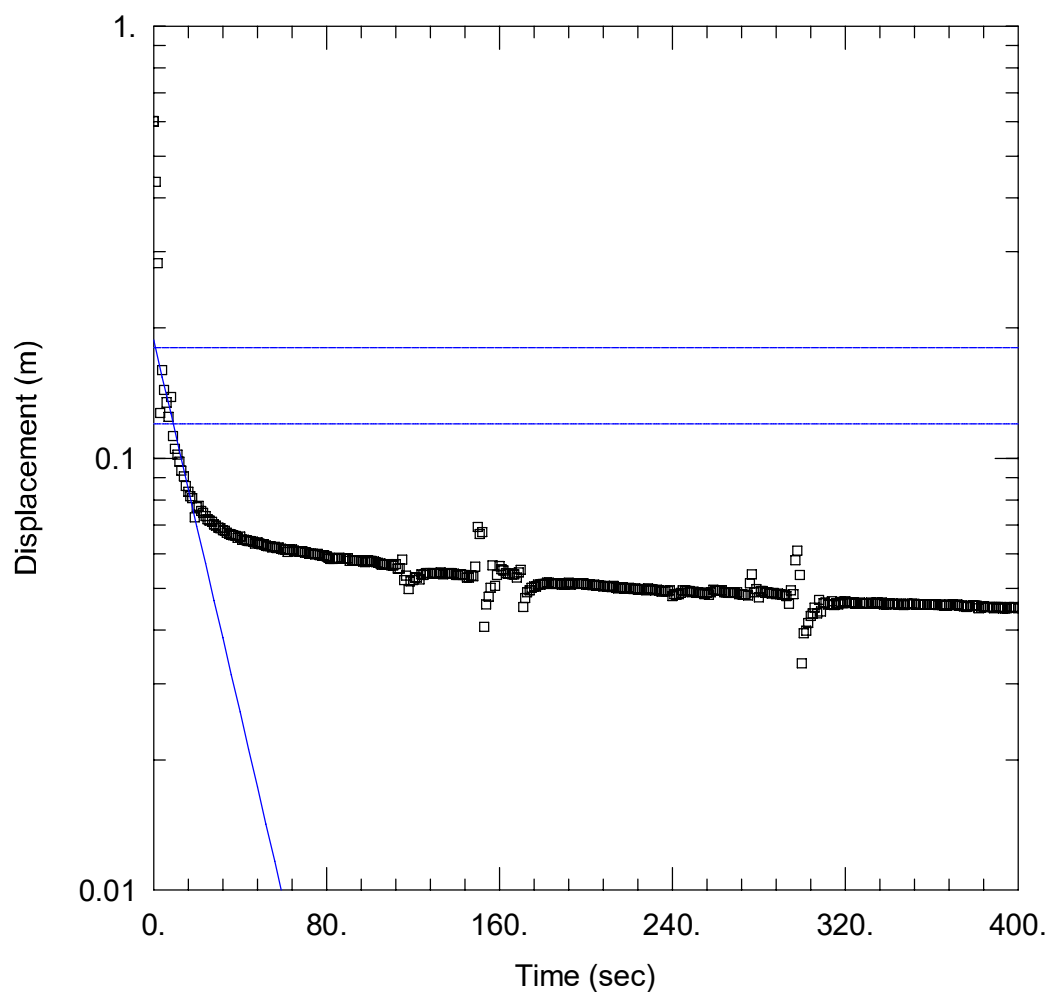
**STRATIGRAPHIC LOG**

Silt

EOH @ 2m

Data

Time (s)	Tape Avg (m)	Head (m)	Perm. Length (m)	Hvorslev 'k' Case G (ms ⁻¹)	CIRIA 113 'k' (ms ⁻¹)
0	0.289	1.711	1.437	9.44E-06	7.50E-05
100	0.837	1.163	1.018	2.22E-06	1.36E-05
500	1.127	0.873	0.851	3.61E-07	1.92E-06
1000	1.171	0.830	0.822	1.23E-07	6.35E-07
1500	1.185	0.815	0.813	4.80E-08	2.46E-07
2000	1.190	0.810	0.808	3.14E-08	1.60E-07
2500	1.194	0.807	0.805	2.71E-08	1.38E-07
3000	1.197	0.804	0.802	3.18E-08	1.62E-07
3500	1.200	0.800	0.800	3.04E-09	1.54E-08
3800	1.200	0.800			



WELL TEST ANALYSIS

Data Set: V:\...\P1-Test1-Falling Head.aqt

Date: 03/13/26

Time: 07:23:37

PROJECT INFORMATION

Company: WGA

Project: WGA242463

Location: SL1 - Industrial North

Test Well: P1

Test Date: 23/02/2026

AQUIFER DATA

Saturated Thickness: 5.64 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (P1)

Initial Displacement: 0.5999 m

Total Well Penetration Depth: 3.475 m

Casing Radius: 0.02 m

Static Water Column Height: 3.475 m

Screen Length: 1.5 m

Well Radius: 0.0375 m

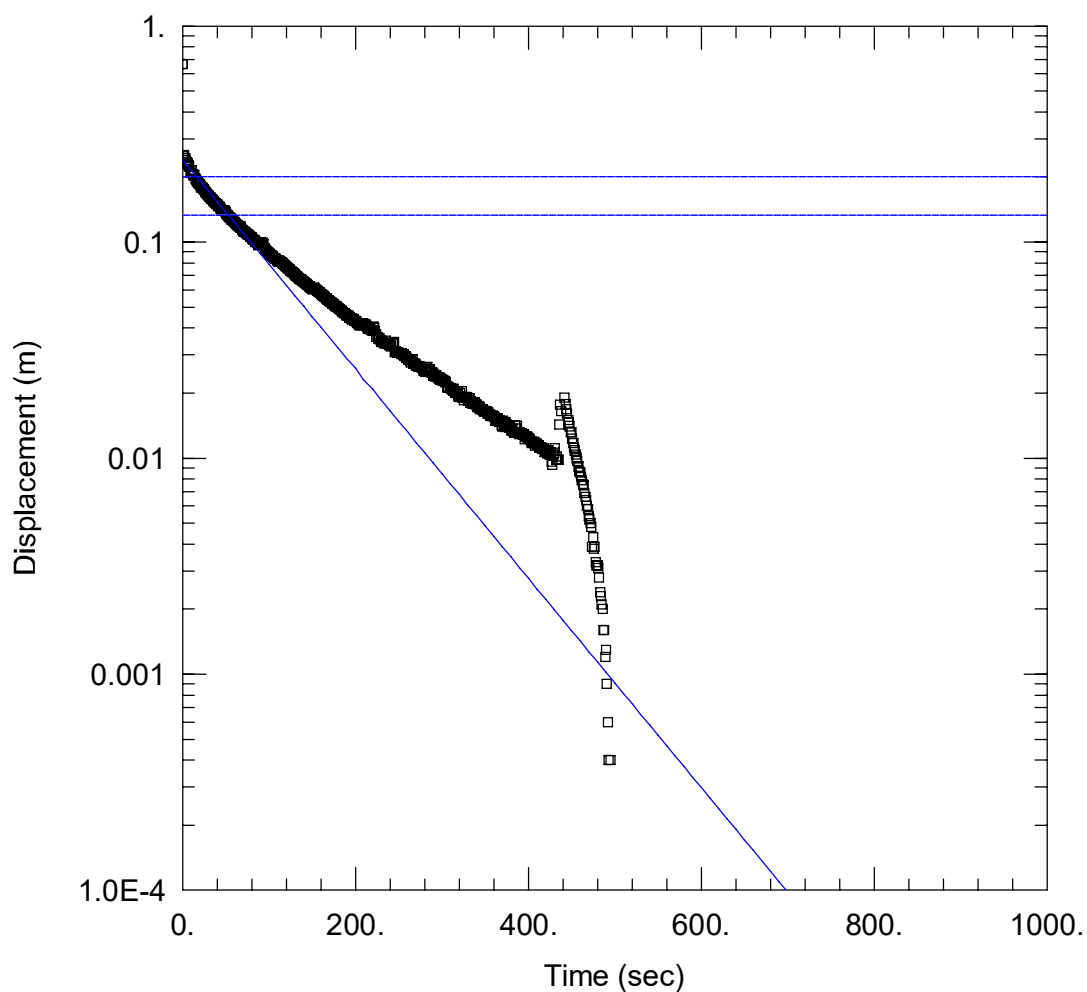
SOLUTION

Aquifer Model: Unconfined

$K = 1.598$ m/day

Solution Method: Bouwer-Rice

$y_0 = 0.1876$ m



WELL TEST ANALYSIS

Data Set: V:\...\P1-Test1-Rising Head.aqt

Date: 03/13/26

Time: 07:23:40

PROJECT INFORMATION

Company: WGA

Project: WGA242463

Location: SL1 - Industrial North

Test Well: P1

Test Date: 23/02/2026

AQUIFER DATA

Saturated Thickness: 5.64 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (P1)

Initial Displacement: 0.6669 m

Static Water Column Height: 3.475 m

Total Well Penetration Depth: 3.475 m

Screen Length: 1.5 m

Casing Radius: 0.02 m

Well Radius: 0.0375 m

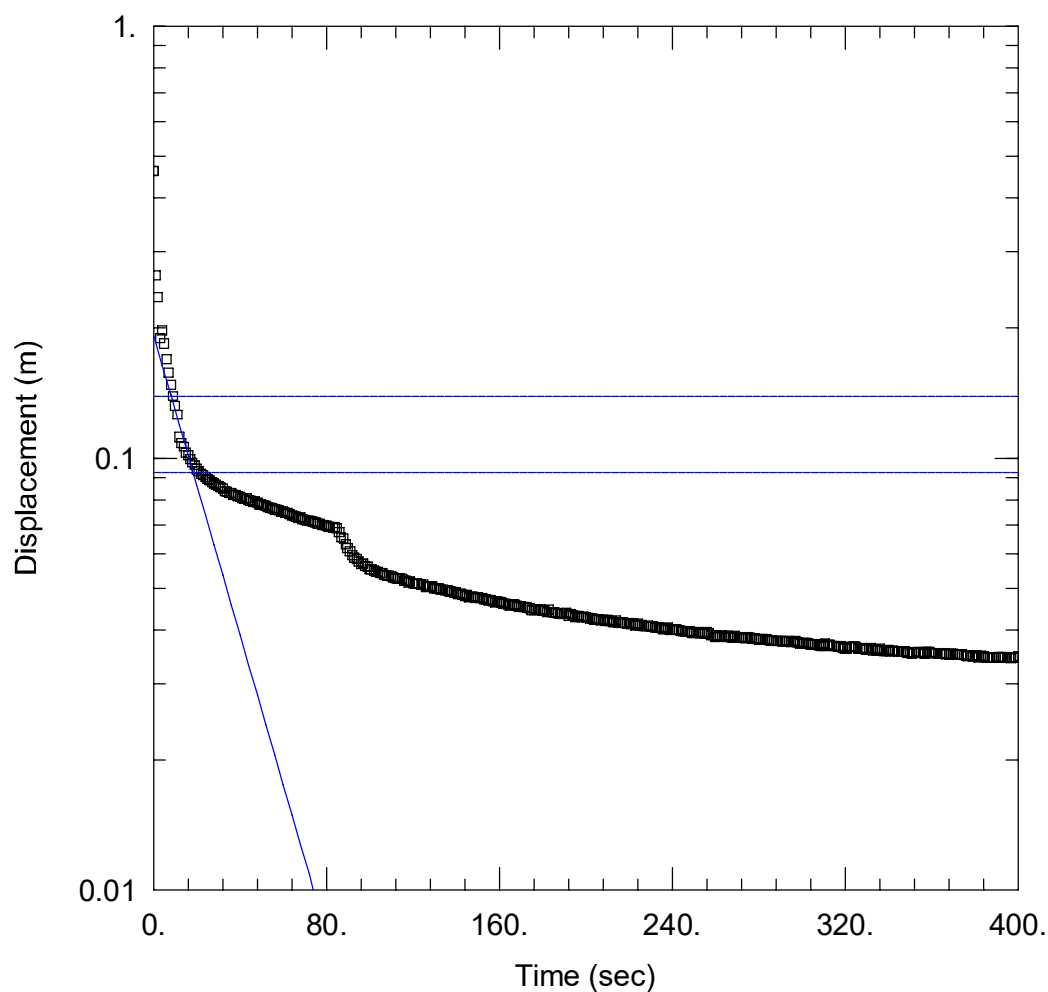
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 0.3596$ m/day

$y_0 = 0.2405$ m



WELL TEST ANALYSIS

Data Set: V:\...\P1-Test2-Falling_Head.aqt

Date: 03/13/26

Time: 07:23:42

PROJECT INFORMATION

Company: WGA

Project: WGA242463

Location: SL1 - Industrial North

Test Well: P1

Test Date: 23/02/2026

AQUIFER DATA

Saturated Thickness: 5.64 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (P1)

Initial Displacement: 0.4625 m

Total Well Penetration Depth: 3.475 m

Casing Radius: 0.02 m

Static Water Column Height: 3.475 m

Screen Length: 1.5 m

Well Radius: 0.0375 m

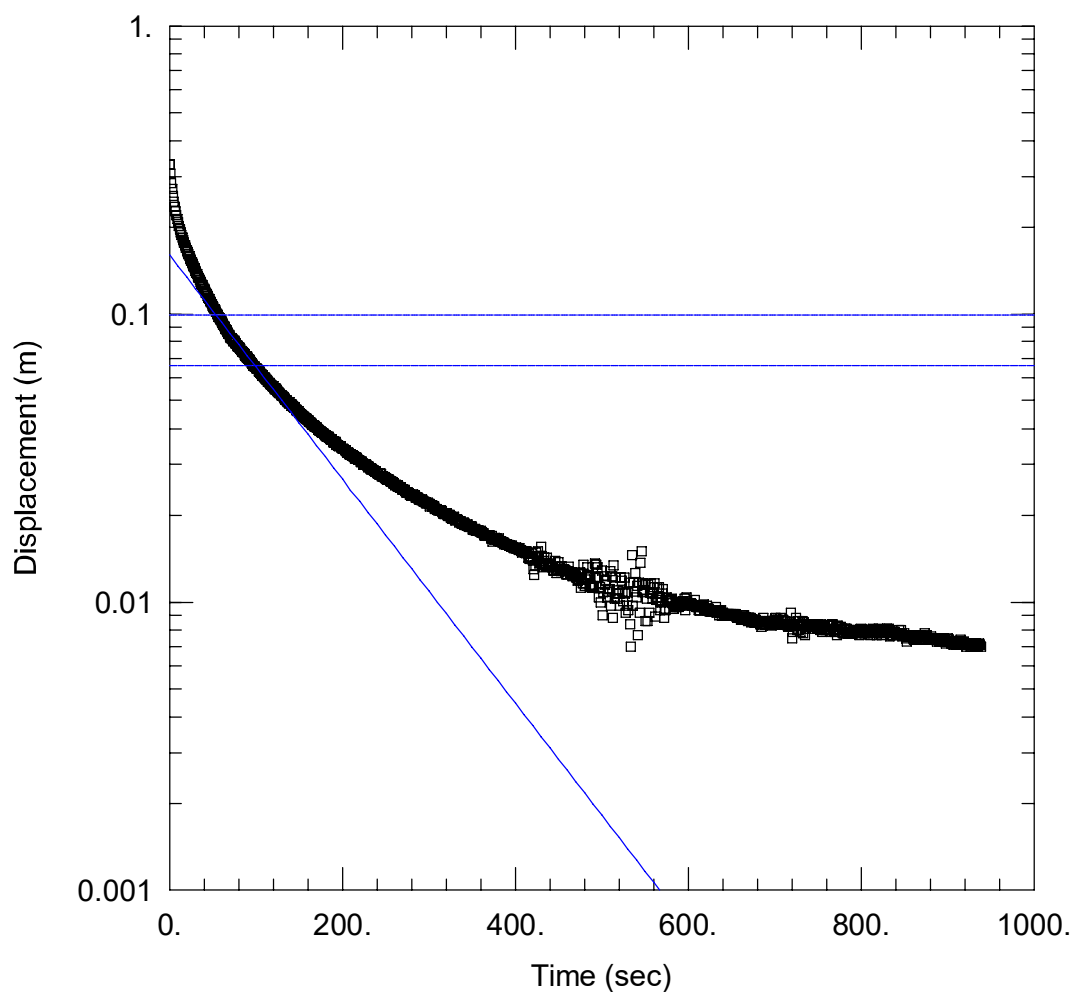
SOLUTION

Aquifer Model: Unconfined

$K = 1.287$ m/day

Solution Method: Bouwer-Rice

$y_0 = 0.1924$ m



WELL TEST ANALYSIS

Data Set: V:\...\P1-Test2-Rising Head.aqt

Date: 03/13/26

Time: 07:23:45

PROJECT INFORMATION

Company: WGA

Project: WGA242463

Location: SL1 - Industrial North

Test Well: P1

Test Date: 23/02/2026

AQUIFER DATA

Saturated Thickness: 5.64 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (P1)

Initial Displacement: 0.3309 m

Total Well Penetration Depth: 3.475 m

Casing Radius: 0.02 m

Static Water Column Height: 3.475 m

Screen Length: 1.5 m

Well Radius: 0.0375 m

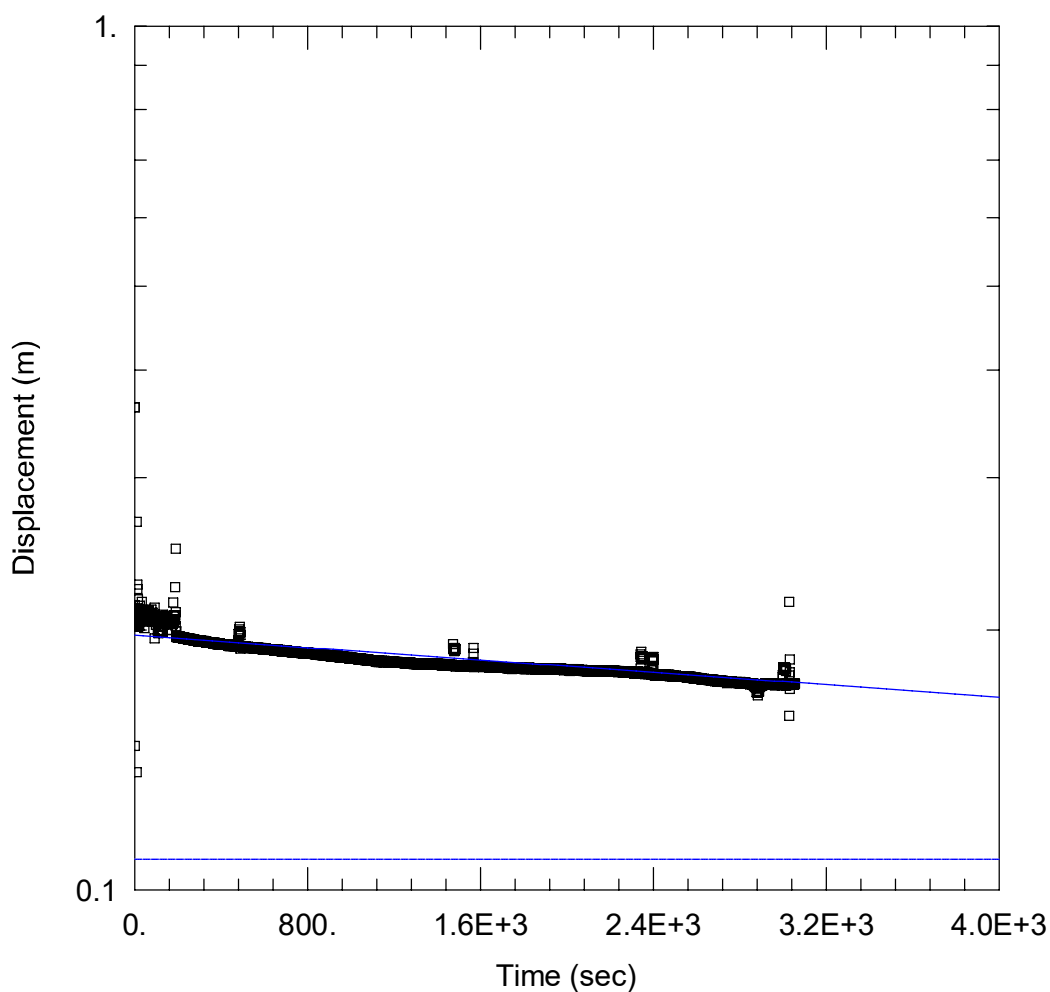
SOLUTION

Aquifer Model: Unconfined

$K = 0.2888$ m/day

Solution Method: Bouwer-Rice

$y_0 = 0.1605$ m



WELL TEST ANALYSIS

Data Set: V:\...\P2-Test1-Falling_Head.aqt

Date: 03/13/26

Time: 07:26:03

PROJECT INFORMATION

Company: WGA

Project: WGA242463

Location: SL1 - Industrial North

Test Well: P1

Test Date: 23/02/2026

AQUIFER DATA

Saturated Thickness: 13.54 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (P2)

Initial Displacement: 0.362 m

Total Well Penetration Depth: 1.347 m

Casing Radius: 0.02 m

Static Water Column Height: 1.347 m

Screen Length: 1.347 m

Well Radius: 0.0375 m

Gravel Pack Porosity: 0.2

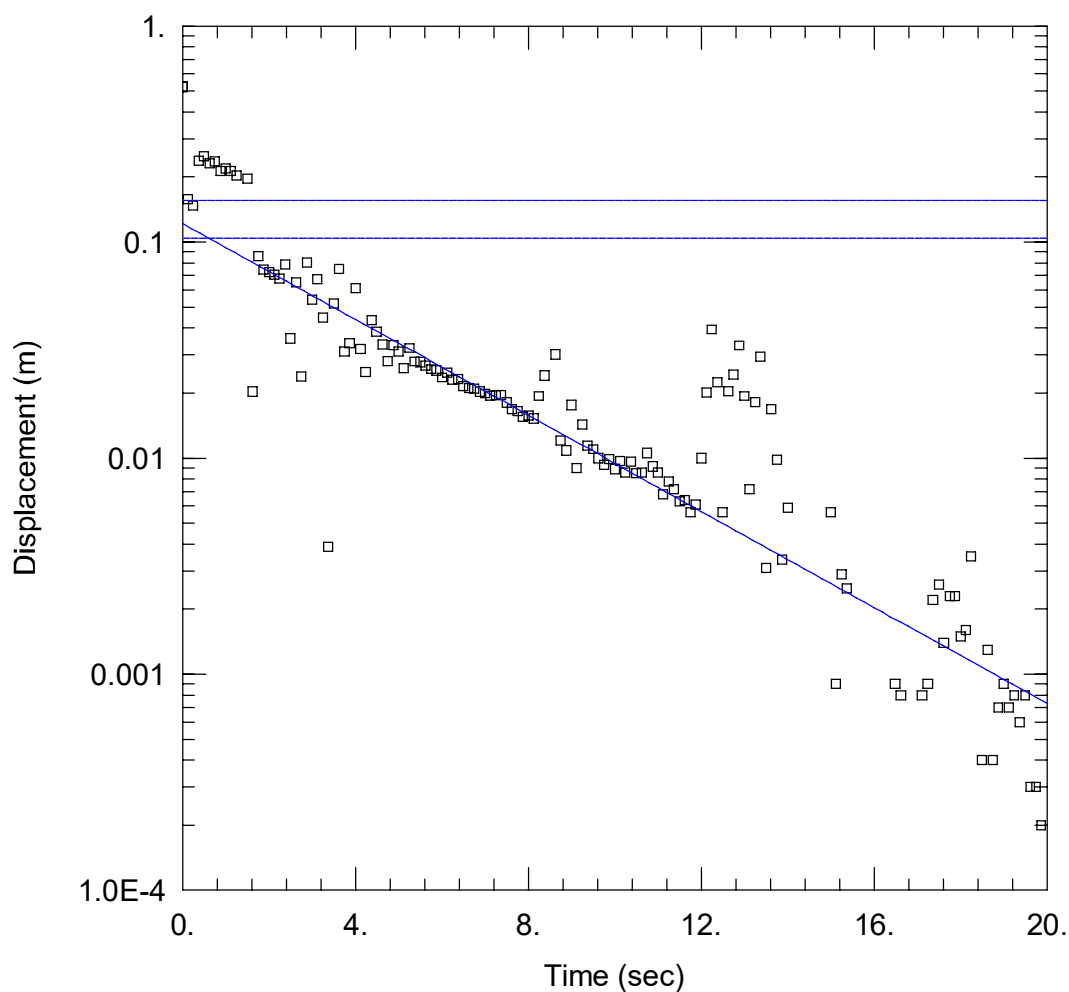
SOLUTION

Aquifer Model: Unconfined

$K = 0.001761$ m/day

Solution Method: Bouwer-Rice

$y_0 = 0.1972$ m



WELL TEST ANALYSIS

Data Set: V:\...\P3-Test1-Falling Head.aqt

Date: 03/13/26

Time: 07:26:07

PROJECT INFORMATION

Company: WGA

Project: WGA242463

Location: SL1 - Industrial North

Test Well: P1

Test Date: 23/02/2026

AQUIFER DATA

Saturated Thickness: 12.55 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (P3)

Initial Displacement: 0.5209 m

Total Well Penetration Depth: 1.067 m

Casing Radius: 0.02 m

Static Water Column Height: 1.067 m

Screen Length: 1.067 m

Well Radius: 0.0375 m

Gravel Pack Porosity: 0.2

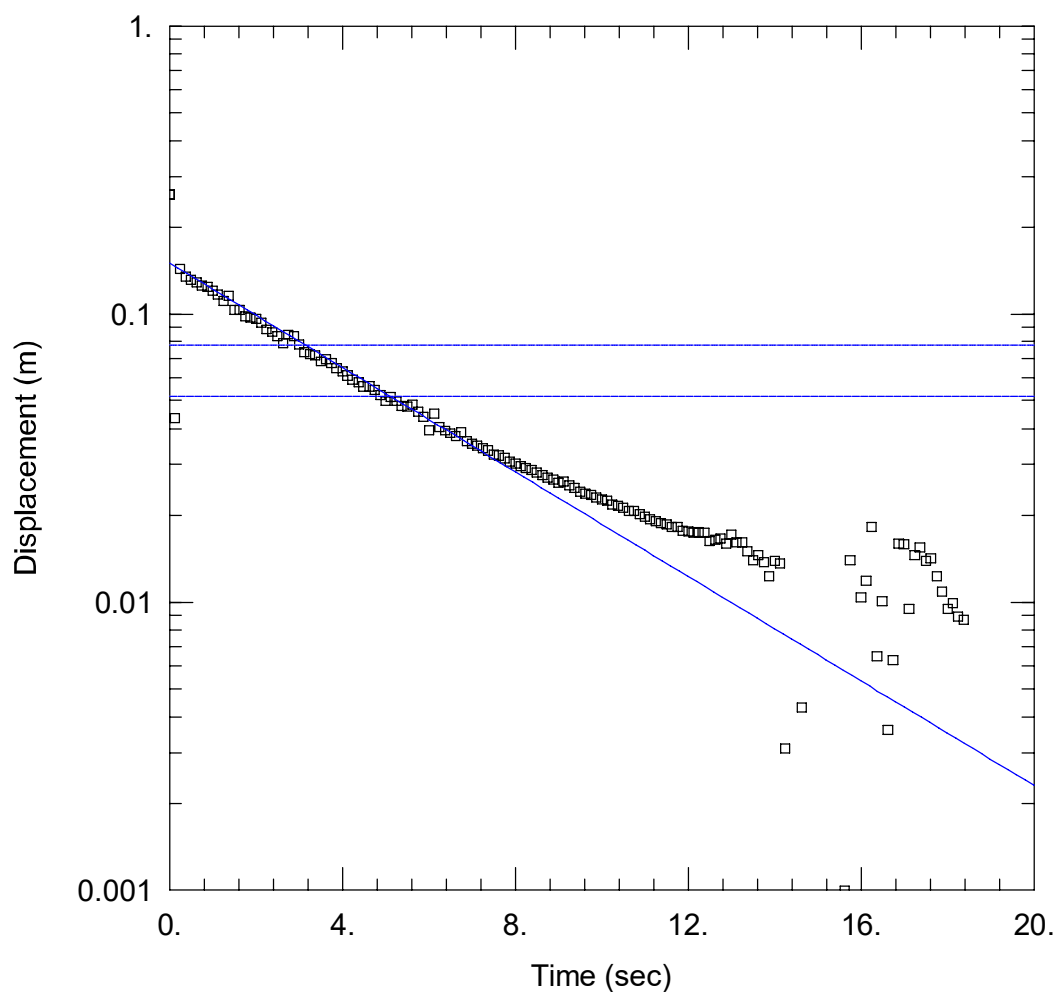
SOLUTION

Aquifer Model: Unconfined

$K = 12.67$ m/day

Solution Method: Bouwer-Rice

$y_0 = 0.1218$ m



WELL TEST ANALYSIS

Data Set: V:\...\P3-Test1-Rising Head.aqt

Date: 03/13/26

Time: 07:26:10

PROJECT INFORMATION

Company: WGA

Project: WGA242463

Location: SL1 - Industrial North

Test Well: P1

Test Date: 23/02/2026

AQUIFER DATA

Saturated Thickness: 12.55 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (P3)

Initial Displacement: 0.2596 m

Total Well Penetration Depth: 1.067 m

Casing Radius: 0.02 m

Static Water Column Height: 1.067 m

Screen Length: 1.067 m

Well Radius: 0.0375 m

Gravel Pack Porosity: 0.2

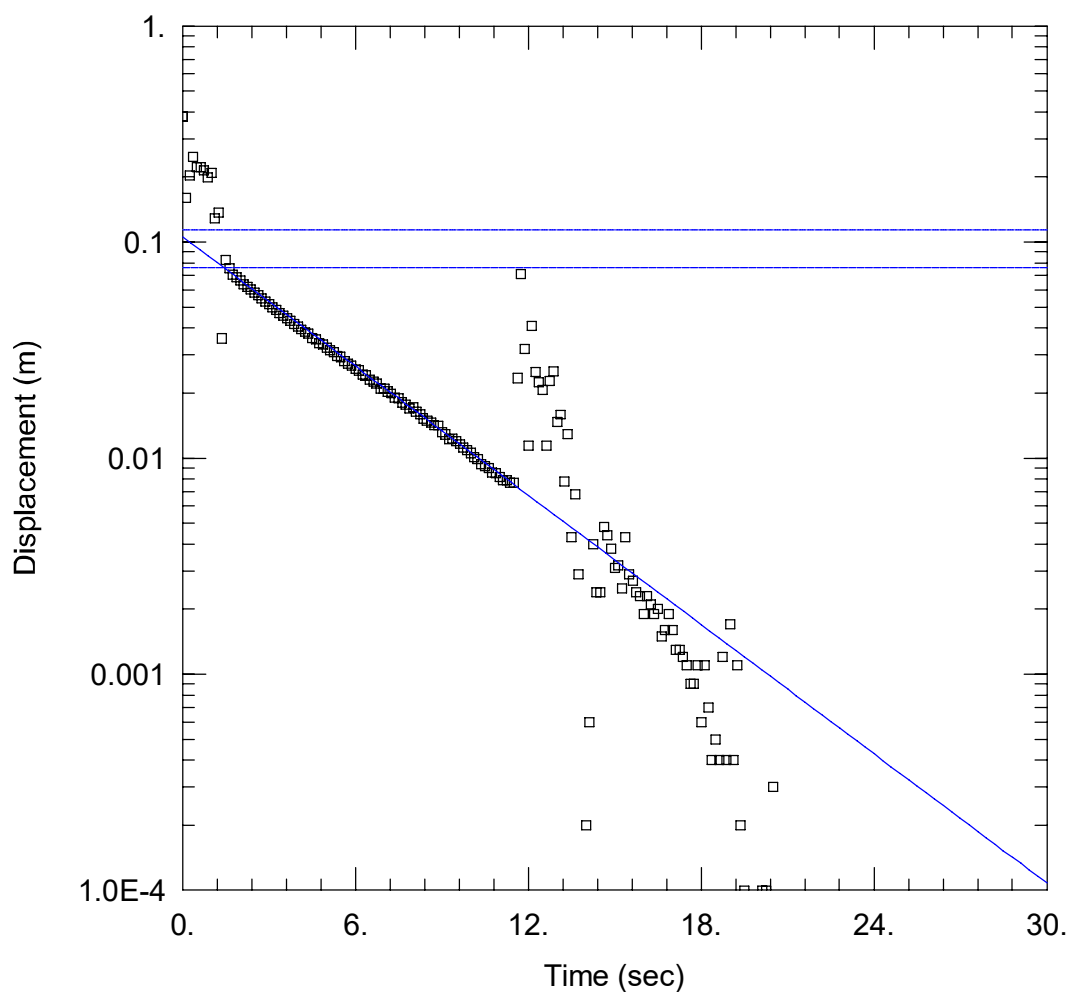
SOLUTION

Aquifer Model: Unconfined

$K = 10.34$ m/day

Solution Method: Bouwer-Rice

$y_0 = 0.1503$ m



WELL TEST ANALYSIS

Data Set: V:\...\P3-Test2-Falling Head.aqt

Date: 03/13/26

Time: 07:26:12

PROJECT INFORMATION

Company: WGA

Project: WGA242463

Location: SL1 - Industrial North

Test Well: P1

Test Date: 23/02/2026

AQUIFER DATA

Saturated Thickness: 12.55 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (P3)

Initial Displacement: 0.3799 m

Total Well Penetration Depth: 1.067 m

Casing Radius: 0.02 m

Static Water Column Height: 1.067 m

Screen Length: 1.067 m

Well Radius: 0.0375 m

Gravel Pack Porosity: 0.2

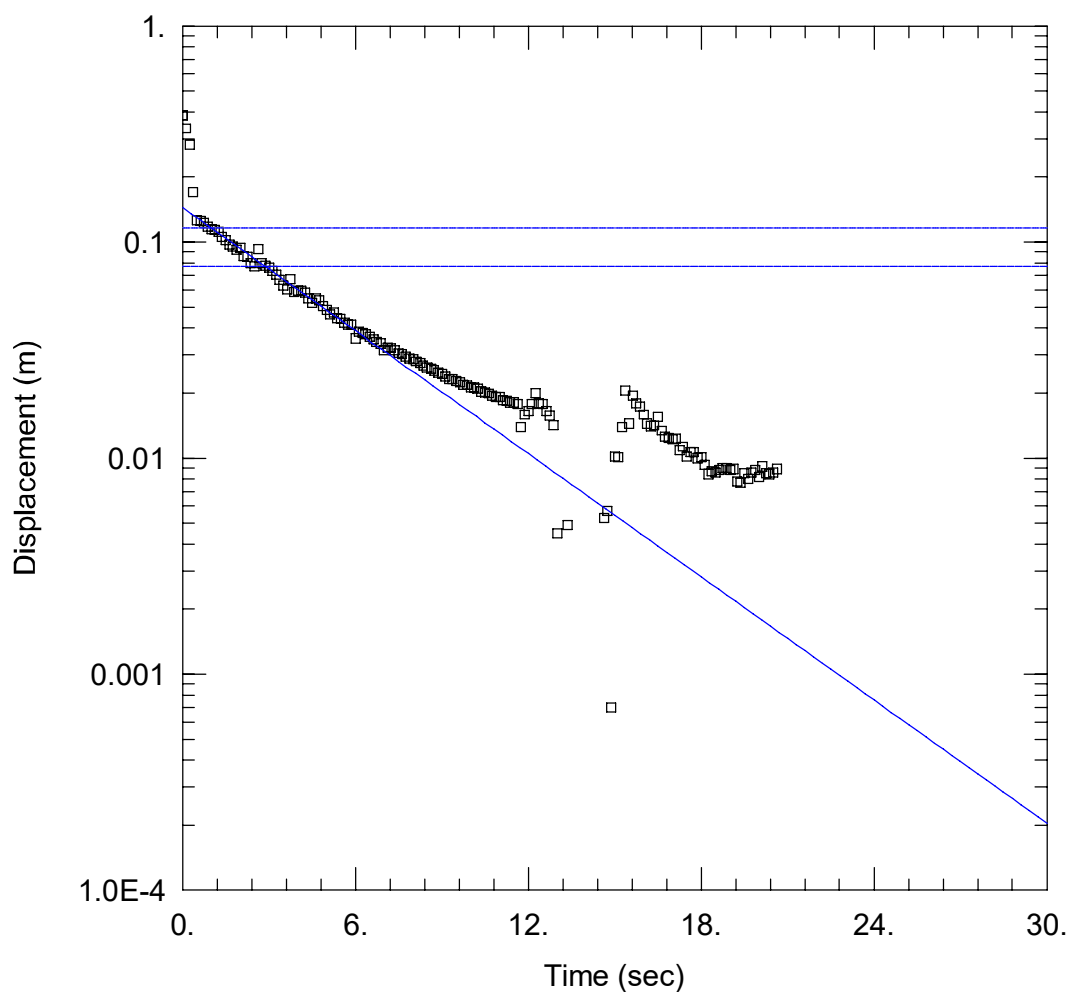
SOLUTION

Aquifer Model: Unconfined

$K = 11.38$ m/day

Solution Method: Bouwer-Rice

$y_0 = 0.1057$ m



WELL TEST ANALYSIS

Data Set: V:\...\P3-Test2-Rising Head.aqt

Date: 03/13/26

Time: 07:27:37

PROJECT INFORMATION

Company: WGA

Project: WGA242463

Location: SL1 - Industrial North

Test Well: P1

Test Date: 23/02/2026

AQUIFER DATA

Saturated Thickness: 12.55 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (P3)

Initial Displacement: 0.3864 m

Total Well Penetration Depth: 1.067 m

Casing Radius: 0.02 m

Static Water Column Height: 1.067 m

Screen Length: 1.067 m

Well Radius: 0.0375 m

Gravel Pack Porosity: 0.2

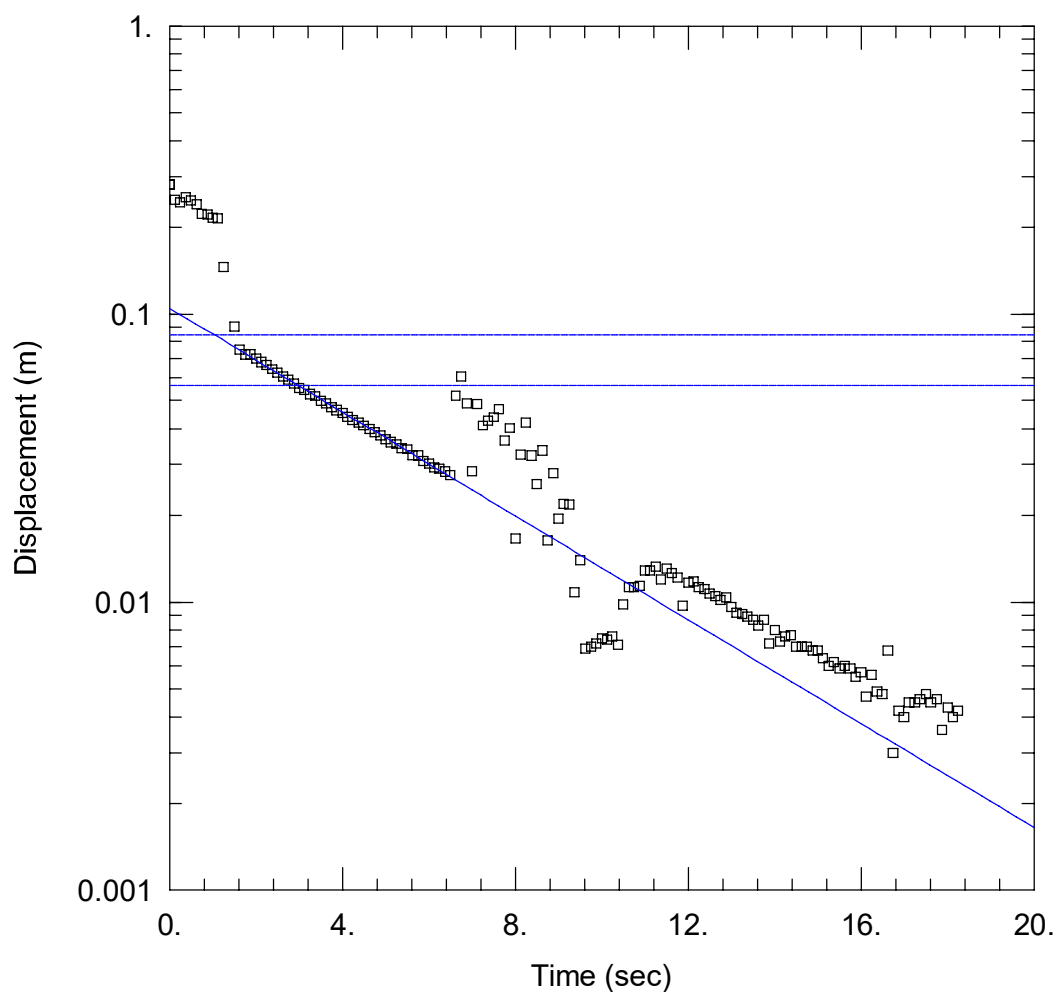
SOLUTION

Aquifer Model: Unconfined

$K = 10.84$ m/day

Solution Method: Bouwer-Rice

$y_0 = 0.1444$ m



WELL TEST ANALYSIS

Data Set: V:\...\P3-Test3-Falling Head.aqt

Date: 03/13/26

Time: 07:27:40

PROJECT INFORMATION

Company: WGA

Project: WGA242463

Location: SL1 - Industrial North

Test Well: P1

Test Date: 23/02/2026

AQUIFER DATA

Saturated Thickness: 12.55 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (P3)

Initial Displacement: 0.2823 m

Total Well Penetration Depth: 1.067 m

Casing Radius: 0.02 m

Static Water Column Height: 1.067 m

Screen Length: 1.067 m

Well Radius: 0.0375 m

Gravel Pack Porosity: 0.2

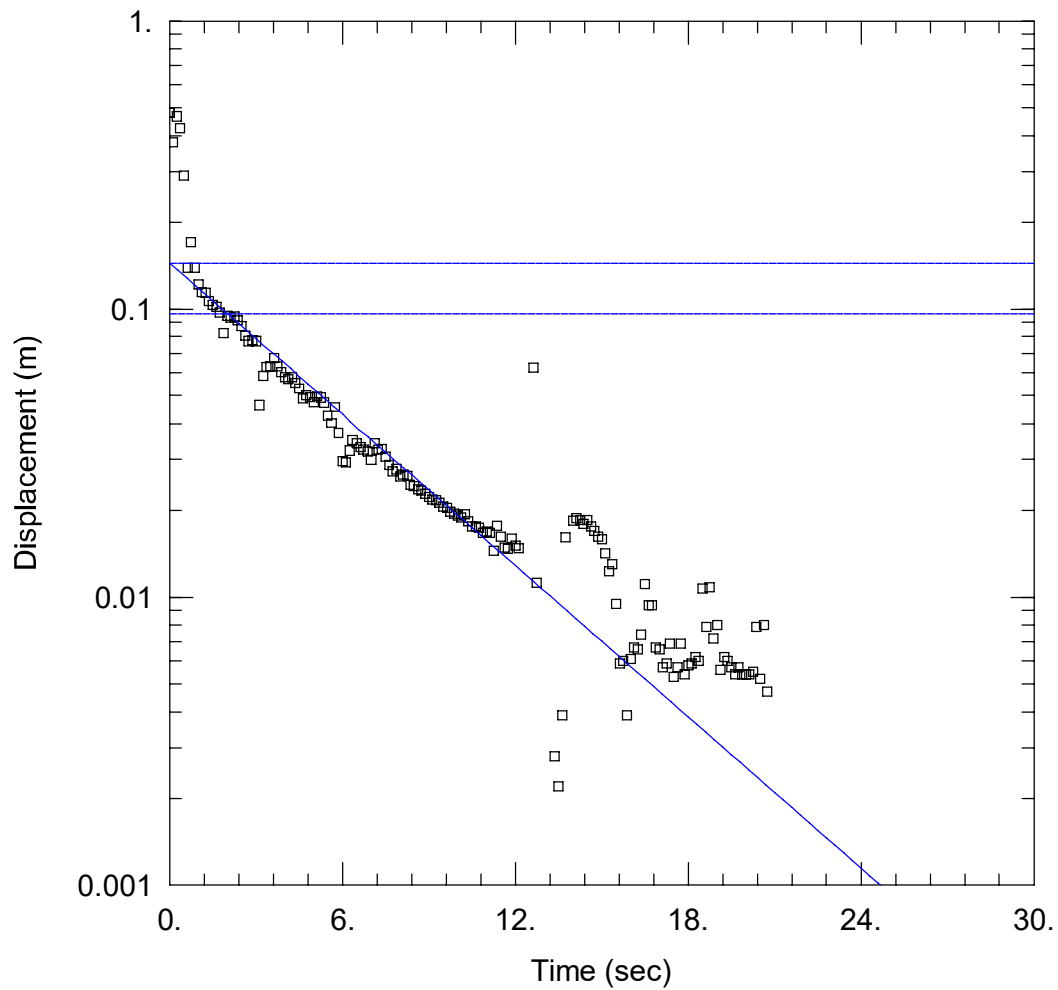
SOLUTION

Aquifer Model: Unconfined

$K = 10.28$ m/day

Solution Method: Bouwer-Rice

$y_0 = 0.1046$ m



WELL TEST ANALYSIS

Data Set: V:\...\P3-Test3-Rising Head.aqt

Date: 03/13/26

Time: 07:27:43

PROJECT INFORMATION

Company: WGA

Project: WGA242463

Location: SL1 - Industrial North

Test Well: P1

Test Date: 23/02/2026

AQUIFER DATA

Saturated Thickness: 12.55 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (P3)

Initial Displacement: 0.4806 m

Total Well Penetration Depth: 1.067 m

Casing Radius: 0.02 m

Static Water Column Height: 1.067 m

Screen Length: 1.067 m

Well Radius: 0.0375 m

Gravel Pack Porosity: 0.2

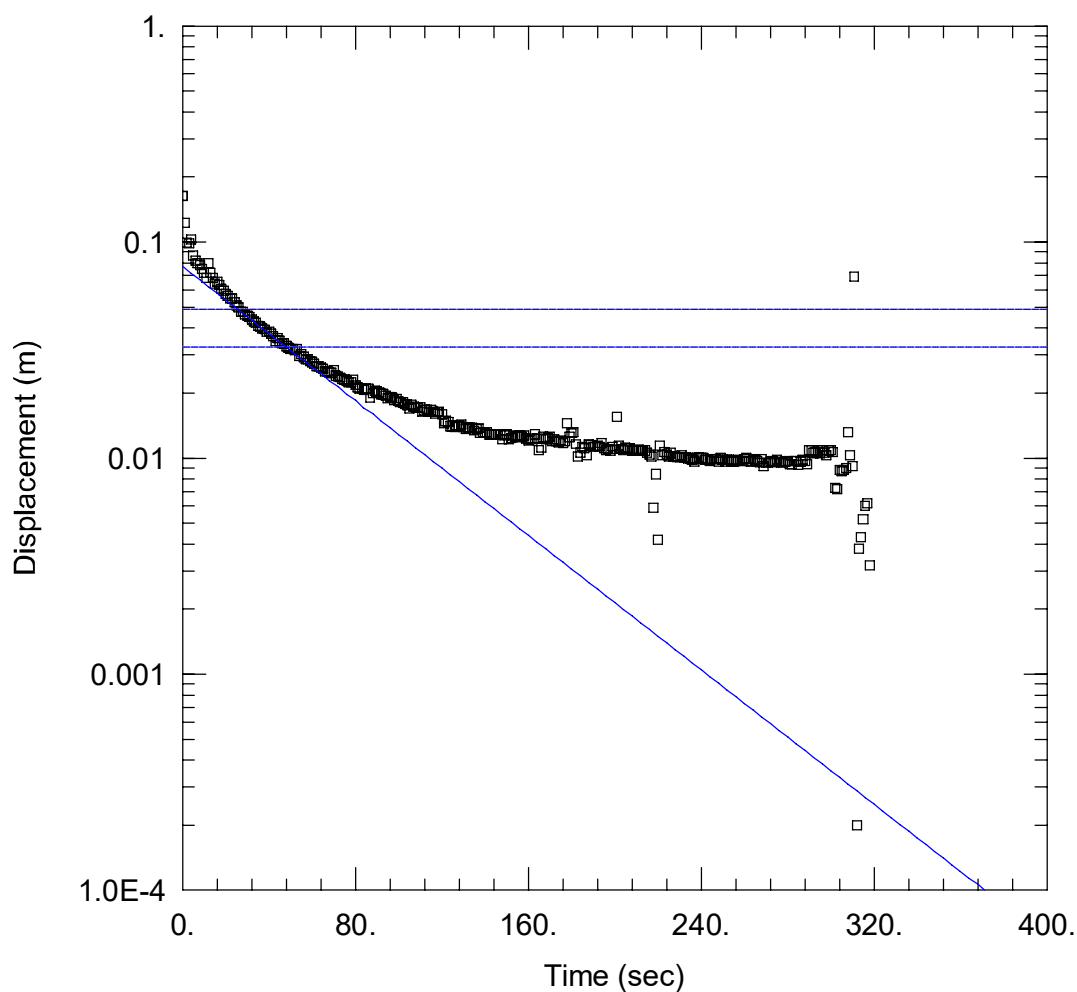
SOLUTION

Aquifer Model: Unconfined

$K = 9.991$ m/day

Solution Method: Bouwer-Rice

$y_0 = 0.1445$ m



WELL TEST ANALYSIS

Data Set: V:\...\P4-Test1-Falling Head.aqt

Date: 03/13/26

Time: 07:28:34

PROJECT INFORMATION

Company: WGA

Project: WGA242463

Location: SL1 - Industrial North

Test Well: P1

Test Date: 23/02/2026

AQUIFER DATA

Saturated Thickness: 14.71 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (P4)

Initial Displacement: 0.1629 m

Total Well Penetration Depth: 1.084 m

Casing Radius: 0.02 m

Static Water Column Height: 1.084 m

Screen Length: 1.084 m

Well Radius: 0.0375 m

Gravel Pack Porosity: 0.2

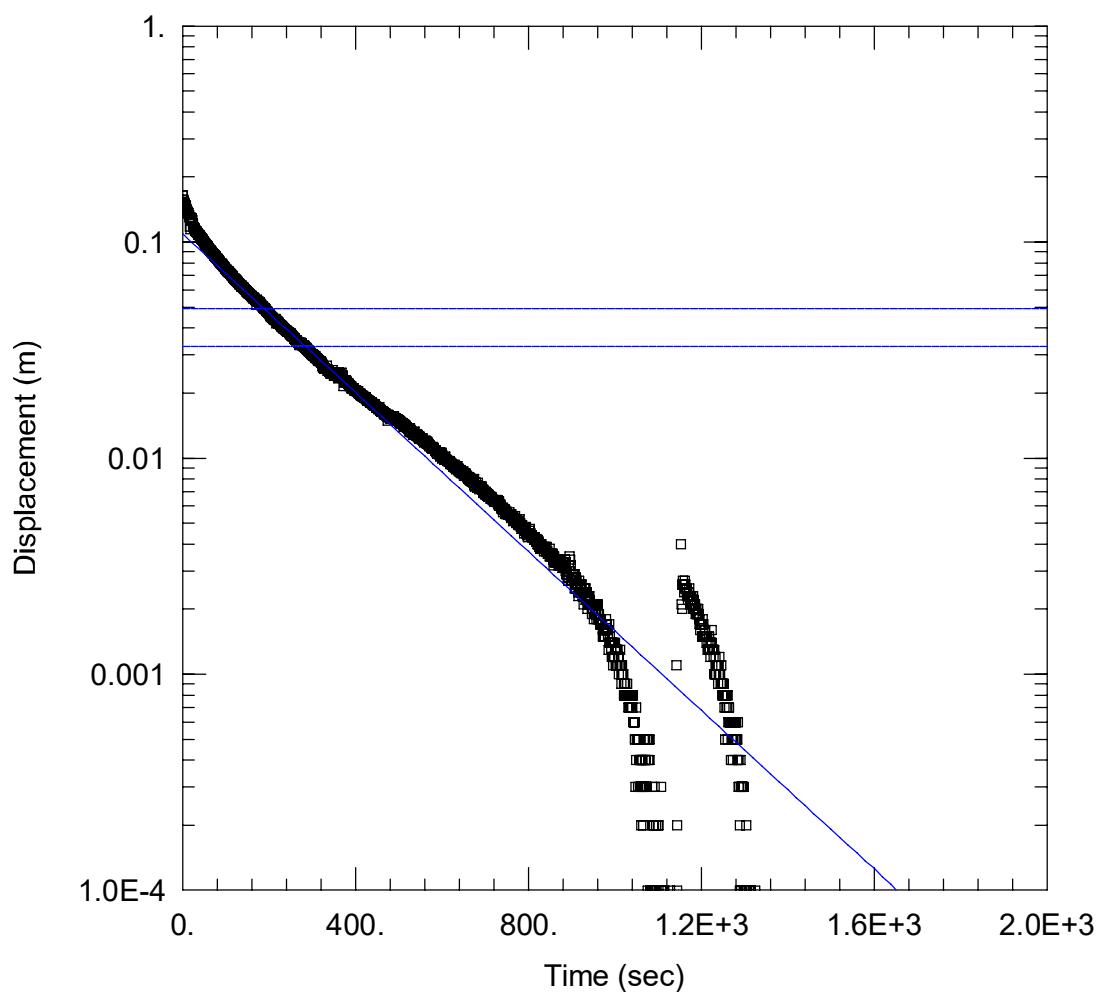
SOLUTION

Aquifer Model: Unconfined

$K = 0.8756$ m/day

Solution Method: Bouwer-Rice

$y_0 = 0.07706$ m



WELL TEST ANALYSIS

Data Set: V:\...\P4-Test1-Rising Head.aqt

Date: 03/13/26

Time: 07:28:37

PROJECT INFORMATION

Company: WGA

Project: WGA242463

Location: SL1 - Industrial North

Test Well: P1

Test Date: 23/02/2026

AQUIFER DATA

Saturated Thickness: 14.71 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (P4)

Initial Displacement: 0.1643 m

Total Well Penetration Depth: 1.084 m

Casing Radius: 0.02 m

Static Water Column Height: 1.084 m

Screen Length: 1.084 m

Well Radius: 0.0375 m

Gravel Pack Porosity: 0.2

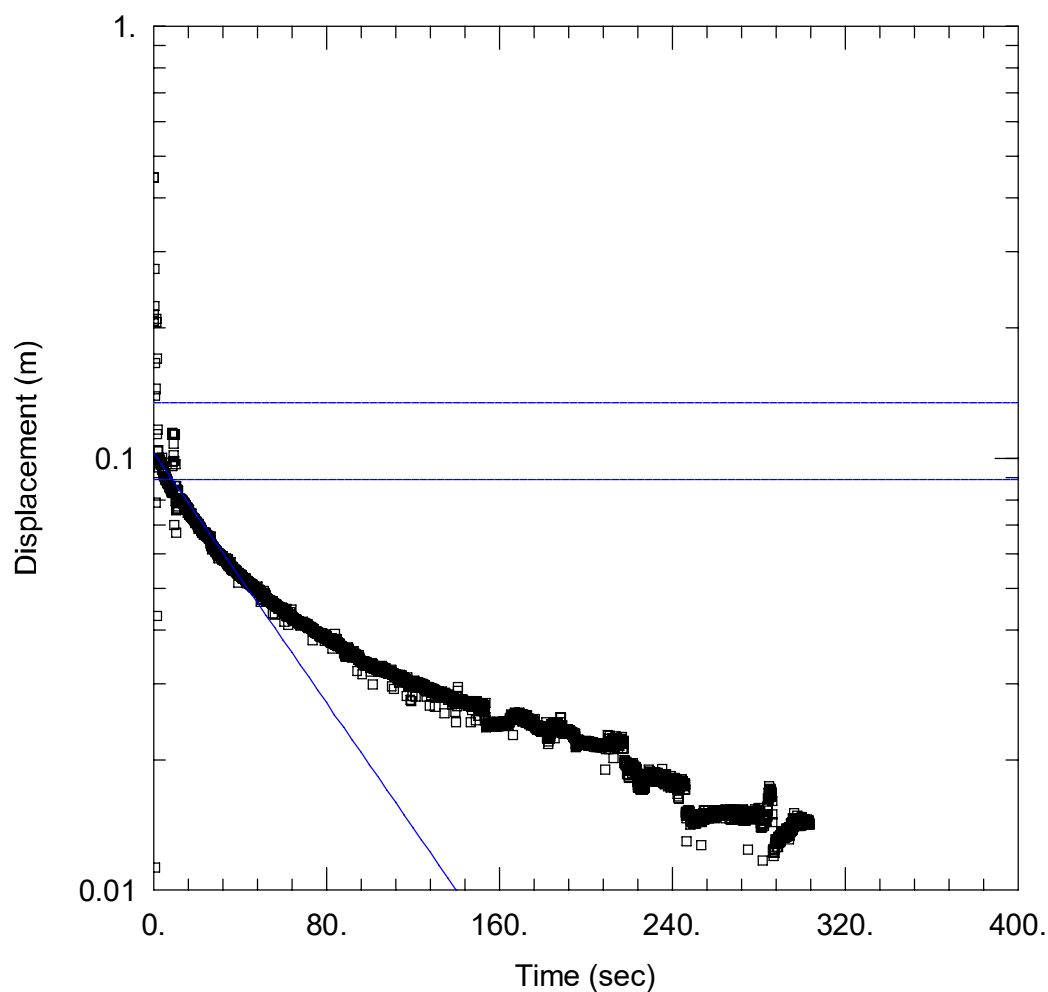
SOLUTION

Aquifer Model: Unconfined

$K = 0.2068$ m/day

Solution Method: Bouwer-Rice

$y_0 = 0.1091$ m



WELL TEST ANALYSIS

Data Set: V:\...\P4-Test2-Falling Head.aqt

Date: 03/13/26

Time: 07:28:41

PROJECT INFORMATION

Company: WGA

Project: WGA242463

Location: SL1 - Industrial North

Test Well: P1

Test Date: 23/02/2026

AQUIFER DATA

Saturated Thickness: 14.71 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (P4)

Initial Displacement: 0.4467 m

Total Well Penetration Depth: 1.084 m

Casing Radius: 0.02 m

Static Water Column Height: 1.084 m

Screen Length: 1.084 m

Well Radius: 0.0375 m

Gravel Pack Porosity: 0.2

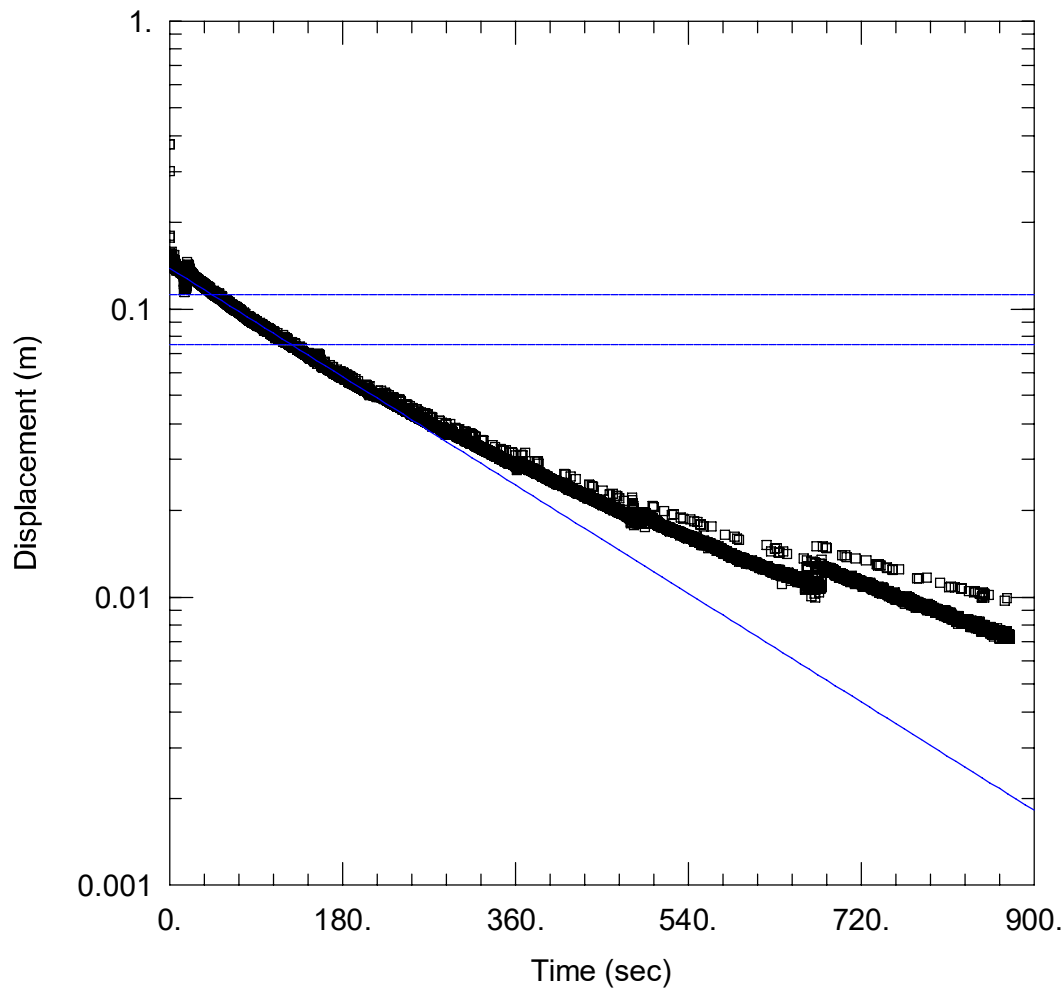
SOLUTION

Aquifer Model: Unconfined

$K = 0.813$ m/day

Solution Method: Bouwer-Rice

$y_0 = 0.1028$ m



WELL TEST ANALYSIS

Data Set: V:\...\P4-Test2-Rising Head.aqt

Date: 03/13/26

Time: 07:28:46

PROJECT INFORMATION

Company: WGA

Project: WGA242463

Location: SL1 - Industrial North

Test Well: P1

Test Date: 23/02/2026

AQUIFER DATA

Saturated Thickness: 14.71 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (P4)

Initial Displacement: 0.3743 m

Total Well Penetration Depth: 1.084 m

Casing Radius: 0.02 m

Static Water Column Height: 1.084 m

Screen Length: 1.084 m

Well Radius: 0.0375 m

Gravel Pack Porosity: 0.2

SOLUTION

Aquifer Model: Unconfined

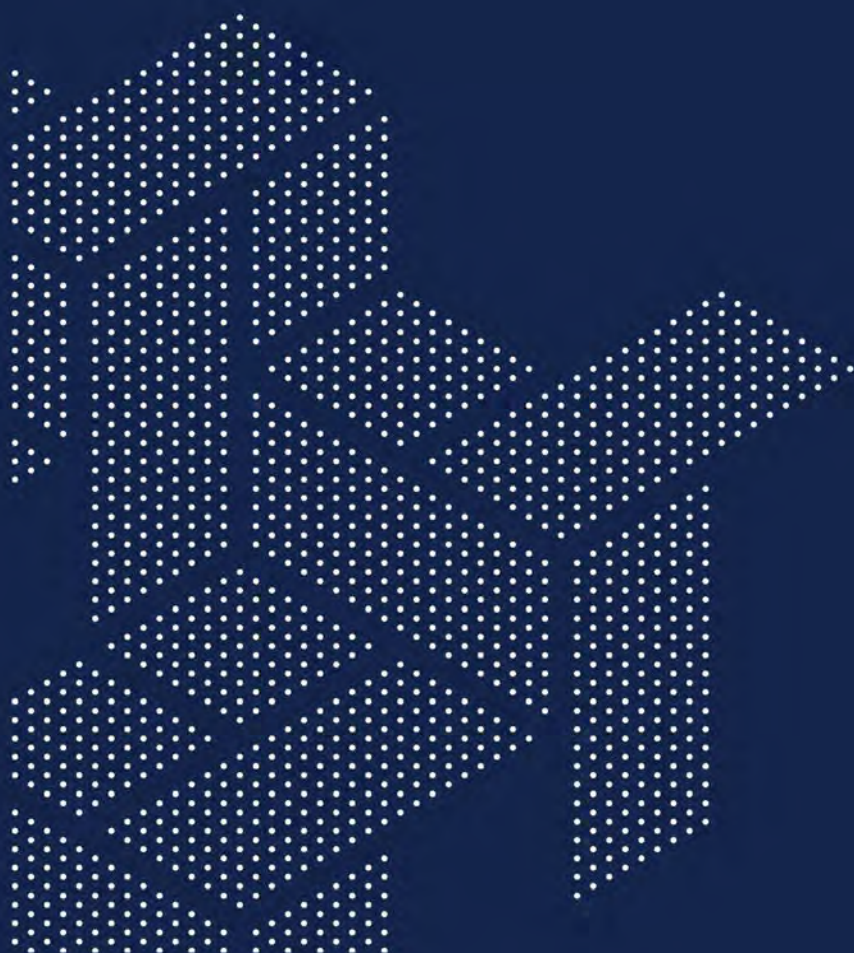
$K = 0.2353$ m/day

Solution Method: Bouwer-Rice

$y_0 = 0.1387$ m

APPENDIX D

MAVEN DESIGNS



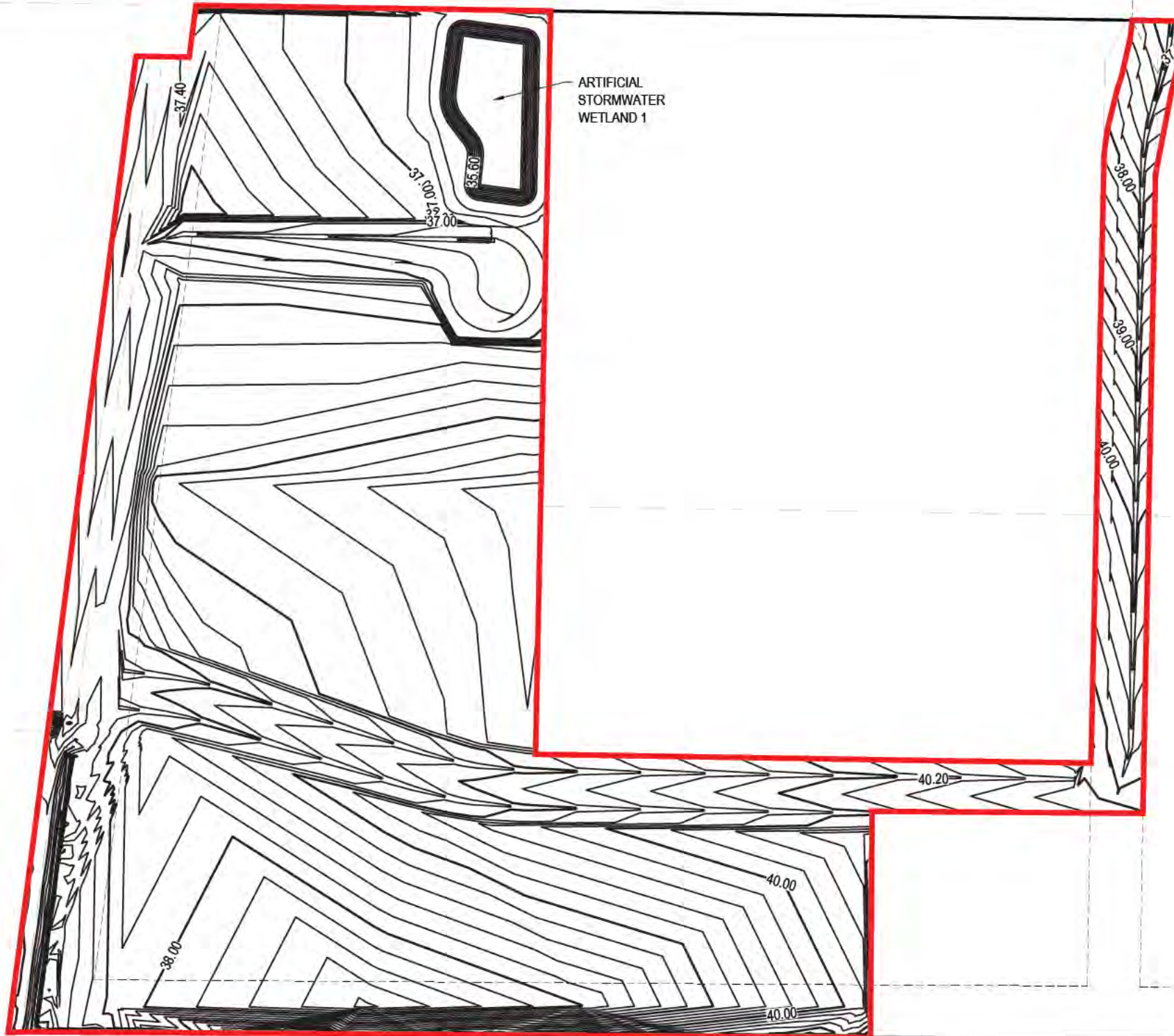
Project no.	298002		
Scale	1:5000 @ A3		
Cad file	298002-I1-C200 EARTHWORKS.DWG		
Drawing no.	C200	Rev	C

1400150 *See* 1400149



HIGGINS ROAD

WICKHAM STREET



ARTIFICIAL
STORMWATER
WETLAND 1

LOT 1 DP5 51437

- NOTES
1. ALL WORKS TO BE IN ACCORDANCE WITH WAIKATO REGIONAL COUNCIL EROSION AND SEDIMENT CONTROL: GUIDELINES FOR SOIL DISTURBING ACTIVITIES TR 2009/02.
 2. COORDINATES IN TERMS OF NZ GEODETIC DATUM MT EDEN 2000
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 7. CONTRACTOR SHALL PROVIDE AS-BUILT OF WORKING SEDIMENT CONTROL DEVICES AND CONFIRMATION OF POND/DECENT VOLUMES TO ENGINEER.

LEGEND

---	EX BDY
---	PROP BDY
---	PR MAJOR CONTOUR
---	PR MINOR CONTOUR

C	DRAFT	MKS	06/2026
B	DRAFT	MKS	06/2026
A	DRAFT	MKS	06/2026
Rev	Description	By	Date
Survey	MAVEN		05/2025
Design	MKS		06/2026
Drawn	MKS		06/2026
Checked	SM		06/2026

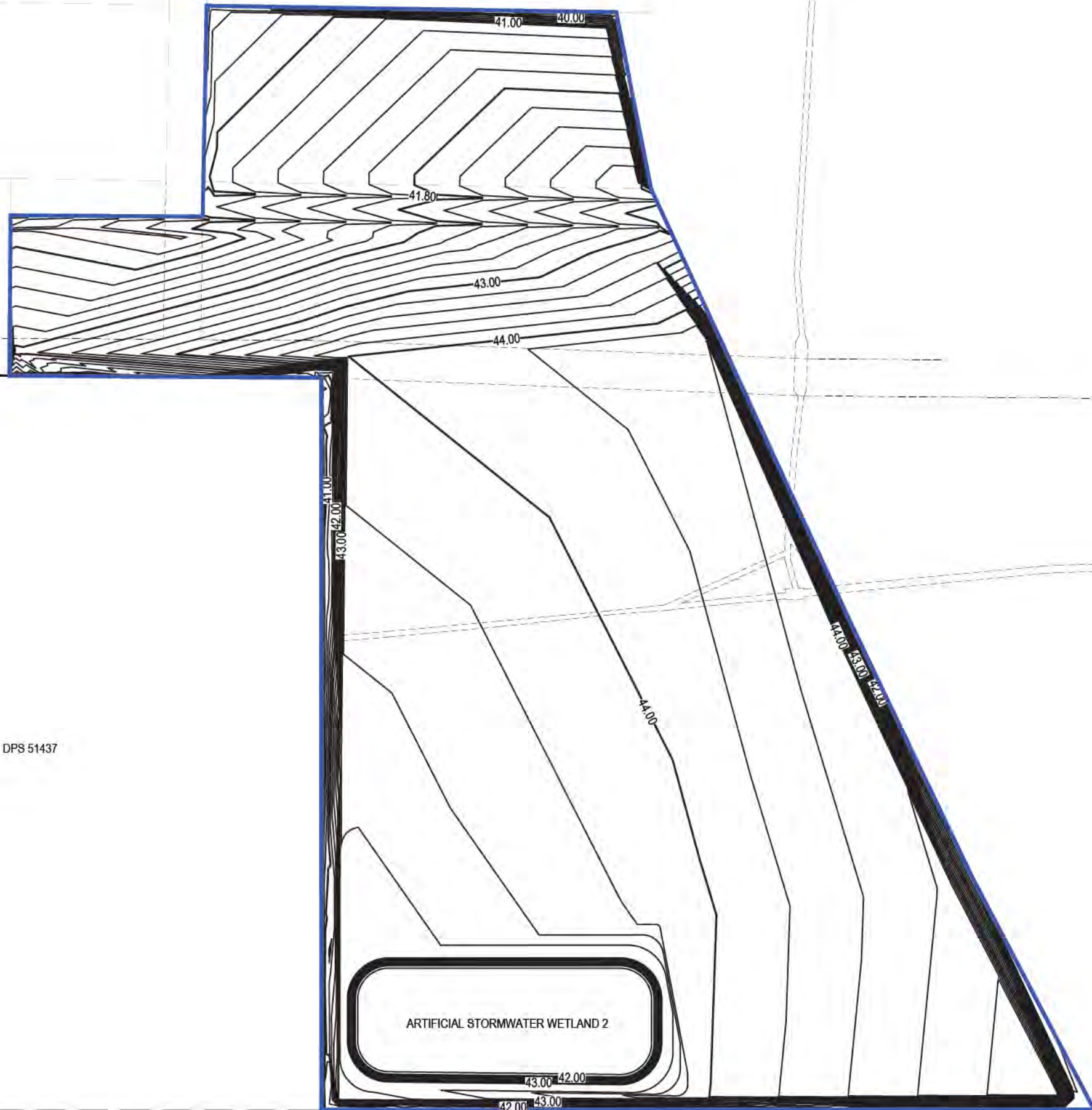
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Project
**SOUTHERN LINKS 1
INDUSTRIAL STAGE 1
HAMILTON, WAIKATO
FOR SL1
NORTHERN CONSORTIUM**

Title
**PROPOSED
CONTOUR PLAN
STAGE 1A**

Project no.	298002
Scale	1:2000 @ A3
Cad file	298002-11-C200 EARTHWORKS.DWG
Drawing no.	C200-1
Rev	C

DRAFT FOR REVIEW



- NOTES
1. ALL WORKS TO BE IN ACCORDANCE WITH WAIKATO REGIONAL COUNCIL EROSION AND SEDIMENT CONTROL: GUIDELINES FOR SOIL DISTURBING ACTIVITIES TR 2009/02.
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LEGEND

---	EX BDY
---	PROP BDY
---	PR MAJOR CONTOUR
---	PR MINOR CONTOUR

C	DRAFT	MKS	06/2026
B	DRAFT	MKS	06/2026
A	DRAFT	MKS	06/2026
Rev	Description	By	Date
		By	Date
Survey	MAVEN		05/2025
Design	MKS		06/2026
Drawn	MKS		06/2026
Checked	SM		06/2026

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Project
**SOUTHERN LINKS 1
INDUSTRIAL STAGE 1
HAMILTON, WAIKATO
FOR SL1
NORTHERN CONSORTIUM**

Title
**PROPOSED
CONTOUR PLAN
STAGE 1B**

Project no.	298002		
Scale	1:2500 @ A3		
Cad file	298002-1-C200 EARTHWORKS.DWG		
Drawing no.	C200-2	Rev	C

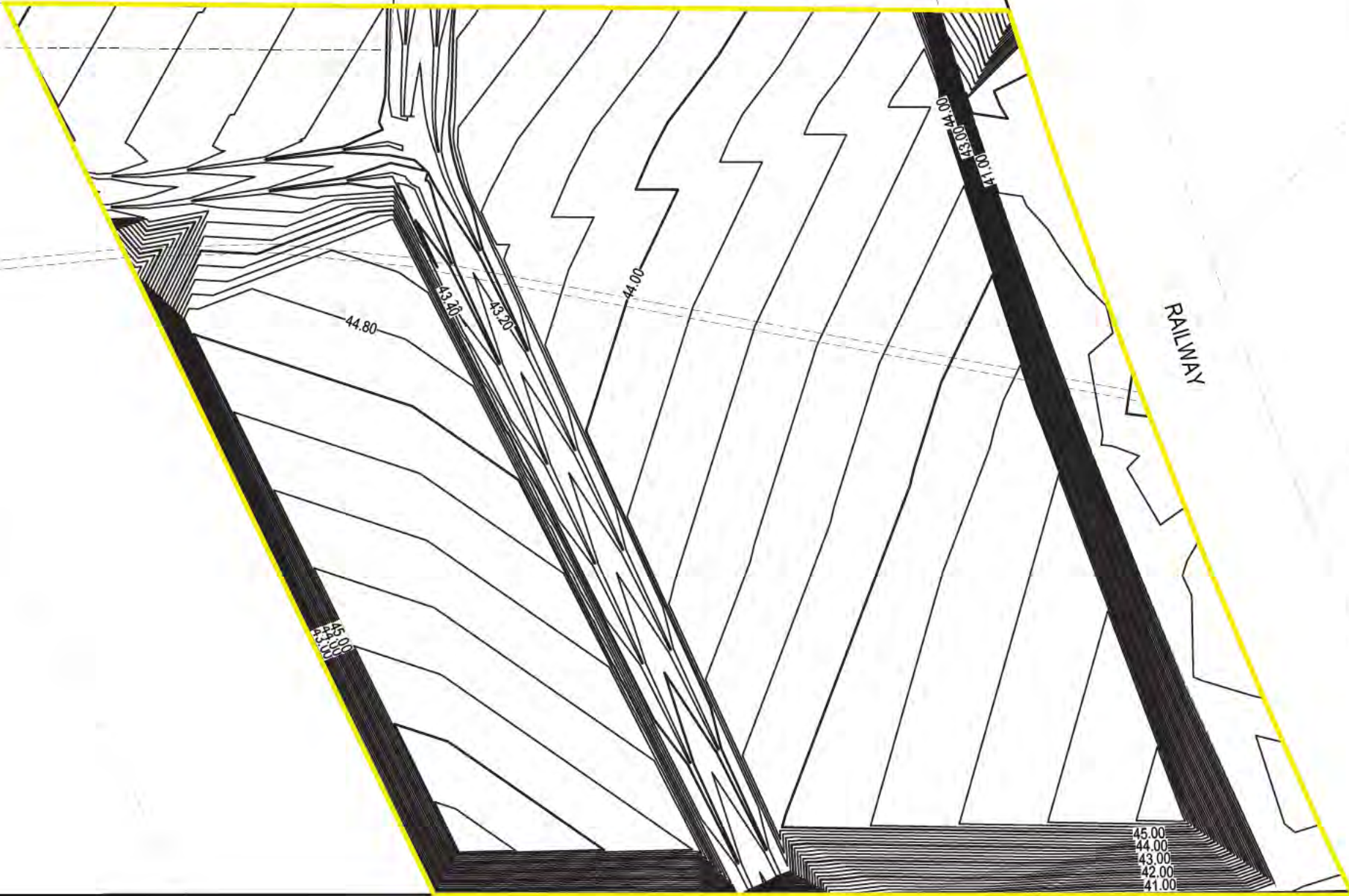
DRAFT FOR REVIEW

PART LOT 2 DPS 4764

LOT 2 DPS 51437

LOT 1 DPS 51437

ARTIFICIAL STORMWATER WETLAND 2



- NOTES
1. ALL WORKS TO BE IN ACCORDANCE WITH WAIKATO REGIONAL COUNCIL EROSION AND SEDIMENT CONTROL: GUIDELINES FOR SOIL DISTURBING ACTIVITIES TR 2009/02.
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LEGEND

---	EX BDY
---	PROP BDY
---	PR MAJOR CONTOUR
---	PR MINOR CONTOUR

C	DRAFT	MKS	06/2026
B	DRAFT	MKS	06/2026
A	DRAFT	MKS	06/2026
Rev	Description	By	Date
		By	Date
Survey	MAVEN		05/2025
Design	MKS		06/2026
Drawn	MKS		06/2026
Checked	SM		06/2026

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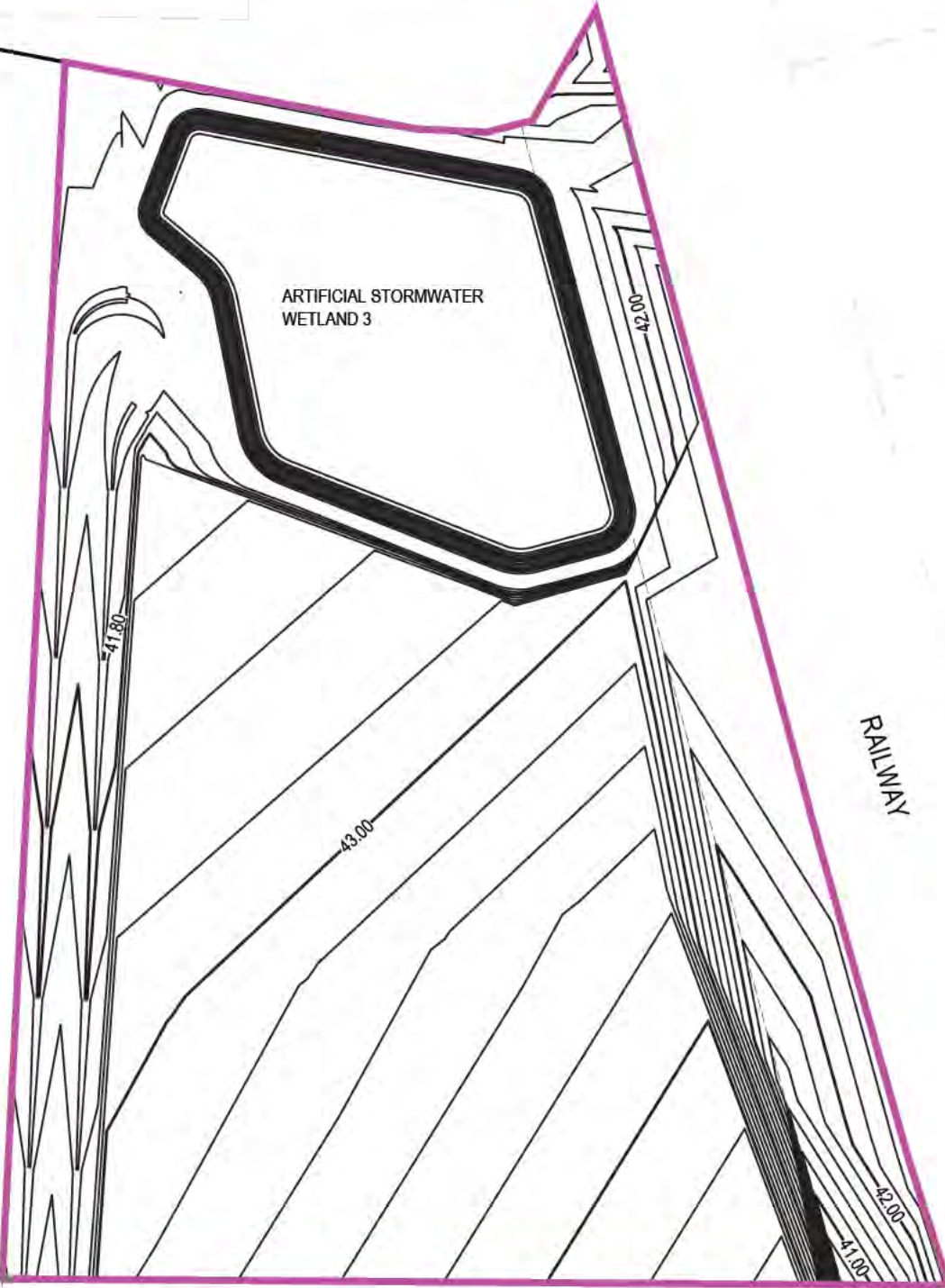
Project
**SOUTHERN LINKS 1
INDUSTRIAL STAGE 1
HAMILTON, WAIKATO
FOR SL1
NORTHERN CONSORTIUM**

Title
**PROPOSED
CONTOUR PLAN
STAGE 2**

Project no.	298002		
Scale	1:2500 @ A3		
Cad file	298002-11-C200 EARTHWORKS.DWG		
Drawing no.	C200-3	Rev	C

LOT 2 DPS 51437

DRAFT FOR REVIEW



- NOTES
1. ALL WORKS TO BE IN ACCORDANCE WITH WAIKATO REGIONAL COUNCIL EROSION AND SEDIMENT CONTROL: GUIDELINES FOR SOIL DISTURBING ACTIVITIES TR 2009/02.
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LEGEND

---	EX BDY
---	PROP BDY
---	PR MAJOR CONTOUR
---	PR MINOR CONTOUR

C	DRAFT	MKS	06/2026
B	DRAFT	MKS	06/2026
A	DRAFT	MKS	06/2026
Rev	Description	By	Date
		By	Date
Survey	MAVEN		05/2025
Design	MKS		06/2026
Drawn	MKS		06/2026
Checked	SM		06/2026



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Project
**SOUTHERN LINKS 1
INDUSTRIAL STAGE 1
HAMILTON, WAIKATO
FOR SL1
NORTHERN CONSORTIUM**

Title
**PROPOSED
CONTOUR PLAN
STAGE 3**

Project no.	298002		
Scale	1:2000 @ A3		
Cad file	298002-11-C200 EARTHWORKS.DWG		
Drawing no.	C200-4	Rev	C

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WICKHAM STREET

LATHAM COURT

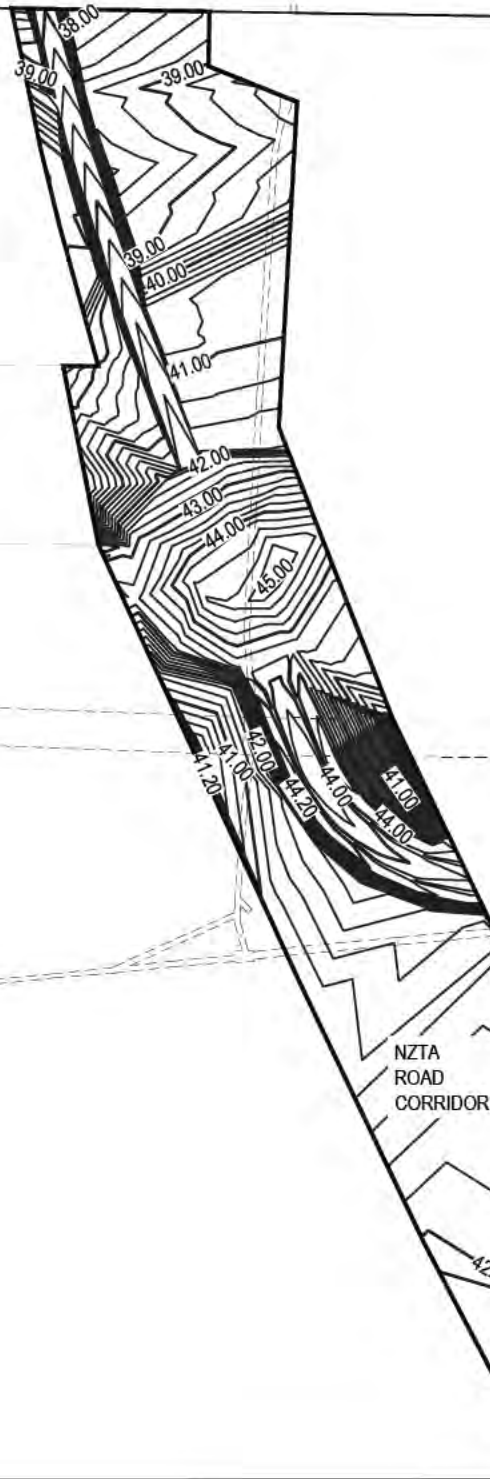
RAILWAY

LOT 1 DPS 51437

PART LOT 2 DPS 4764

LOT 2 DPS 51437

NZTA
ROAD
CORRIDOR



- NOTES
1. ALL WORKS TO BE IN ACCORDANCE WITH WAIKATO REGIONAL COUNCIL EROSION AND SEDIMENT CONTROL: GUIDELINES FOR SOIL DISTURBING ACTIVITIES TR 2009/02.
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LEGEND

---	EX BDY
---	PROP BDY
---	PR MAJOR CONTOUR
---	PR MINOR CONTOUR

A.	DRAFT	MKS	06/2026
Rev	Description	By	Date
Survey	MAVEN		05/2025
Design	MKS		06/2026
Drawn	MKS		06/2026
Checked	SM		06/2026

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Project
**SOUTHERN LINKS 1
INDUSTRIAL STAGE 1
HAMILTON, WAIKATO
FOR SL1
NORTHERN CONSORTIUM**

Title
**PROPOSED
CONTOUR PLAN
STAGE HSL**

Project no.	298002		
Scale	1:4000 @ A3		
Cad file	298002-11-C200 EARTHWORKS.DWG		
Drawing no.	C200-5	Rev	A

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WICKHAM STREET

LATHAM COURT

RAILWAY

LOT 1 DPS 51437

NZTA
ROAD
CORRIDOR

PART LOT 2 DPS 4764

LOT 2 DPS 51437

DRAFT FOR REVIEW

- NOTES
1. ALL WORKS TO BE IN ACCORDANCE WITH WAIKATO REGIONAL COUNCIL EROSION AND SEDIMENT CONTROL: GUIDELINES FOR SOIL DISTURBING ACTIVITIES TR 2009/02.
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LEGEND

	EX BOY
	PROP BOY
	PR MAJOR CONTOUR
	PR MINOR CONTOUR

A	DRAFT	MKS	07/2026
Rev	Description	By	Date
Survey	MAVEN		05/2025
Design	MKS		07/2026
Drawn	MKS		07/2026
Checked	SM		07/2026

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Project
**SOUTHERN LINKS 1
INDUSTRIAL STAGE 1
HAMILTON, WAIKATO
FOR SL1
NORTHERN CONSORTIUM**

Title
**PROPOSED
CONTOUR PLAN
STAGE HSL OPTION 2**

Project no.	298002
Scale	1:4000 @ A3
Cad file	298002-11-C200 EARTHWORKS.DWG
Drawing no.	C200-6
Rev	A



- NOTES
1. ALL WORKS TO BE IN ACCORDANCE WITH WAIKATO REGIONAL INFRASTRUCTURE TECHNICAL SPECIFICATIONS.
 2. CO-ORDINATES IN TERMS OF NZ GEODETIC DATUM MT EDEN 2000.
 3. LEVELS IN TERMS OF THE NEW ZEALAND VERTICAL DATUM 2016.
 4. IT IS THE CONTRACTORS RESPONSIBILITY TO LOCATE ALL SERVICES THAT MAY BE AFFECTED BY HIS OPERATIONS.

- LEGEND
- EX BDY
 - PROP BDY
 - 1M PRELOAD
 - 1.5M PRELOAD
 - 2M PRELOAD
 - 3M PRELOAD
 - 4M PRELOAD
 - 4.5M PRELOAD

B	DRAFT	MKS	06/2026
A	DRAFT	MKS	06/2026
Rev	Description	By	Date
		By	Date
Survey	MAVEN		05/2025
Design	MKS		06/2026
Drawn	MKS		06/2026
Checked	SM		06/2026



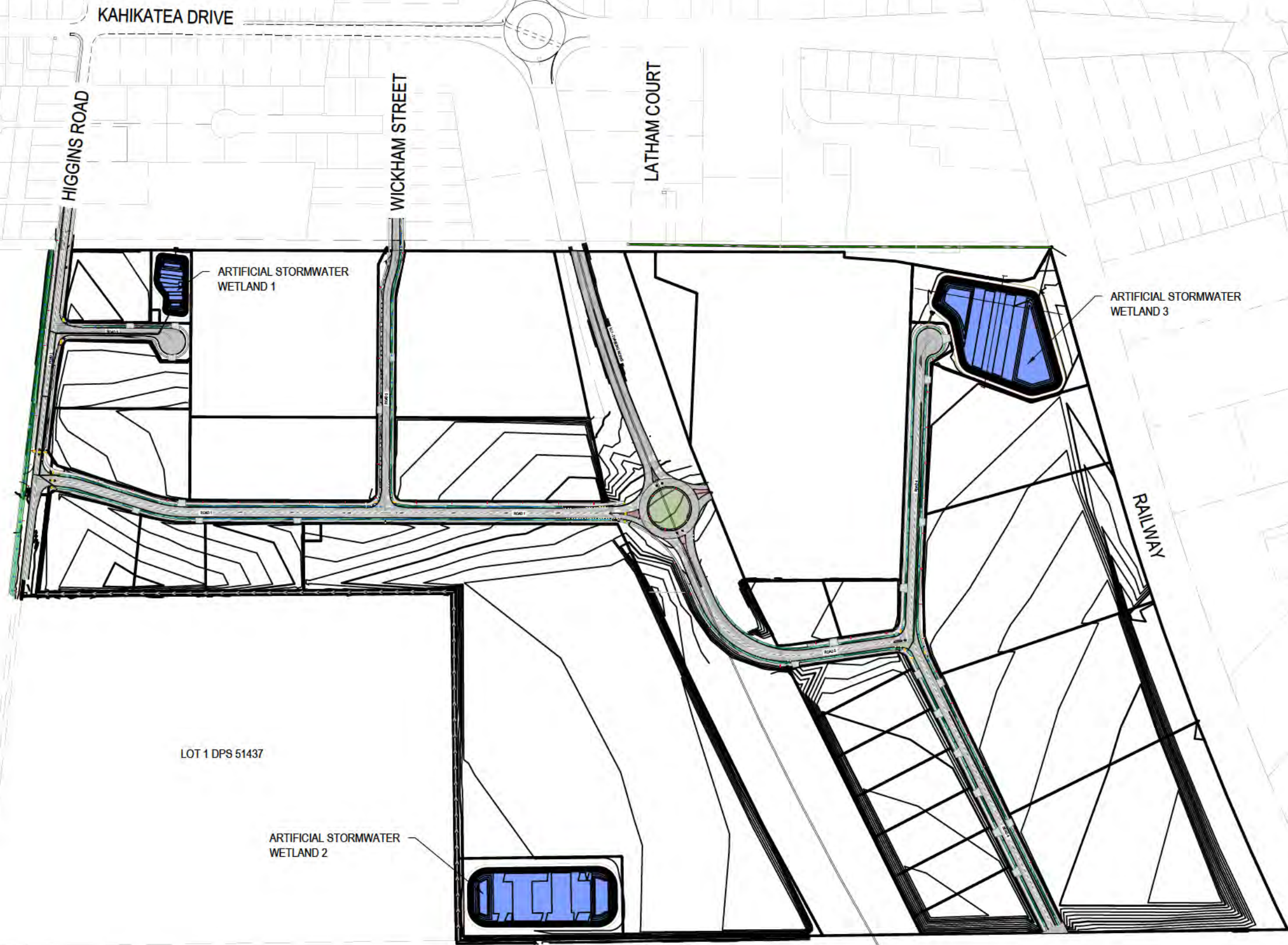
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Project
**SOUTHERN LINKS 1
INDUSTRIAL STAGE 1
HAMILTON, WAIKATO
FOR SL1
NORTHERN CONSORTIUM**

Title
**PROPOSED
PEAT PRELOAD
OVERVIEW PLAN**

Project no.	298002		
Scale	1:5000 @ A3		
Cad file	298002-11-C215 PEAT PRELOAD.DWG		
Drawing no.	C215	Rev	B

DRAFT FOR REVIEW



- NOTES
1. ALL WORKS TO BE IN ACCORDANCE WITH WAIKATO REGIONAL INFRASTRUCTURE TECHNICAL SPECIFICATIONS.
 2. CO-ORDINATES IN TERMS OF NZ GEODETIC DATUM MT EDEN 2000. LEVELS IN TERMS OF THE NEW ZEALAND VERTICAL DATUM 2016. CONVERSION TO MOTURIKI 1953 CAN BE ACHIEVED BY ADDING 0.2594M.
 3. IT IS THE CONTRACTORS RESPONSIBILITY TO LOCATE ALL SERVICES THAT MAY BE AFFECTED BY HIS OPERATIONS.
 4. ALL CONCRETE SW PIPE TO BE INSTALLED IN ACCORDANCE WITH AS/NZS 3725:2007 FOR BURIED CONCRETE PIPES AND AS/NZ 4058:2007 FOR PRECAST CONCRETE PIPES (PRESSURE AND NON-PRESSURE) AS STIPULATED IN THE RITS 2018.
 5. APPROVED HARDFILL IS TO BE USED IN BACKFILLING OF ALL STORMWATER LINES WITHIN THE ROAD RESERVE.
 6. HEAVY DUTY MANHOLE LIDS AND FRAMES TO BE USED IN TRAFFICKED AREAS.
 7. ALL CESSPIT LEADS SHALL HAVE MIN COVER 0.9M.
 8. ALL LINES ARE TO BE CLASS4 RCRRJ UNLESS SHOWN OTHERWISE.
 9. ALL LINES TO BE ABANDONED SHALL BE SEALED AT EACH END. TIMING OF ALL SEALING TO BE COORDINATED WITH COUNCIL STAFF.

Legend

	EX BOUNDARY
	PR STORMWATER
	PROP WETLAND

B	DRAFT	MKS	06/2026
A	DRAFT	MKS	06/2026
Rev	Description	By	Date
		By	Date
Survey	MAVEN		05/2025
Design	MKS		06/2026
Drawn	MKS		06/2026
Checked	SM		06/2026

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Project
**SOUTHERN LINKS 1
INDUSTRIAL STAGE 1
HAMILTON, WAIKATO
FOR SL1
NORTHERN CONSORTIUM**

Title
**PROPOSED
SW WETLAND
OVERVIEW PLAN**

Project no.	298002		
Scale	1:5000 @ A3		
Cad file	298002-11-C440 SW WETLAND.DWG		
Drawing no.	I1-C440	Rev	B

DRAFT FOR REVIEW



REFER TO PLAN C400
FOR MANHOLE/SCRUFFY
DOME DETAILS

PART LOT 1 DPS 13477

FOREBAY >10% OF
WETLAND AREA

0 HO

CH 20

CH 20

CH 40

CH 40

CH 46

ARTIFICIAL
WETLAND 1

09 HO

08 HO

98 HO

STORMWATER WETLAND C
VOLUME: 2,938m³
CATCHMENT AREA: 3.6 HA

MAINTENANCE RAMP
1:12 MAX GRADE

3.5m WIDE SHARED PATH / MAINTENANCE TRACK
OF 50mm MAP20 ON 200mm GAP 65
OR SIMILAR APPROVED

ROAD 5

DRAFT FOR REVIEW

Notes

1. All works to be in accordance with Waikato Regional Infrastructure Technical Specifications.
2. Co-ordinates in terms of NZ Geodetic Datum Mount Eden 2000.
3. Levels in terms of the New Zealand Vertical Datum 2016.
4. It is the contractors responsibility to locate all services that may be affected by his operations.
5. Approved hardfill is to be used in backfilling of all stormwater lines within the road reserve.
6. All catchpit leads shall be laid at 1% unless otherwise specified.
7. All lines to be abandoned shall be sealed at each end. Timing of all sealing to be coordinated with council staff.

Legend

- EX BOUNDARY
- PR STORMWATER
- PROP WETLAND

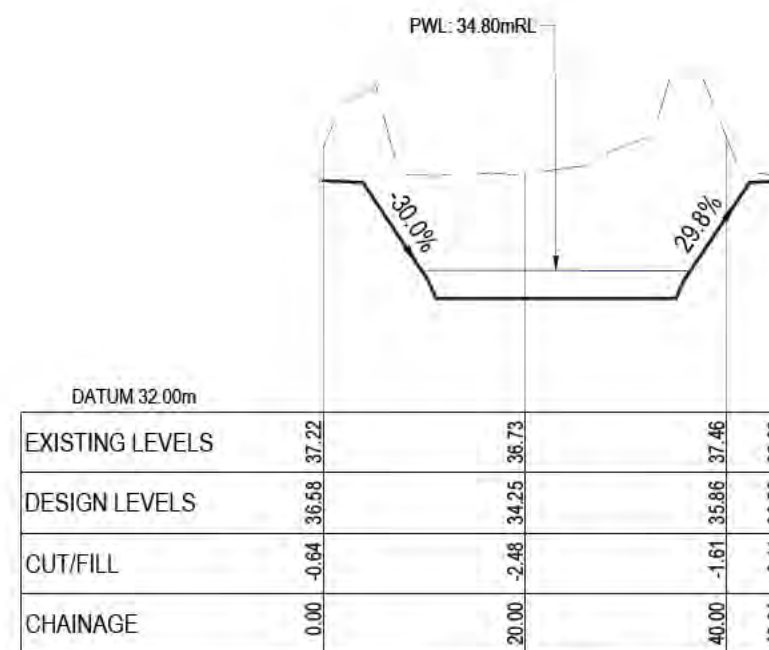
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Rev	Description	By	Date
Survey	MAVEN	05/2025	
Design	MKS	06/2026	
Drawn	MKS	06/2026	
Checked	SM	06/2026	



Project
**SOUTHERN LINKS 1
INDUSTRIAL STAGE 1
HAMILTON, WAIKATO
FOR SL1
NORTHERN CONSORTIUM**

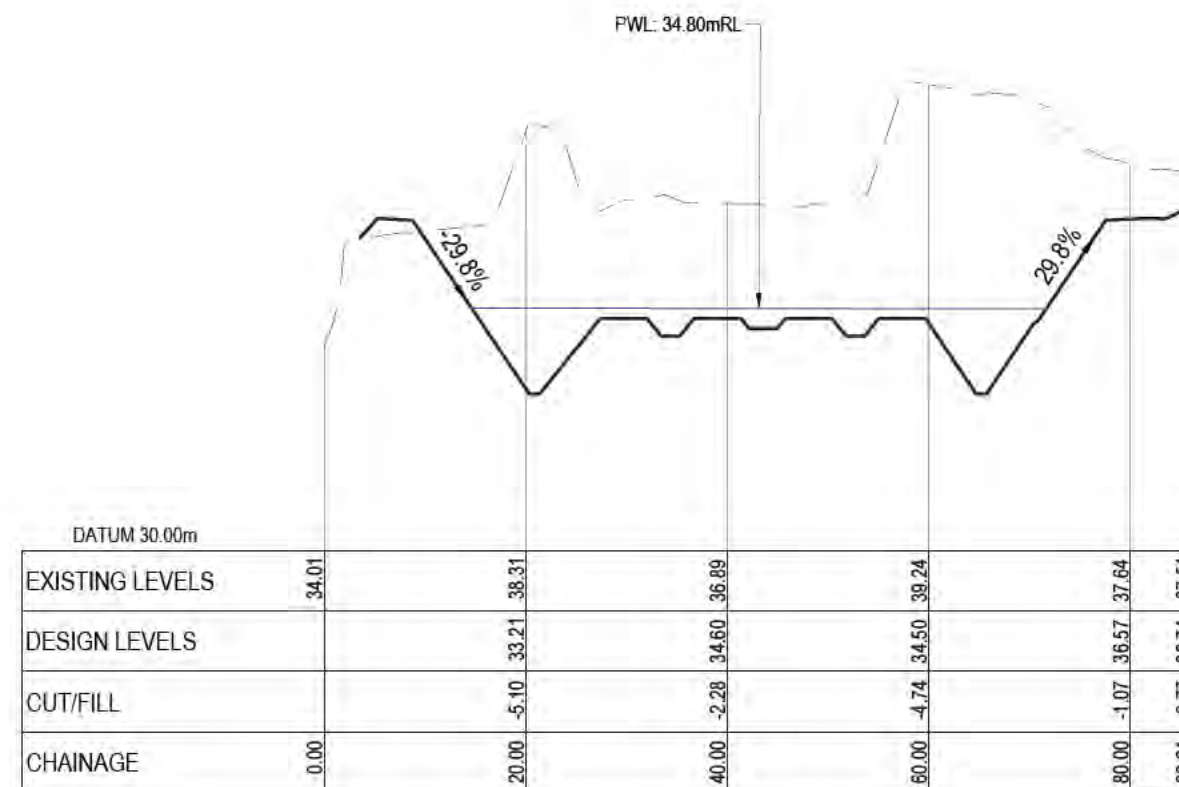
Title
**PROPOSED
SW WETLAND 1
PLAN**

Project no.	298002
Scale	1:500 @ A3
Cad file	298002-I1-C440 SW WETLAND.DWG
Drawing no.	I1-C440-1
Rev	B



WETLAND 1-1
SCALE: HORI 1:750 VERT 1:150

Legend
— EX GROUND LEVEL
— PROP GROUND LEVEL



WETLAND 1-2
SCALE: HORI 1:750 VERT 1:150

DRAFT FOR REVIEW

B	DRAFT	MKS	06/2026
A	DRAFT	MKS	06/2026
Rev	Description	By	Date
	Survey	MAVEN	05/2025
	Design	MKS	06/2026
	Drawn	MKS	06/2026
	Checked	SM	06/2026



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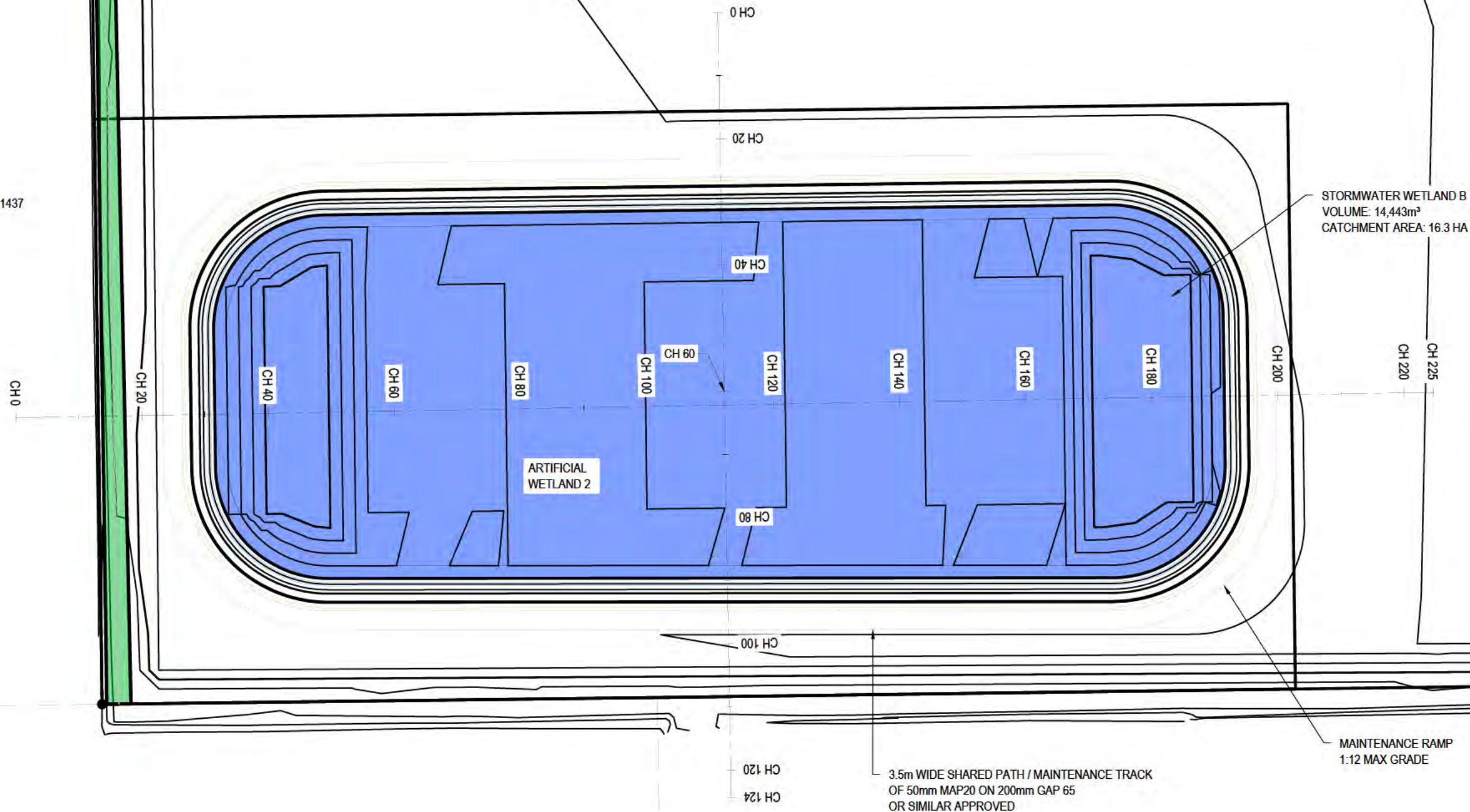
Project
**SOUTHERN LINKS 1
INDUSTRIAL STAGE 1
HAMILTON, WAIKATO
FOR SL1
NORTHERN CONSORTIUM**

Title
**PROPOSED
SW WETLAND 1
DETAILS**

Project no.	298002
Scale	AS SHOWN
Cad file	298002-I1-C440 SW WETLAND.DWG
Drawing no.	I1-C440-2
Rev	B



LOT 1 DPS 51437



PART LOT 2 DPS 4764

LOT 2 DPS 51437

DRAFT FOR REVIEW

- Notes
1. All works to be in accordance with Waikato Regional Infrastructure Technical Specifications.
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Legend

- EX BOUNDARY
- PR STORMWATER
- PROP WETLAND

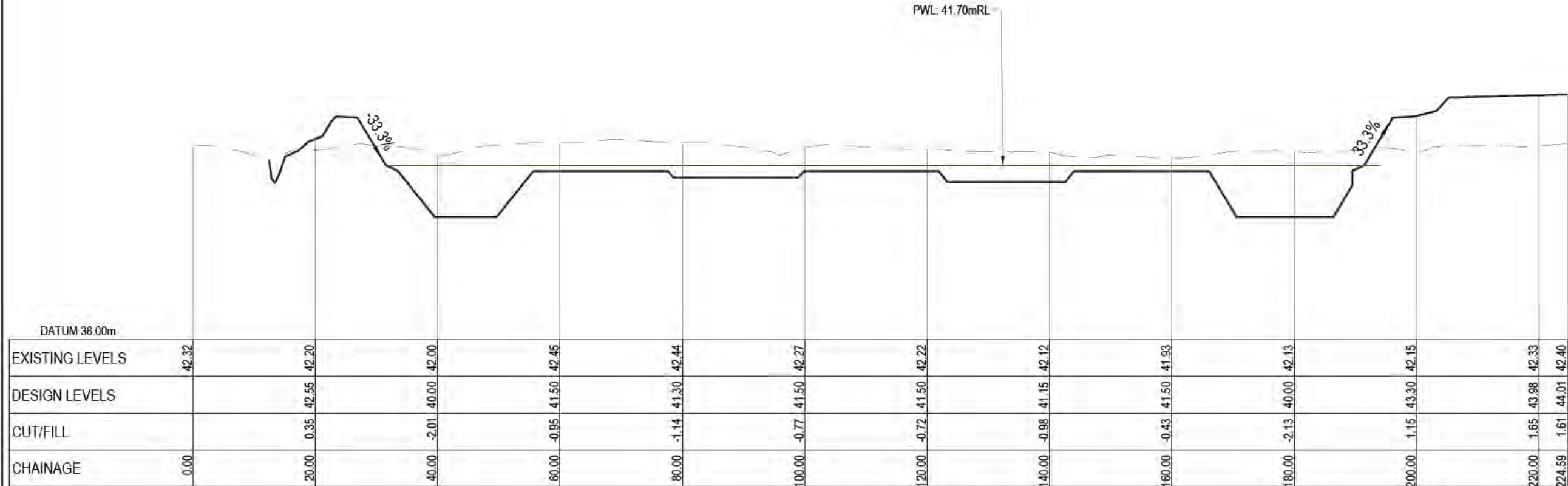
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Rev	Description	By	Date
Survey	MAVEN		05/2025
Design	MKS		06/2026
Drawn	MKS		06/2026
Checked	SM		06/2026

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Project
**SOUTHERN LINKS 1
INDUSTRIAL STAGE 1
HAMILTON, WAIKATO
FOR SL1
NORTHERN CONSORTIUM**

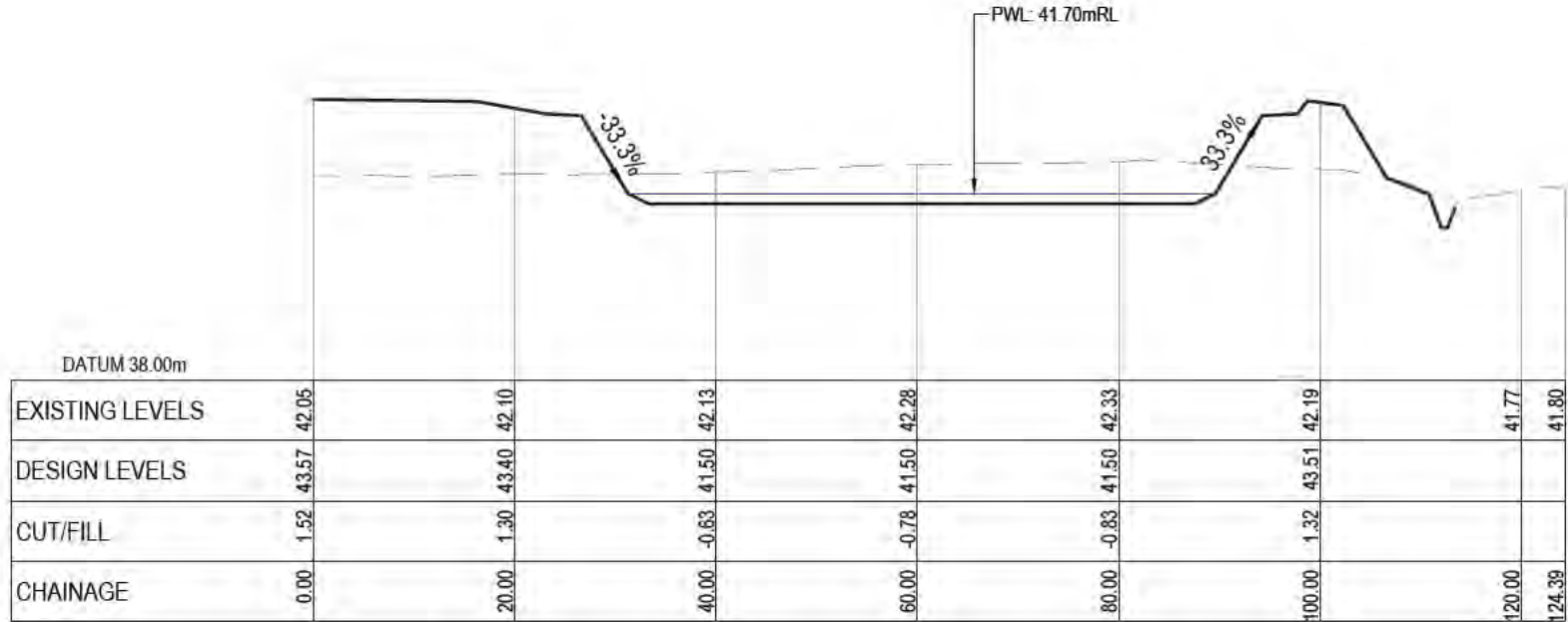
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**PROPOSED
SW WETLAND 2
PLAN**

Project no.	298002
Scale	1:750 @ A3
Cad file	298002-11-C440 SW WETLAND.DWG
Drawing no.	11-C440-3
Rev	B



WETLAND 2-1
SCALE: HORI 1:750 VERT 1:150

Legend
— EX GROUND LEVEL
— PROP GROUND LEVEL



WETLAND 2-2
SCALE: HORI 1:750 VERT 1:150

DRAFT FOR REVIEW

B	DRAFT	MKS	06/2026
A	DRAFT	MKS	06/2026
Rev	Description	By	Date
	By	Date	
Survey	MAVEN	05/2025	
Design	MKS	06/2026	
Drawn	MKS	06/2026	
Checked	SM	06/2026	
M MAVEN Maven Waikato 07 242 0801 info@maven.co.nz www.maven.co.nz Level 1 286 Victoria Street, Hamilton New Zealand			
Project SOUTHERN LINKS 1 INDUSTRIAL STAGE 1 HAMILTON, WAIKATO FOR SL1 NORTHERN CONSORTIUM			
Title PROPOSED SW WETLAND 2 DETAILS			
Project no.	298002		
Scale	AS SHOWN		
Cad file	298002-I1-C440 SW WETLAND.DWG		
Drawing no.	I1-C440-4	Rev	B



STORMWATER WETLAND A
VOLUME: 18,391m³
CATCHMENT AREA: 20.8 HA

FOREBAY >10% OF
WETLAND AREA

ARTIFICIAL
WETLAND 3

RAILWAY

REFER TO PLAN C400
FOR MANHOLE/SCRUFFY
DOME DETAILS

MAINTENANCE RAMP
1:12 MAX GRADE

3.5m WIDE SHARED PATH / MAINTENANCE TRACK
OF 50mm MAP20 ON 200mm GAP 65
OR SIMILAR APPROVED

DRAFT FOR REVIEW

Notes

1. All works to be in accordance with Waikato Regional Infrastructure Technical Specifications.
2. Co-ordinates in terms of NZ Geodetic Datum Mount Eden 2000.
3. Levels in terms of the New Zealand Vertical Datum 2016.
4. It is the contractors responsibility to locate all services that may be affected by his operations.
5. Approved hardfill is to be used in backfilling of all stormwater lines within the road reserve.
6. All catchpit leads shall be laid at 1% unless otherwise specified.
7. All lines to be abandoned shall be sealed at each end. Timing of all sealing to be coordinated with council staff.

Legend

- EX BOUNDARY
- PR STORMWATER
- PROP WETLAND

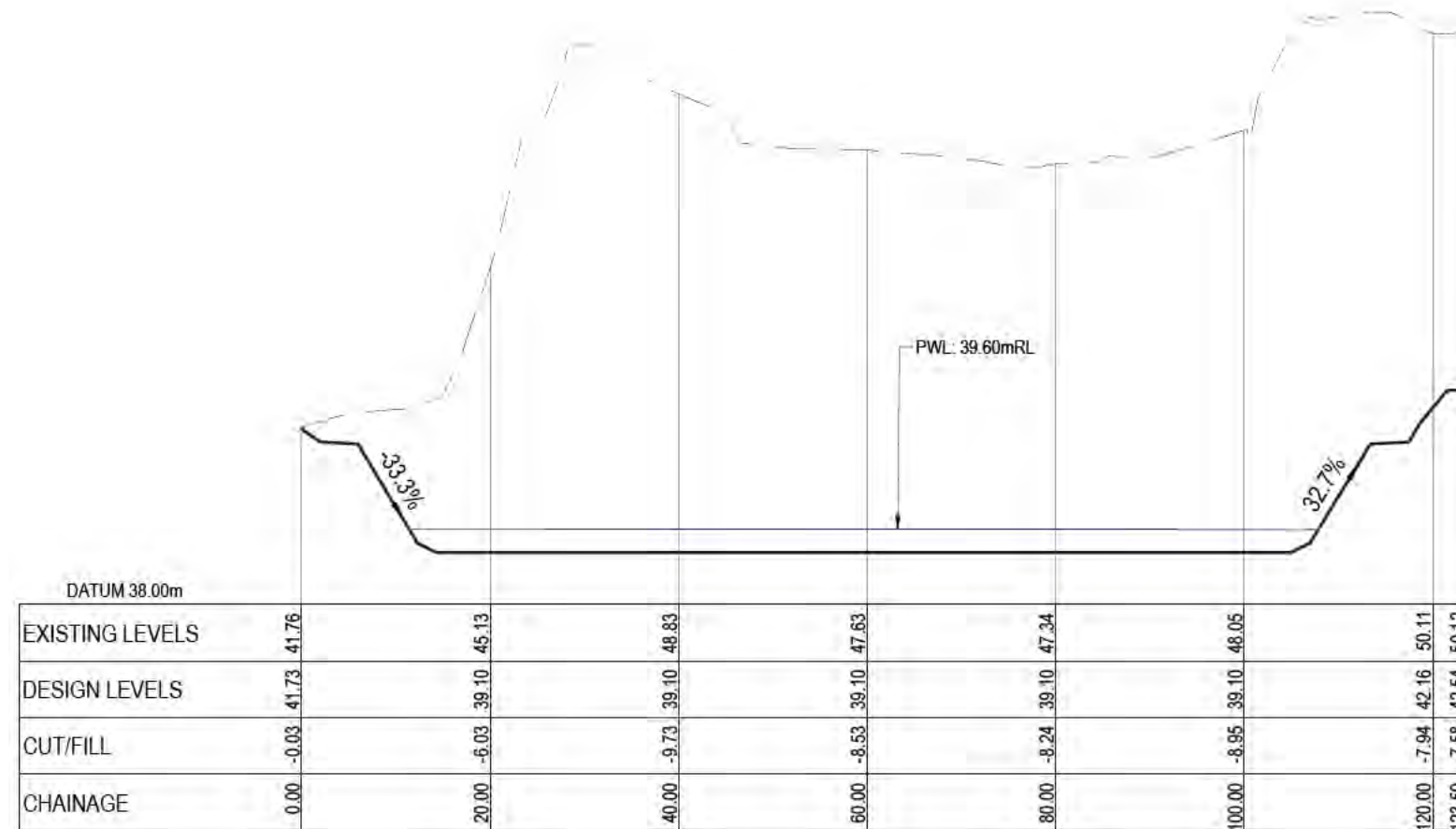
Rev	Description	By	Date
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Rev	Description	By	Date
Survey	MAVEN		05/2025
Design	MKS		06/2026
Drawn	MKS		06/2026
Checked	SM		06/2026



Project
**SOUTHERN LINKS 1
INDUSTRIAL STAGE 1
HAMILTON, WAIKATO
FOR SL1
NORTHERN CONSORTIUM**

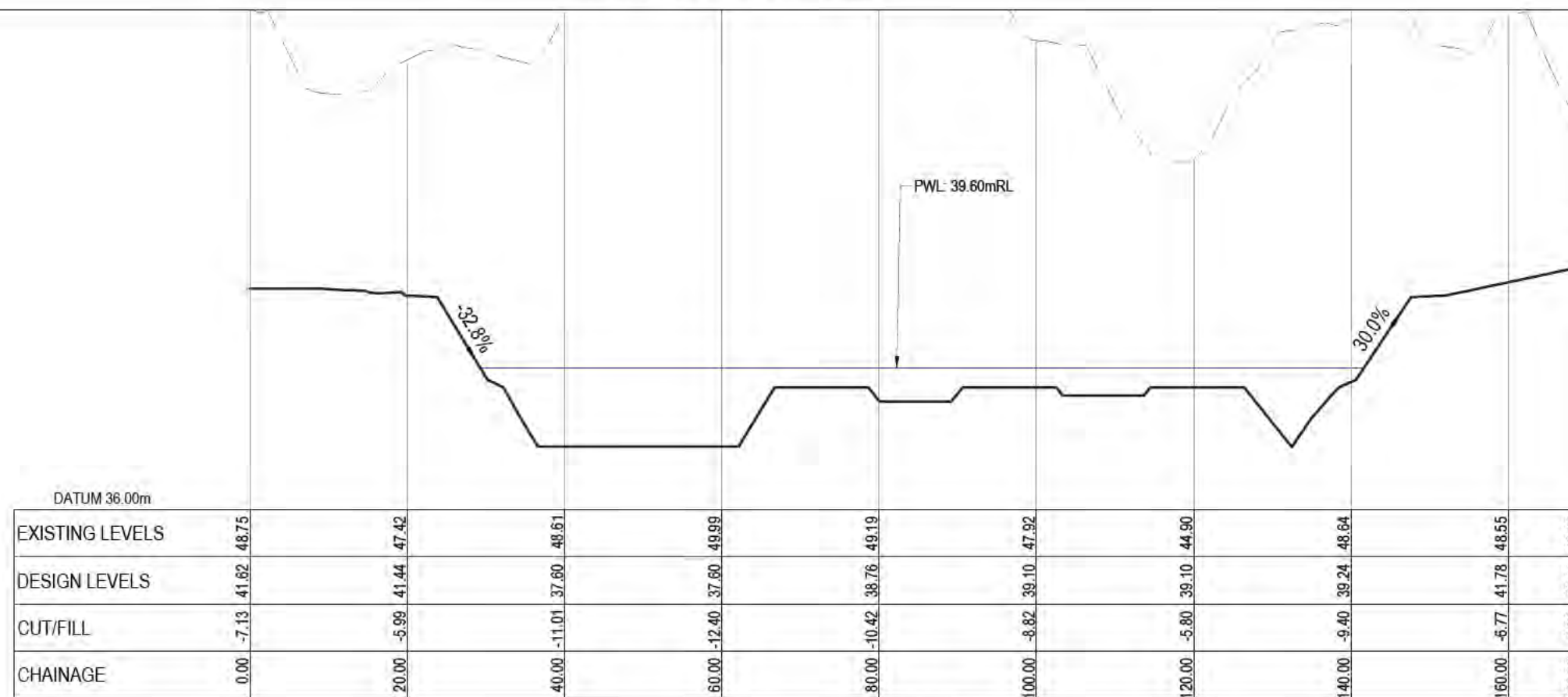
Title
**PROPOSED
SW WETLAND 3
PLAN**

Project no.	298002
Scale	1:1000 @ A3
Cad file	298002-I1-C440 SW WETLAND.DWG
Drawing no.	I1-C440-5
Rev	B



WETLAND 3-1
SCALE: HORI 1:750 VERT 1:150

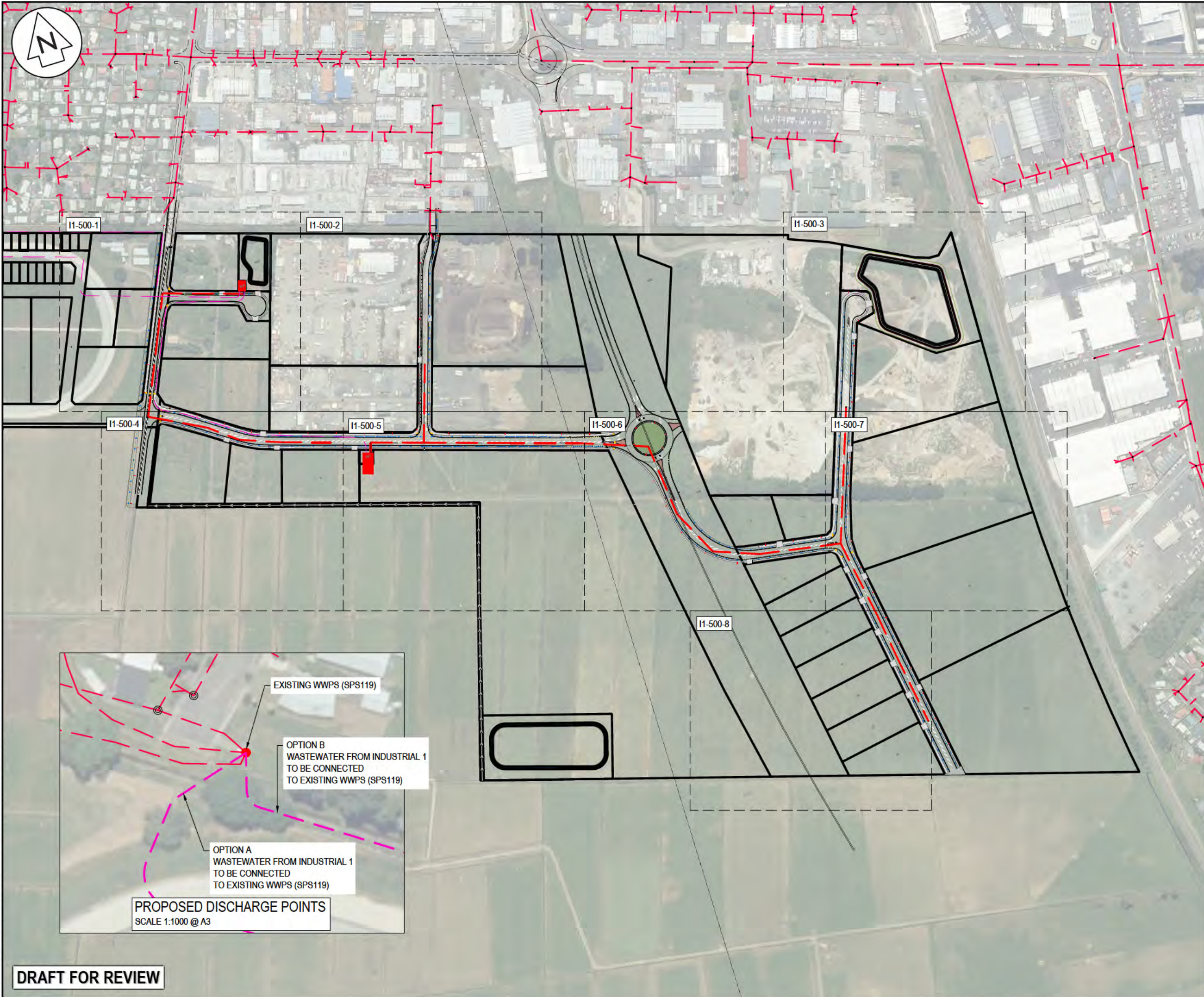
Legend
— EX GROUND LEVEL
— PROP GROUND LEVEL



WETLAND 3-2
SCALE: HORI 1:750 VERT 1:150

DRAFT FOR REVIEW

B	DRAFT	MKS	06/2026
A	DRAFT	MKS	06/2026
Rev	Description	By	Date
	By	Date	
Survey	MAVEN	05/2025	
Design	MKS	06/2026	
Drawn	MKS	06/2026	
Checked	SM	06/2026	
M MAVEN Maven Waikato 07 242 0801 info@maven.co.nz www.maven.co.nz Level 1 298 Victoria Street, Hamilton New Zealand			
Project SOUTHERN LINKS 1 INDUSTRIAL STAGE 1 HAMILTON, WAIKATO FOR SL1 NORTHERN CONSORTIUM			
Title PROPOSED SW WETLAND 3 DETAILS			
Project no.	298002		
Scale	AS SHOWN		
Cad file	298002-I1-C440 SW WETLAND.DWG		
Drawing no.	I1-C440-6	Rev	B



- NOTES
1. ALL WORKS TO BE IN ACCORDANCE WITH WAIKATO REGIONAL INFRASTRUCTURE TECHNICAL SPECIFICATIONS.
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 9. MEASUREMENTS SHOWN ON LOT CONNECTIONS ARE DISTANCE TO CENTER OF LOT CONNECTION FROM THE NEAREST DOWNSTREAM MANHOLE.

LEGEND

---	EX BDY
---	PROP BDY
---	EX WASTEWATER
---	PROP WASTEWATER
---	PROP RISING MAIN
○	EX/PROP WWMH
+	PR WW LOT CON

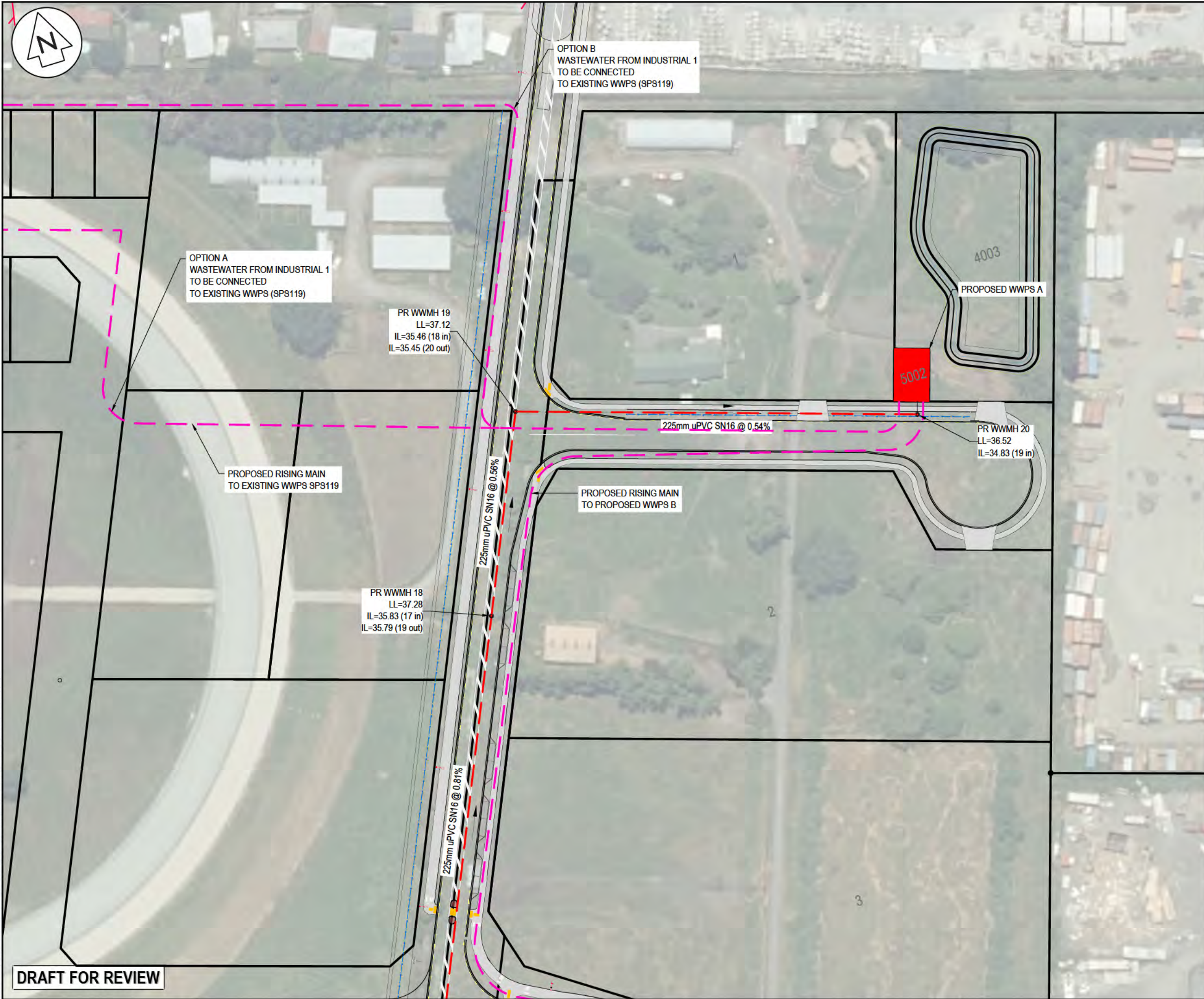
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A	DRAFT	MKS	06/2026
Rev	Description	By	Date
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	Design	MKS	04/2026
	Drawn	MKS	04/2026
	Checked	SM	04/2026

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Project
**SOUTHERN LINKS 1
INDUSTRIAL STAGE 1
HAMILTON, WAIKATO
FOR SL1
NORTHERN CONSORTIUM**

Title
**PROPOSED
WASTEWATER
OVERVIEW PLAN**

Project no.	298002		
Scale	1:5000 @ A3		
Cad file	298002-I1-C500 WWW.DWG		
Drawing no.	I1-C500	Rev	B



NOTES

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---	PROP BDY
---	EX WASTEWATER
---	PROP WASTEWATER
---	PROP RISING MAIN
○	EX/PROP WWMH
+	PR WW LOT CON

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		By	Date
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Design	MKS		04/2026
Drawn	MKS		04/2026
Checked	SM		04/2026

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Project

**SOUTHERN LINKS 1
INDUSTRIAL STAGE 1
HAMILTON, WAIKATO
FOR SL1
NORTHERN CONSORTIUM**

Title

**PROPOSED
WASTEWATER
PLAN**

Project no.	298002		
Scale	1:1000 @ A3		
Cad file	298002-11-C500 WW.DWG		
Drawing no.	I1-C500-1	Rev	B

DRAFT FOR REVIEW



- NOTES
1. ALL WORKS TO BE IN ACCORDANCE WITH WAIKATO REGIONAL INFRASTRUCTURE TECHNICAL SPECIFICATIONS.
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	EX BDY
	PROP BDY
	EX WASTEWATER
	PROP WASTEWATER
	PROP RISING MAIN
	EX/PROP WWMH
	PR WW LOT CON

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Drawn		SM	04/2026
Checked			



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Project
**SOUTHERN LINKS 1
INDUSTRIAL STAGE 1
HAMILTON, WAIKATO
FOR SL1
NORTHERN CONSORTIUM**

Title
**PROPOSED
WASTEWATER
PLAN**

Project no.	298002		
Scale	1:1000 @ A3		
Cad file	298002-11-C500 WW.DWG		
Drawing no.	11-C500-2	Rev	B

DRAFT FOR REVIEW



- NOTES
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	EX BDY
	PROP BDY
	EX WASTEWATER
	PROP WASTEWATER
	PROP RISING MAIN
	EX/PROP WWMH
	PR WW LOT CON

B	DRAFT	MKS	06/2026
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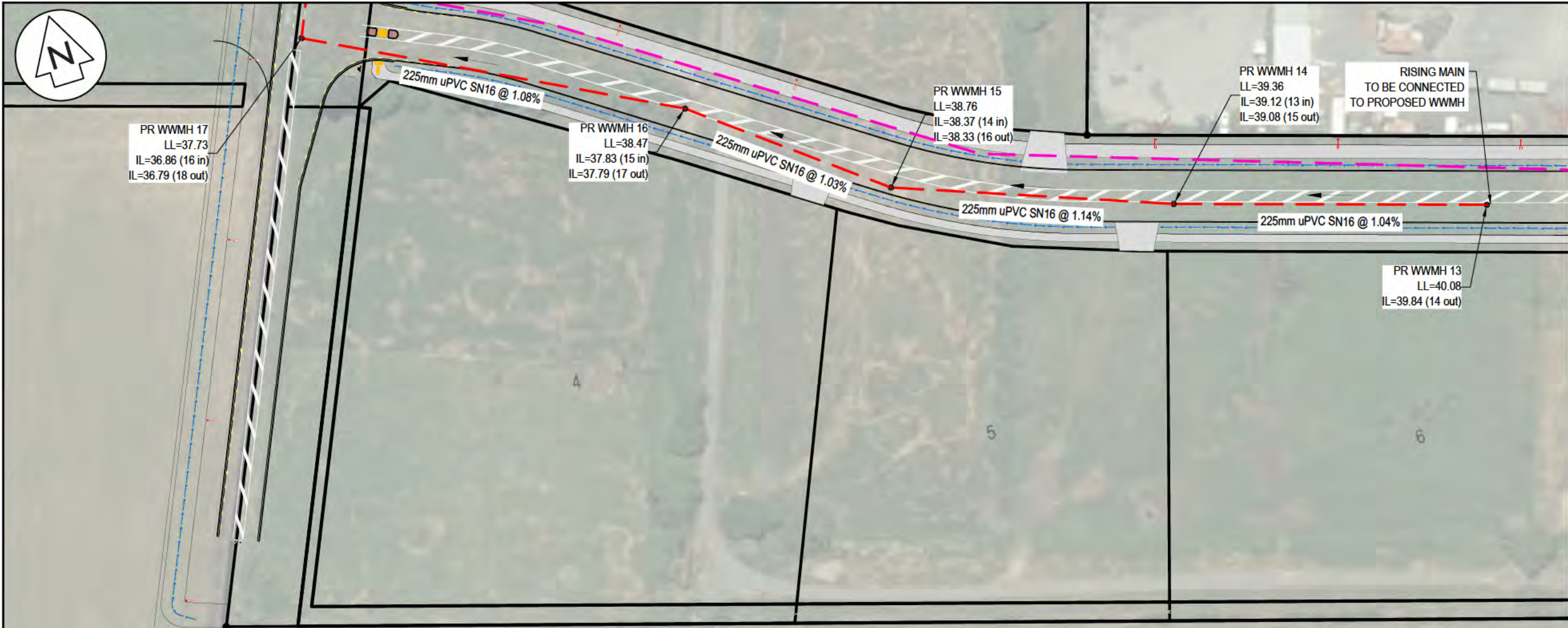
Project
**SOUTHERN LINKS 1
INDUSTRIAL STAGE 1
HAMILTON, WAIKATO
FOR SL1
NORTHERN CONSORTIUM**

Title
**PROPOSED
WASTEWATER
PLAN**

Project no.	298002		
Scale	1:1000 @ A3		
Cad file	298002-I1-C500 WWW.DWG		
Drawing no.	I1-C500-3	Rev	B

DRAFT FOR REVIEW

PR WWMH 13
LL=42.16
IL=41.75 (9 out)



- NOTES
1. ALL WORKS TO BE IN ACCORDANCE WITH WAIKATO REGIONAL INFRASTRUCTURE TECHNICAL SPECIFICATIONS.
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LEGEND

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	PROP BDY
	EX WASTEWATER
	PROP WASTEWATER
	PROP RISING MAIN
	EX/PROP WWMH
	PR WW LOT CON

B	DRAFT	MKS	06/2026
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Project
**SOUTHERN LINKS 1
INDUSTRIAL STAGE 1
HAMILTON, WAIKATO
FOR SL1
NORTHERN CONSORTIUM**

Title
**PROPOSED
WASTEWATER
PLAN**

Project no.	298002		
Scale	1:1000 @ A3		
Cad file	298002-11-C500 WW.DWG		
Drawing no.	I1-C500-4	Rev	B

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DATE: 31/03/2025 FILEPATH: \\MAVEN\MAVENCONSULTING\CO-NORTH\NEW ZEALAND\HAMILTON\PROJECTS\298002-SOUTHERN LINKS 1\INDUSTRIAL STAGE 1\11-C500 WW.DWG



NOTES

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	PROP BDY
	EX WASTEWATER
	PROP WASTEWATER
	PROP RISING MAIN
	EX/PROP WWMH
	PR WW LOT CON

B	DRAFT	MKS	06/2026
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Project

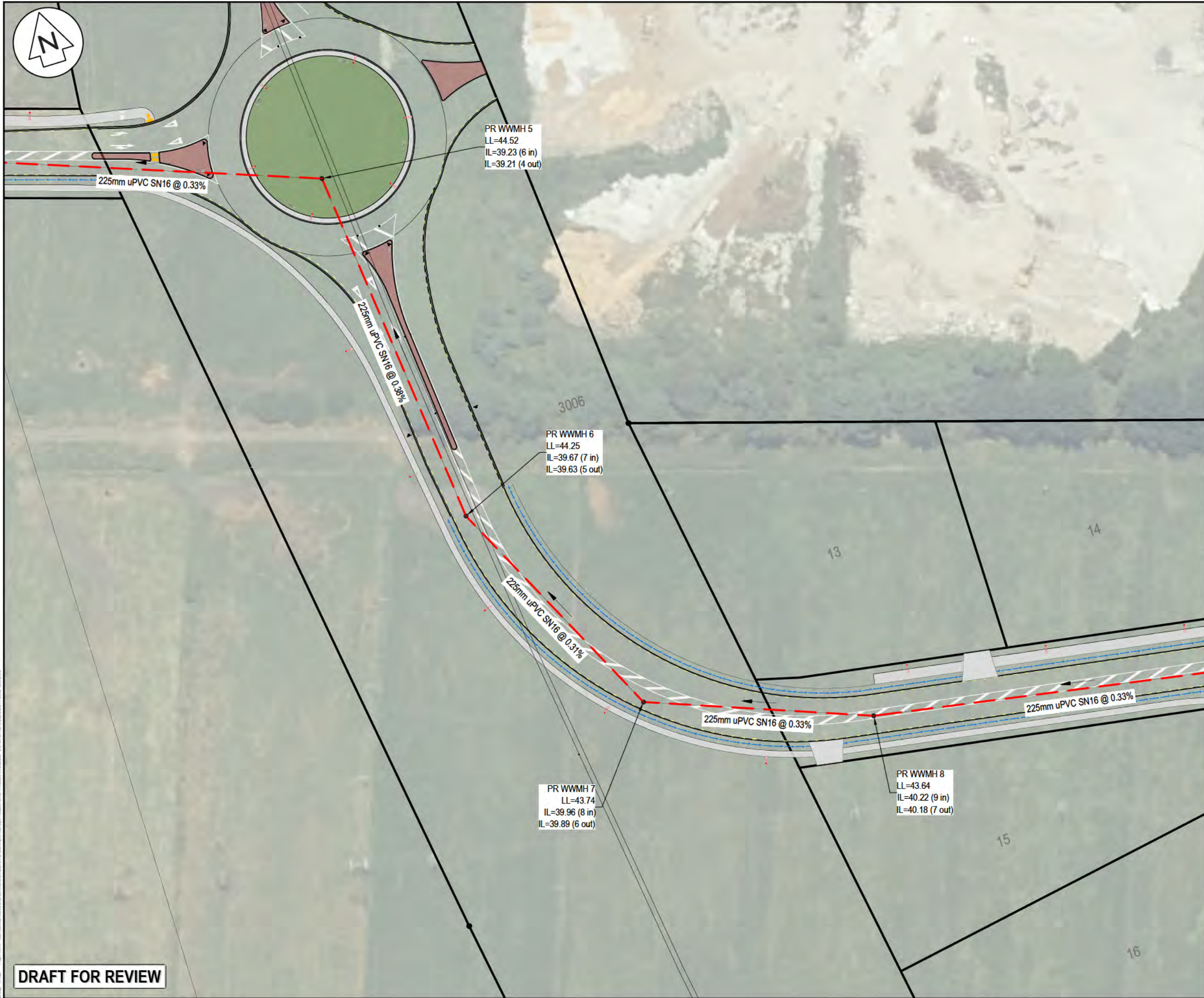
**SOUTHERN LINKS 1
INDUSTRIAL STAGE 1
HAMILTON, WAIKATO
FOR SL1
NORTHERN CONSORTIUM**

Title

**PROPOSED
WASTEWATER
PLAN**

Project no.	298002		
Scale	1:1000 @ A3		
Cad file	298002-11-C500 WW.DWG		
Drawing no.	I1-C500-5	Rev	B

DRAFT FOR REVIEW



NOTES

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LEGEND

	EX BDY
	PROP BDY
	EX WASTEWATER
	PROP WASTEWATER
	PROP RISING MAIN
	EX/PROP WWMH
	PR WW LOT CON

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Project

**SOUTHERN LINKS 1
INDUSTRIAL STAGE 1
HAMILTON, WAIKATO
FOR SL1
NORTHERN CONSORTIUM**

Title

**PROPOSED
WASTEWATER
PLAN**

Project no.	298002		
Scale	1:1000 @ A3		
Cad file	298002-11-C500 WW.DWG		
Drawing no.	11-C500-6	Rev	B

DATE: 7/1/2025 FILEPATH: \\MAVEN\PROJECTS\298002-11-C500 WW.DWG PROJECT: 298002-11-C500 WW.DWG



- NOTES
1. ALL WORKS TO BE IN ACCORDANCE WITH WAIKATO REGIONAL INFRASTRUCTURE TECHNICAL SPECIFICATIONS.
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→	PR WW LOT CON

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M
M A E N

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Project
**SOUTHERN LINKS 1
INDUSTRIAL STAGE 1
HAMILTON, WAIKATO
FOR SL1
NORTHERN CONSORTIUM**

Title
**PROPOSED
WASTEWATER
PLAN**

Project no.	298002
Scale	1:1000 @ A3
Cad file	298002-11-C500 WW.DWG
Drawing no.	I1-C500-7
Rev	B

DRAFT FOR REVIEW

DATE: 27/02 FILE PATH: I:\M\VEN\CONSULTING\CO-ORDINATE\WAIKATO\HAMILTON\PROJECTS\298002 - BLUSTO\11-000000-11-C500 WW.DWG



PR WWMH 10
LL=43.41
IL=41.11 (11 in)
IL=41.07 (9 out)

PR WWMH 11
LL=43.71
IL=41.40 (12 in)
IL=41.36 (10 out)

PR WWMH 12
LL=44.08
IL=41.70 (11 out)

225mm UPVC SN16 @ 0.33%

225mm UPVC SN 225mm UPVC SN16 @ 0.33%

- NOTES
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	PROP BDY
	EX WASTEWATER
	PROP WASTEWATER
	PROP RISING MAIN
	EX/PROP WWMH
	PR WW LOT CON

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Drawn	MKS	04/2026	
Checked	SM	04/2026	



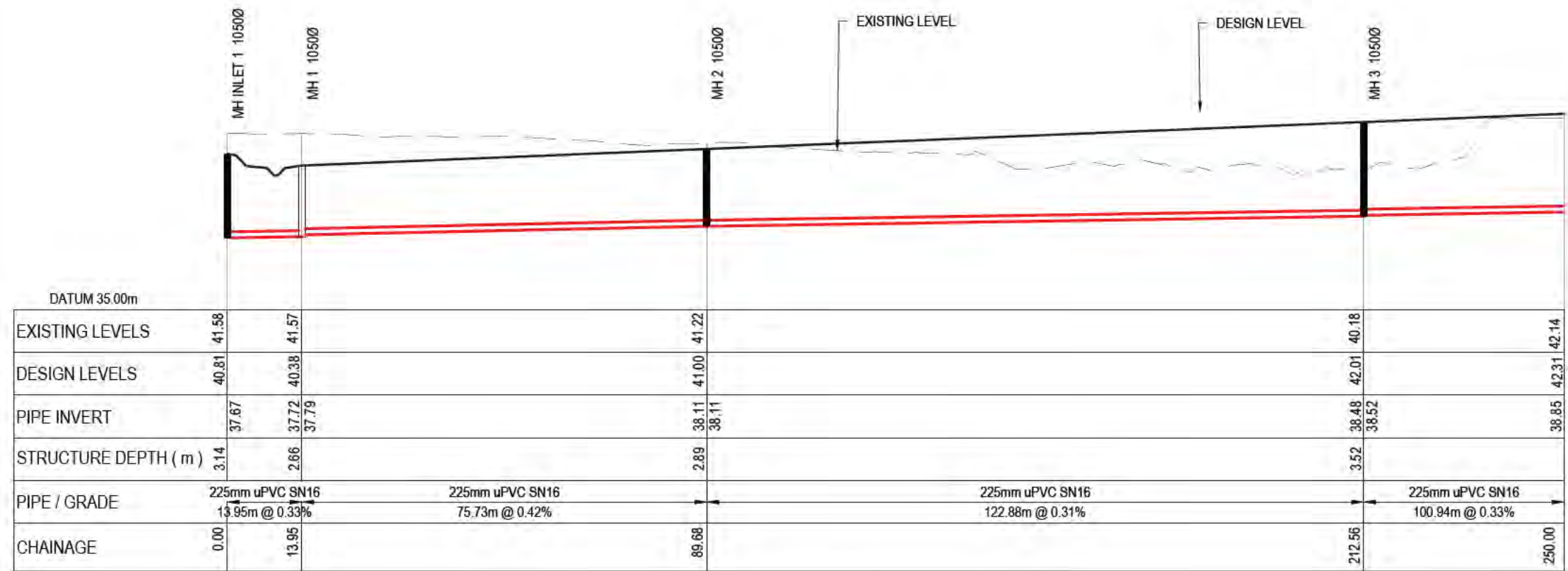
Maven Waikato
07 242 0601
info@maven.co.nz
www.maven.co.nz
Level 1 286 Victoria Street, Hamilton
New Zealand

Project
**SOUTHERN LINKS 1
INDUSTRIAL STAGE 1
HAMILTON, WAIKATO
FOR SL1
NORTHERN CONSORTIUM**

Title
**PROPOSED
WASTEWATER
PLAN**

Project no.	298002		
Scale	1:1000 @ A3		
Cad file	298002-11-C500 WW.DWG		
Drawing no.	I1-C500-8	Rev	B

DRAFT FOR REVIEW

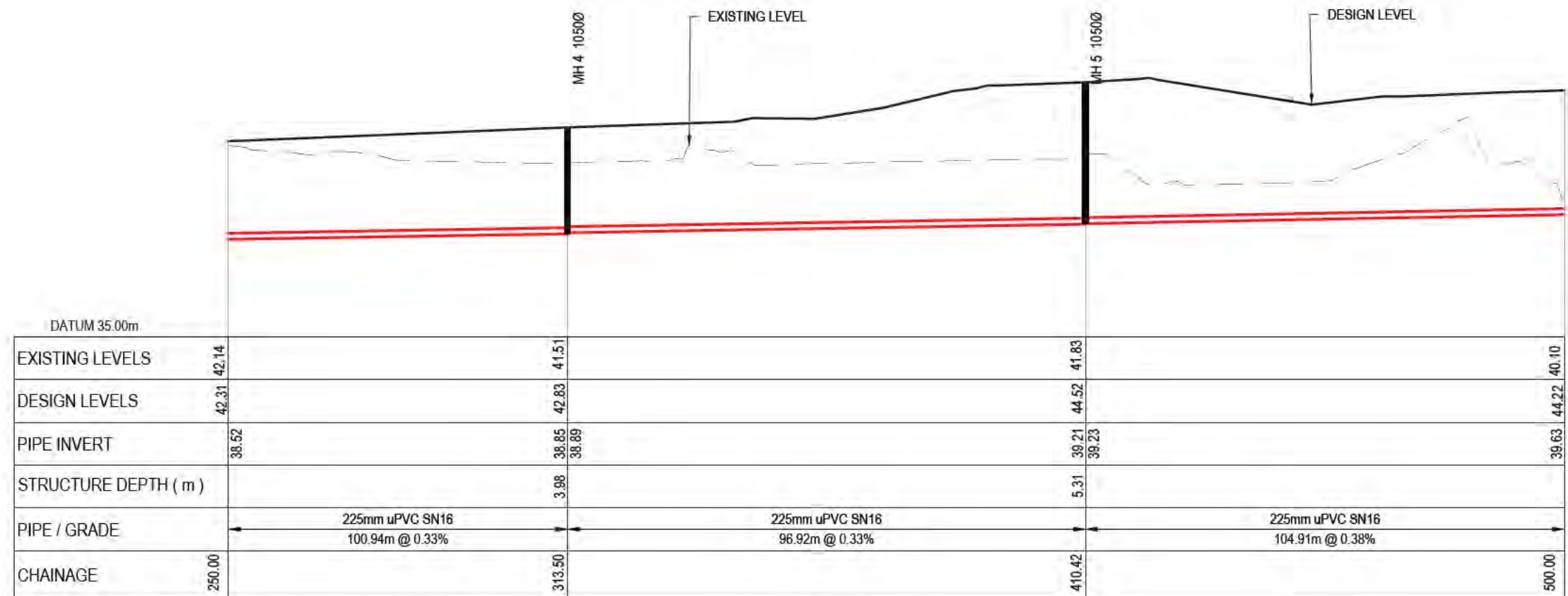


LONGSECTION - CATCHMENT WW 1
SCALE 1:1000 HORI & 1:200 VERTICAL @ A3

- NOTES
1. ALL WORKS TO BE IN ACCORDANCE WITH WAIKATO REGIONAL INFRASTRUCTURE TECHNICAL SPECIFICATIONS.
 2. CO-ORDINATES IN TERMS OF NZ GEODETIC DATUM MT EDEN 2000. LEVELS IN TERMS OF THE NEW ZEALAND VERTICAL DATUM 2016. CONVERSION TO MOTURIKI 1953 CAN BE ACHIEVED BY ADDING 0.2594M.
 3. IT IS THE CONTRACTORS RESPONSIBILITY TO LOCATE ALL SERVICES THAT MAY BE AFFECTED BY HIS OPERATIONS.
 4. APPROVED HARDFILL IS TO BE USED IN BACKFILLING OF ALL ROAD CROSSINGS TO COUNCIL STANDARDS.
 5. HEAVY DUTY MANHOLE LIDS AND FRAMES TO BE USED IN TRAFFICKED AREAS, ALL MANHOLES SHALL HAVE STAINLESS GRATES INSTALLED.
 6. ALL LINES ARE TO BE 150mmØ PVC CLASS SN16 UNLESS SHOWN OTHERWISE.
 7. 150mmØ PIPES THAT DO NOT TERMINATE IN A MANHOLE MUST BE TERMINATED WITH A 100mmØ ON A 150mmØ LONDON JUNCTION AND BLANK CAP.
 8. MANHOLE DIAMETERS SHOWN ON STRUCTURE LABEL ARE INTERNAL DIAMETER.
 9. MEASUREMENTS SHOWN ON LOT CONNECTIONS ARE DISTANCE TO CENTER OF LOT CONNECTION FROM THE NEAREST DOWNSTREAM MANHOLE.

Legend

— EX GROUND LEVEL
— PROP GROUND LEVEL



LONGSECTION - CATCHMENT WW 1 CONT.
SCALE 1:1000 HORI & 1:200 VERTICAL @ A3

DRAFT FOR REVIEW

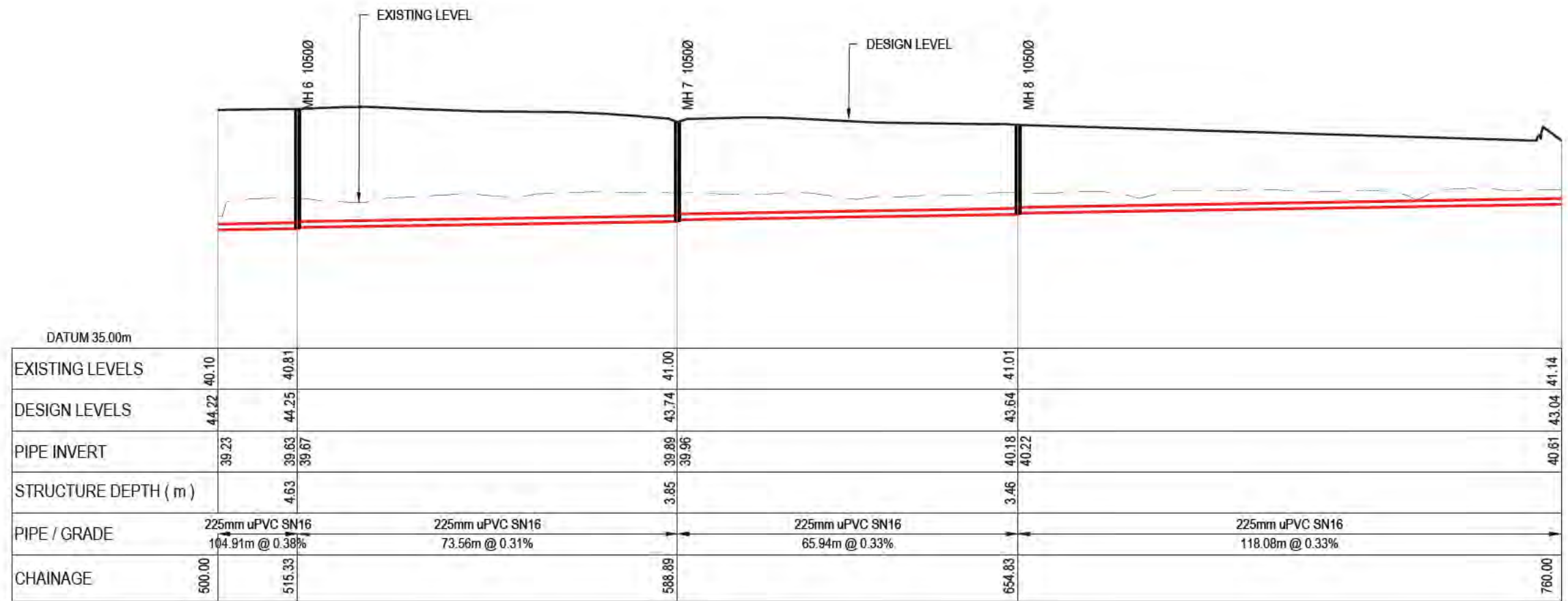
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A	DRAFT	MKS	06/2026
Rev	Description	By	Date
		By	Date
Survey	MAVEN		05/2025
Design	MKS		04/2026
Drawn	MKS		04/2026
Checked	SM		04/2026



Project
**SOUTHERN LINKS 1
INDUSTRIAL STAGE 1
HAMILTON, WAIKATO
FOR SL1
NORTHERN CONSORTIUM**

Title
**PROPOSED
WASTEWATER
LONGSECTION**

Project no.	298002
Scale	AS SHOWN
Cad file	298002-11-C500 WW.DWG
Drawing no.	11-C520-1
Rev	B



LONGSECTION - CATCHMENT WW 1 CONT.
SCALE 1:1000 HORI & 1:200 VERTICAL @ A3

- NOTES
1. ALL WORKS TO BE IN ACCORDANCE WITH WAIKATO REGIONAL INFRASTRUCTURE TECHNICAL SPECIFICATIONS.
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Legend

EX GROUND LEVEL

PROP GROUND LEVEL

B	DRAFT	MKS	06/2026
A	DRAFT	MKS	06/2026
Rev	Description	By	Date
		By	Date
Survey	MAVEN		05/2025
Design	MKS		04/2026
Drawn	MKS		04/2026
Checked	SM		04/2026



Project

SOUTHERN LINKS 1

INDUSTRIAL STAGE 1

HAMILTON, WAIKATO

FOR SL1

NORTHERN CONSORTIUM

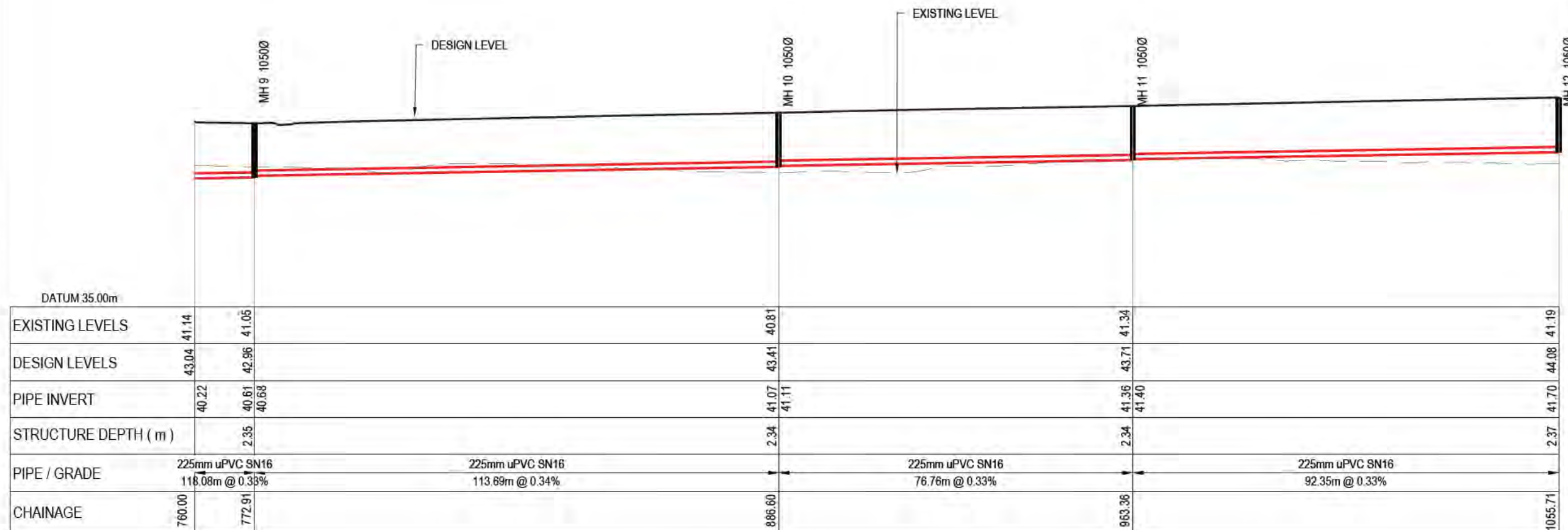
Title

PROPOSED

WASTEWATER

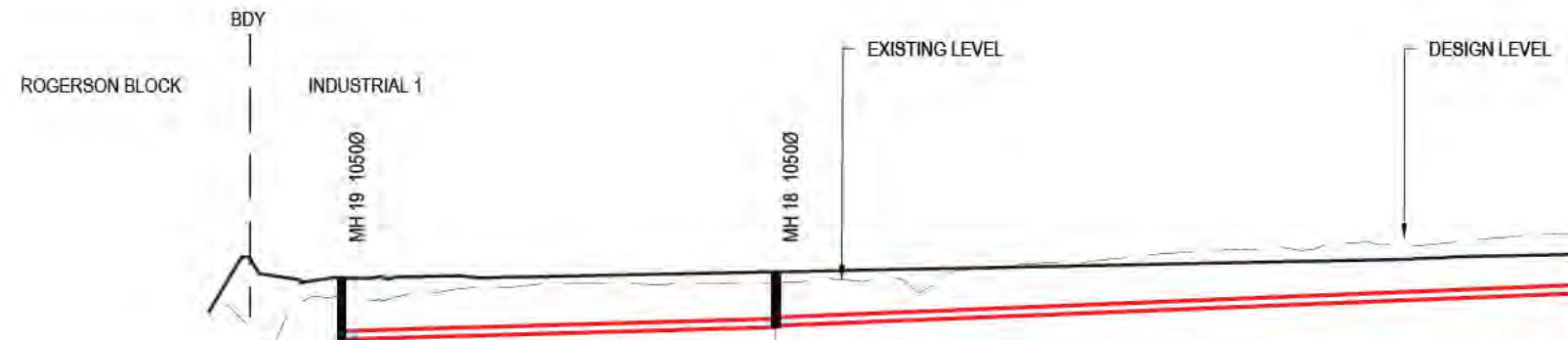
LONGSECTION

Project no.	298002
Scale	AS SHOWN
Cad file	298002-11-C500 WW.DWG
Drawing no.	I1-C520-2
Rev	B



LONGSECTION - CATCHMENT WW 1 CONT.
SCALE 1:1000 HORI & 1:200 VERTICAL @ A3

DRAFT FOR REVIEW



DATUM 32.00m				
EXISTING LEVELS		36.53	36.99	38.33
DESIGN LEVELS		37.12	37.28	37.76
PIPE INVERT		35.46	35.79	36.79
STRUCTURE DEPTH (m)		1.69	1.49	
PIPE / GRADE		225mm uPVC SN16 58.78m @ 0.56%		225mm uPVC SN16 118.88m @ 0.81%
CHAINAGE	0.00	118.55	177.33	285.00

LONGSECTION - CATCHMENT WW 2
SCALE 1:1000 HORI & 1:200 VERTICAL @ A3

- NOTES
1. ALL WORKS TO BE IN ACCORDANCE WITH WAIKATO REGIONAL INFRASTRUCTURE TECHNICAL SPECIFICATIONS.
 2. CO-ORDINATES IN TERMS OF NZ GEODETIC DATUM MT EDEN 2000. LEVELS IN TERMS OF THE NEW ZEALAND VERTICAL DATUM 2016. CONVERSION TO MOTURIKI 1953 CAN BE ACHIEVED BY ADDING 0.2594M
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 9. MEASUREMENTS SHOWN ON LOT CONNECTIONS ARE DISTANCE TO CENTER OF LOT CONNECTION FROM THE NEAREST DOWNSTREAM MANHOLE.

Legend

— EX GROUND LEVEL

— PROP GROUND LEVEL



DATUM 32.00m							
EXISTING LEVELS	38.33	38.19	39.34	41.42	41.18	41.04	
DESIGN LEVELS	37.76	37.73	38.47	38.76	39.34	39.91	
PIPE INVERT	35.83	36.79	37.83	38.33	39.08	39.84	
STRUCTURE DEPTH (m)		0.94	0.68	0.43	0.30	0.30	
PIPE / GRADE	225mm uPVC SN16 118.88m @ 0.81%		225mm uPVC SN16 85.89m @ 1.08%		225mm uPVC SN16 48.55m @ 1.03%		225mm uPVC SN16 62.41m @ 1.14%
CHAINAGE	285.00	296.21	382.11	430.66	493.06	562.04	

LONGSECTION - CATCHMENT WW 2 CONT.
SCALE 1:1000 HORI & 1:200 VERTICAL @ A3

DRAFT FOR REVIEW

B	DRAFT	MKS	06/2026
A	DRAFT	MKS	06/2026
Rev	Description	By	Date
		By	Date
Survey	MAVEN		05/2025
Design	MKS		04/2026
Drawn	MKS		04/2026
Checked	SM		04/2026



Project

SOUTHERN LINKS 1

INDUSTRIAL STAGE 1

HAMILTON, WAIKATO

FOR SL1

NORTHERN CONSORTIUM

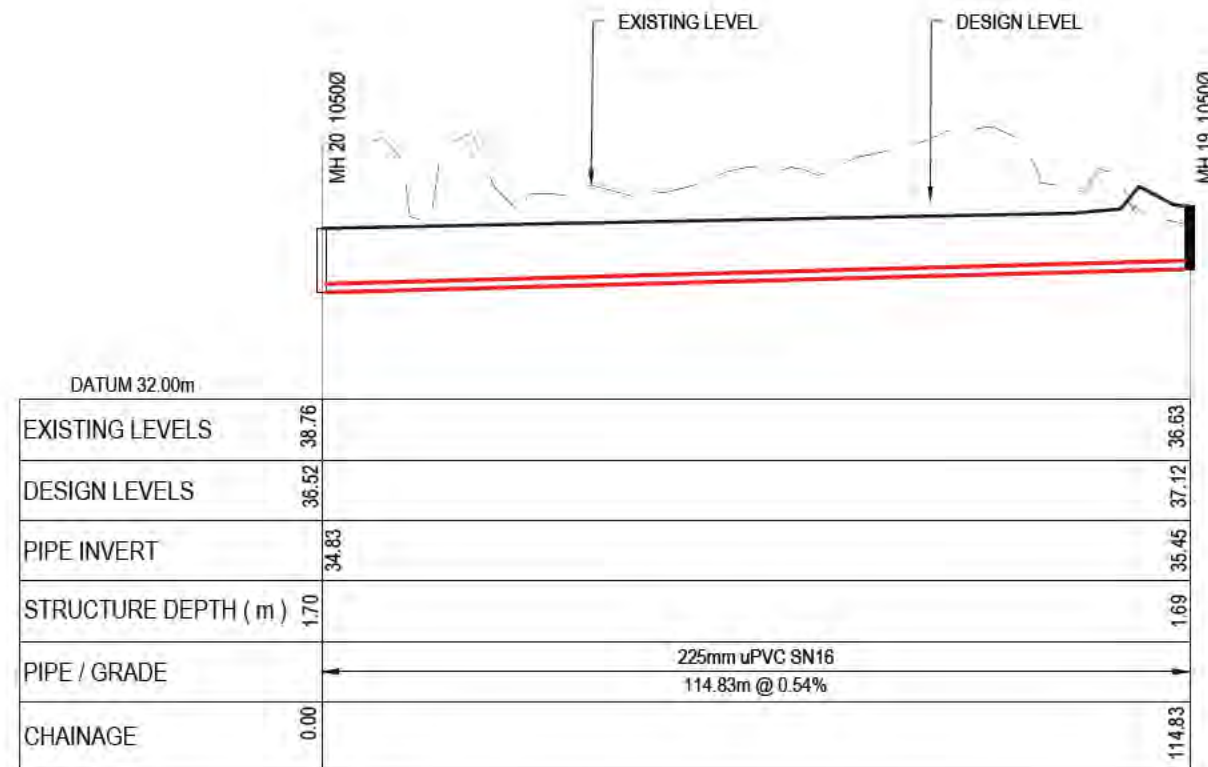
Title

PROPOSED

WASTEWATER

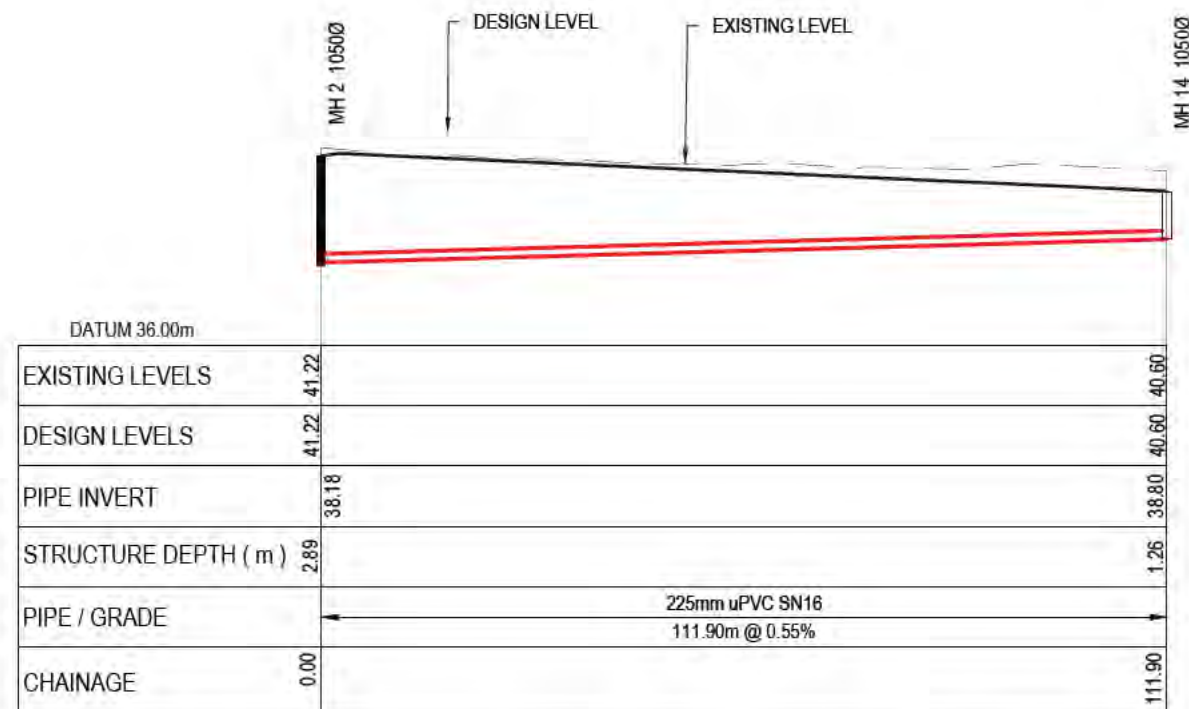
LONGSECTION

Project no.	298002
Scale	AS SHOWN
Cad file	298002-11-C500 WW.DWG
Drawing no.	11-C520-3
Rev	B



LONGSECTION - CATCHMENT WW 3

SCALE 1:1000 HORI & 1:200 VERTICAL @ A3



LONGSECTION - CATCHMENT WW 4

SCALE 1:1000 HORI & 1:200 VERTICAL @ A3

DRAFT FOR REVIEW

- NOTES
1. ALL WORKS TO BE IN ACCORDANCE WITH WAIKATO REGIONAL INFRASTRUCTURE TECHNICAL SPECIFICATIONS.
 2. CO-ORDINATES IN TERMS OF NZ GEODETIC DATUM MT EDEN 2000. LEVELS IN TERMS OF THE NEW ZEALAND VERTICAL DATUM 2016. CONVERSION TO MOTURIKI 1953 CAN BE ACHIEVED BY ADDING 0.2594M
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 9. MEASUREMENTS SHOWN ON LOT CONNECTIONS ARE DISTANCE TO CENTER OF LOT CONNECTION FROM THE NEAREST DOWNSTREAM MANHOLE.

Legend

EX GROUND LEVEL

PROP GROUND LEVEL

B	DRAFT	MKS	06/2026
A	DRAFT	MKS	06/2026
Rev	Description	By	Date
		By	Date
Survey	MAVEN		05/2025
Design	MKS		04/2026
Drawn	MKS		04/2026
Checked	SM		04/2026



Project

SOUTHERN LINKS 1

INDUSTRIAL STAGE 1

HAMILTON, WAIKATO

FOR SL1

NORTHERN CONSORTIUM

Title

PROPOSED

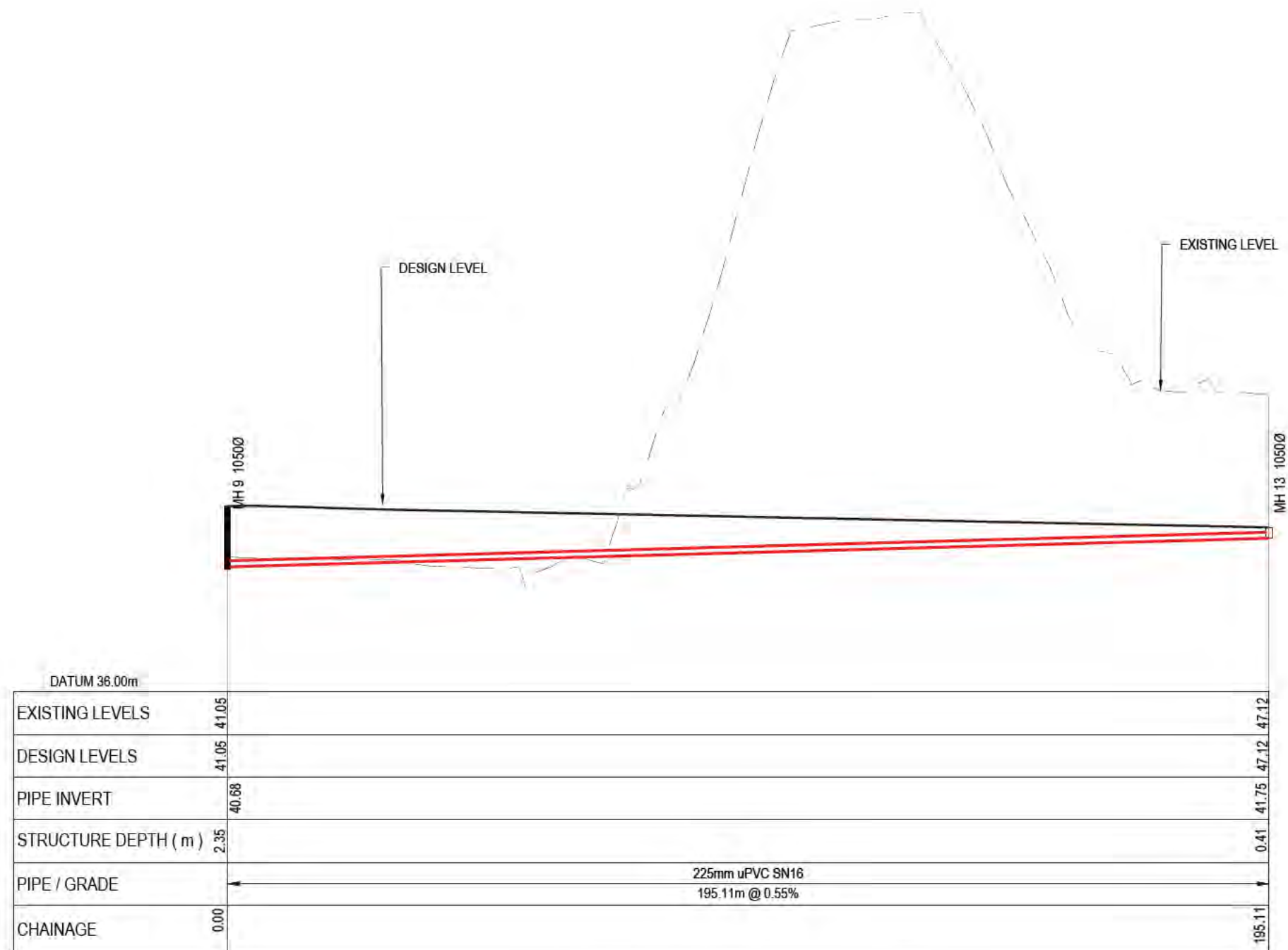
WASTEWATER

LONGSECTION

Project no.	298002		
Scale	AS SHOWN		
Cad file	298002-11-C500 WW.DWG		
Drawing no.	I1-C520-4	Rev	B

DATE: 14/04/2025

DRAFT FOR REVIEW



LONGSECTION - CATCHMENT WW 5
SCALE 1:1000 HORI & 1:200 VERTICAL @ A3

NOTES

1. ALL WORKS TO BE IN ACCORDANCE WITH WAIKATO REGIONAL INFRASTRUCTURE TECHNICAL SPECIFICATIONS.
2. CO-ORDINATES IN TERMS OF NZ GEODETIC DATUM MT EDEN 2000. LEVELS IN TERMS OF THE NEW ZEALAND VERTICAL DATUM 2016. CONVERSION TO MOTURIKI 1953 CAN BE ACHIEVED BY ADDING 0.2594M.
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Legend

— EX GROUND LEVEL
— PROP GROUND LEVEL

B	DRAFT	MKS	06/2026
A	DRAFT	MKS	06/2026
Rev	Description	By	Date
		By	Date
Survey	MAVEN		05/2025
Design	MKS		04/2026
Drawn	MKS		04/2026
Checked	SM		04/2026



Project
**SOUTHERN LINKS 1
INDUSTRIAL STAGE 1
HAMILTON, WAIKATO
FOR SL1
NORTHERN CONSORTIUM**

Title
**PROPOSED
WASTEWATER
LONGSECTION**

Project no.	298002		
Scale	AS SHOWN		
Cad file	298002-11-C500 WW.DWG		
Drawing no.	I1-C520-5	Rev	B

APPENDIX E

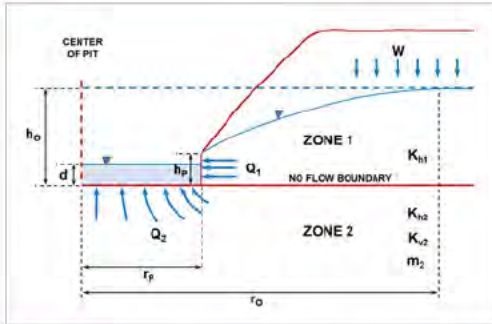
DRAWDOWN CALCULATIONS FOR ARTIFICIAL WETLANDS



INFLOW TO OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
 PROJECT: Southern Links - Northern Block
 Project #: WGA242463
 Location: Artificial Wetland 1 - Conservative Dry Pit
 Date: Monday, 8 June 2026
 Document #: WGA242463-RP-HG-0012_B



$$A \quad h_o = \sqrt{h_p^2 + \frac{W}{K_{h1}} \left[r_o^2 \ln \left(\frac{r_o}{r_p} \right) - \frac{(r_o^2 - r_p^2)}{2} \right]}$$

$$B \quad Q_1 = W \pi (r_o^2 - r_p^2)$$

$$C \quad Q_2 = 4 r_p \left(\frac{K_{h2}}{m_2} \right) (h_o - d)$$

$$D \quad m_2 = \sqrt{\frac{K_{v2}}{K_{h2}}}$$

W	1.11E-08	m/s	recharge flux
K _{h1}	4.48E-07	m/s	horizontal hydraulic conductivity in Zone 1
K _{h2}	4.48E-07	m/s	horizontal hydraulic conductivity in Zone 2
K _{v2}	4.48E-08	m/s	vertical hydraulic conductivity in Zone 2
h _o	3.4	m	initial saturated thickness above the base of Zone 1
h _p	0	m	saturated thickness at the pit wall
r _p	26.99	m	effective pit radius
d	0	m	depth of the pit lake

r_o is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Inflow from Zone 1

Radius of influence r_o calculated by iterating equation A

47 m

Known h_o

3.40 m

h_o calculated using Equation A

3.40 m

Q₁ 5.0E-05 m³/s
4.4E+00 m³/day

Inflow from Zone 2

Anisotropy parameter calculated using equation D

3.162278

Q₂ 5.2E-05 m³/s
4.5E+00 m³/day

Total Pit Inflow

Q_{TOT} 1.0E-04 m³/s
8.85 m³/day

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water inflow
 to a mine pit. Ground Water 38, no. 2: 311-314.

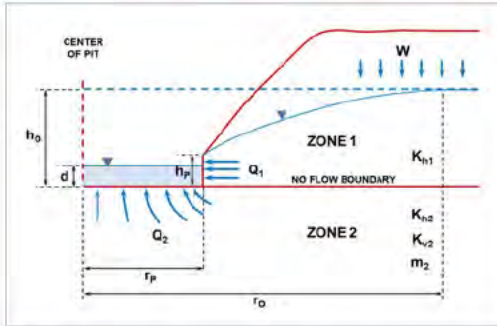
Analysed by: J. Ferry 8/06/2026
 Checked by: B. Sinclair 12/06/2026

Notes:

GROUNDWATER DRAWDOWN AROUND OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
 PROJECT: Southern Links - Northern Block
 Project #: WGA242463
 Location: Artificial Wetland 1 - Conservative Dry Pit
 Date: Monday, 8 June 2026
 Document #: WGA242463-RP-HG-0012_B



$$dH_{Zone1} = h_0 - \sqrt{\frac{h_p^2}{2} + \frac{W}{K_{h1}} \left[r_0^2 \ln\left(\frac{r}{r_p}\right) - \frac{(r^2 - r_p^2)}{2} \right]}$$

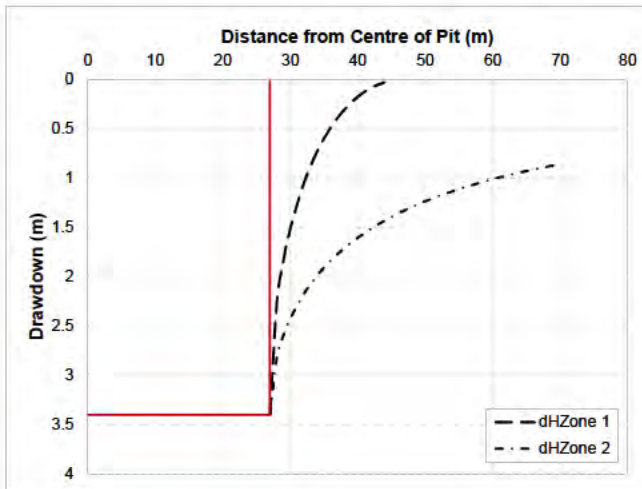
$$dH_{Zone2} = \frac{2(h_0 - d)}{\pi} \sin^{-1}\left(\frac{r_p}{r}\right)$$

$$m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	1.11E-08	m/s	recharge flux
K _{h1}	4.48E-07	m/s	horizontal hydraulic conductivity in Zone 1
K _{h2}	4.48E-07	m/s	horizontal hydraulic conductivity in Zone 2
K _{v2}	4.48E-08	m/s	vertical hydraulic conductivity in Zone 2
h ₀	3.4	m	initial saturated thickness above the base of Zone 1
h _p	0	m	saturated thickness at the pit wall
r _p	26.99065	m	effective pit radius
d	0	m	depth of the pit lake

r₀ is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Radius of influence r₀ calculated by iterating equation A in analysis sheet 1 47 m



Drawdown curves		
r	dH _{Zone 1}	dH _{Zone 2}
26.99065	3.4	3.4
28.0	2.3	2.8
29.0	1.8	2.6
30.0	1.5	2.4
32.0	1.1	2.2
34.0	0.7	2.0
36.0	0.5	1.8
38.0	0.3	1.7
40.0	0.2	1.6
42.0	0.1	1.5
44.0	0.0	1.4
46.0		1.4
48.0		1.3
50.0		1.2
55.0		1.1
60.0		1.0
65.0		0.9
70.0		0.9

Reference: Marinelli, F. & Niccoli W. L. 2000. Simple analytical equations for estimating ground water inflow to a mine pit. Ground Water 38, no. 2: 311-314.

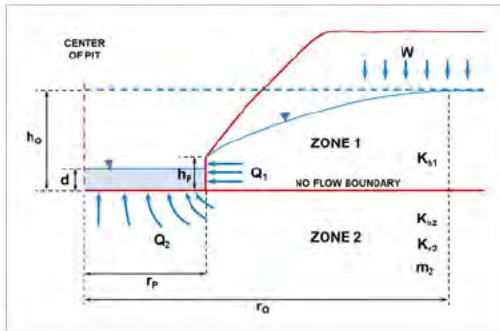
Analysed by: J. Ferry 8/06/2026
 Checked by: B. Sinclair 12/06/2026

Notes: The drawdown curves apply along the no-flow boundary line at an elevation equivalent to the base of the pit. The dH_{Zone2} line does not take into account recharge from above. In this situation represents an overly conservative projection. Drawdown projections are initial approximations only.

INFLOW TO OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
 PROJECT: Southern Links - Northern Block
 Project #: WGA242463
 Location: Artificial Wetland 1 - Operational GW Inflows
 Date: Monday, 8 June 2026
 Document #: WGA242463-RP-HG-0012_B



$$A \quad h_o = \sqrt{h_p^2 + \frac{W}{K_{s1}} \left[r_o^2 \ln \left(\frac{r_o}{r_p} \right) - \frac{(r_o^2 - r_p^2)}{2} \right]}$$

$$B \quad Q_1 = W \pi (r_o^2 - r_p^2)$$

$$C \quad Q_2 = 4 r_p \left(\frac{K_{s2}}{m_2} \right) (h_o - d)$$

$$D \quad m_2 = \sqrt{\frac{K_{s2}}{K_{v2}}}$$

W	1.11E-08	m/s	recharge flux
K_{s1}	4.48E-07	m/s	horizontal hydraulic conductivity in Zone 1
K_{s2}	4.48E-07	m/s	horizontal hydraulic conductivity in Zone 2
K_{v2}	4.48E-08	m/s	vertical hydraulic conductivity in Zone 2
h_o	2.4	m	initial saturated thickness above the base of Zone 1
h_p	1.7	m	saturated thickness at the pit wall
r_p	26.99	m	effective pit radius
d	1.7	m	depth of the pit lake

r_o is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Inflow from Zone 1

Radius of influence r_o calculated by iterating equation A 37 m

Known h_o 2.40 m

h_o calculated using Equation A 2.40 m

Q_1 2.3E-05 m³/s
2.0E+00 m³/day

Inflow from Zone 2

Anisotropy parameter calculated using equation D 3.162278

Q_2 1.1E-05 m³/s
9.3E-01 m³/day

Total Pit Inflow

Q_{TOT} 3.4E-05 m³/s
2.90 m³/day

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water inflow
 to a mine pit. Ground Water 38, no. 2: 311-314.

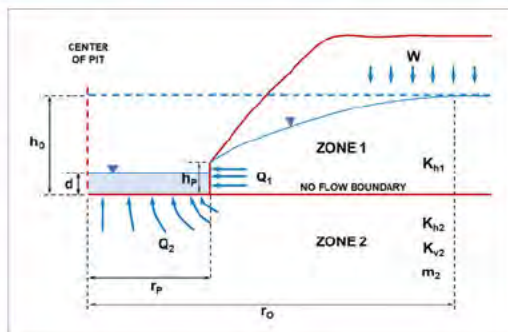
Analysed by: Joanne Ferry 8/06/2026
 Checked by: B. Sinclair 12/06/2026

Notes:

GROUNDWATER DRAWDOWN AROUND OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
PROJECT: Southern Links - Northern Block
Project #: WGA242463
Location: Wetland 1 - Operational GW Inflows Monday, 8
Date: June 2026
Document #: WGA242463-RP-HG-0012_B



$$dH_{Zone1} = h_0 - \sqrt{h_p^2 + \frac{W}{K_{h1}} \left[r_0^2 \ln \left(\frac{r}{r_p} \right) - \frac{(r^2 - r_p^2)}{2} \right]}$$

$$dH_{Zone2} = \frac{2(h_0 - d)}{\pi} \sin^{-1} \left(\frac{r_p}{r} \right)$$

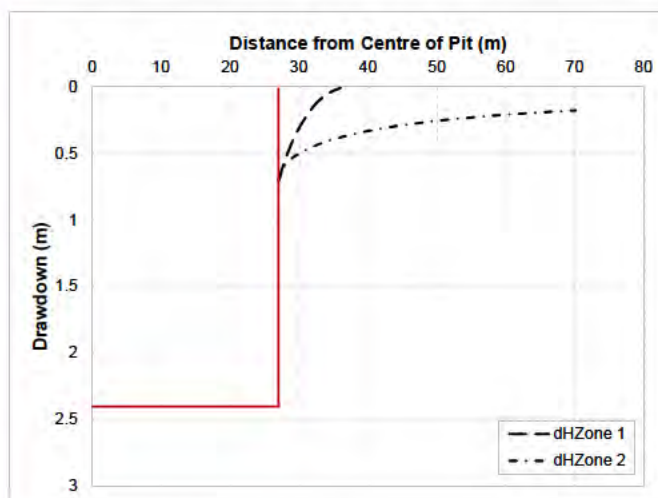
$$m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	1.11E-08	m/s	recharge flux
K _{h1}	4.48E-07	m/s	horizontal hydraulic conductivity in Zone 1
K _{h2}	4.48E-07	m/s	horizontal hydraulic conductivity in Zone 2
K _{v2}	4.48E-08	m/s	vertical hydraulic conductivity in Zone 2
h ₀	2.4	m	initial saturated thickness above the base of Zone 1
h _p	1.7	m	saturated thickness at the pit wall
r _p	26.99065	m	effective pit radius
d	1.7	m	depth of the pit lake

r₀ is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Radius of influence r₀ calculated by iterating equation A in analysis sheet 1

37 m



Drawdown curves

r	dH _{Zone 1}	dH _{Zone 2}
26.99065	0.7	0.7
28.0	0.5	0.6
29.0	0.4	0.5
30.0	0.3	0.5
32.0	0.2	0.4
34.0	0.1	0.4
36.0	0.0	0.4
38.0		0.4
40.0		0.3
42.0		0.3
44.0		0.3
46.0		0.3
48.0		0.3
50.0		0.3
55.0		0.2
60.0		0.2
65.0		0.2
70.0		0.2

Reference: Marinelli, F. & Niccoli W. L. 2000.
Simple analytical equations for estimating ground water inflow
to a mine pit. Ground Water 38, no. 2: 311-314.

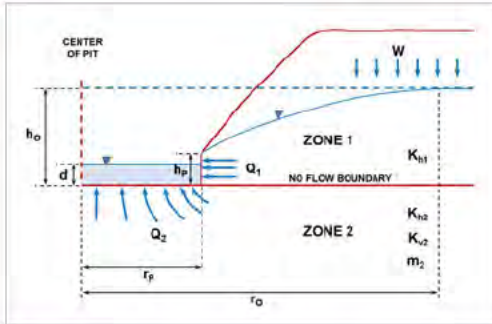
Analysed by: Joanne Ferry 8/06/2026
Checked by: B. Sinclair 12/06/2026

Notes: The drawdown curves apply along the no-flow boundary line at an elevation equivalent to the base of the pit.
The dH_{Zone2} line does not take into account recharge from above.
Drawdown projections are initial approximations only.

INFLOW TO OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
 PROJECT: Southern Links - Southern Block
 Project #: WGA242463
 Location: Artificial Wetland 3 Dewatering for Dry Construction
 Date: Monday, 8 June 2026
 Document #: WGA242463-RP-HG-0012_B



$$A \quad h_o = \sqrt{h_p^2 + \frac{W}{K_{h1}} \left[r_o^2 \ln \left(\frac{r_o}{r_p} \right) - \frac{(r_o^2 - r_p^2)}{2} \right]}$$

$$B \quad Q_1 = W \pi (r_o^2 - r_p^2)$$

$$C \quad Q_2 = 4 r_p \left(\frac{K_{h2}}{m_2} \right) (h_o - d)$$

$$D \quad m_2 = \sqrt{\frac{K_{h2}}{K_{h1}}}$$

W	1.11E-08	m/s	recharge flux
K _{h1}	4.48E-07	m/s	horizontal hydraulic conductivity in Zone 1
K _{h2}	4.48E-07	m/s	horizontal hydraulic conductivity in Zone 2
K _{v2}	4.48E-08	m/s	vertical hydraulic conductivity in Zone 2
h _o	2.3	m	initial saturated thickness above the base of Zone 1
h _p	0	m	saturated thickness at the pit wall
r _p	59.2	m	effective pit radius
d	0	m	depth of the pit lake

r_o is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Inflow from Zone 1

Radius of influence r_o calculated by iterating equation A 73 m

Known h_o 2.3 m

h_o calculated using Equation A 2.3 m

Q₁ 6.5E-05 m³/s
5.62 m³/day

Inflow from Zone 2

Anisotropy parameter calculated using equation D 3.162278

Q₂ 7.7E-05 m³/s
6.67 m³/day

Total Pit Inflow

Q_{TOT} 1.4E-04 m³/s
12.29 m³/day

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water inflow
 to a mine pit. Ground Water 38, no. 2: 311-314.

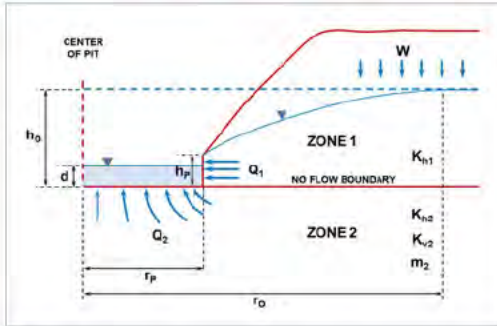
Analysed by: J. Ferry 8/06/2026
 Checked by: B. Sinclair 12/06/2026

Notes:

GROUNDWATER DRAWDOWN AROUND OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
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$$dH_{Zone1} = h_0 - \sqrt{h_p^2 + \frac{W}{K_{h1}} \left[r_0^2 \ln\left(\frac{r}{r_p}\right) - \frac{(r^2 - r_p^2)}{2} \right]}$$

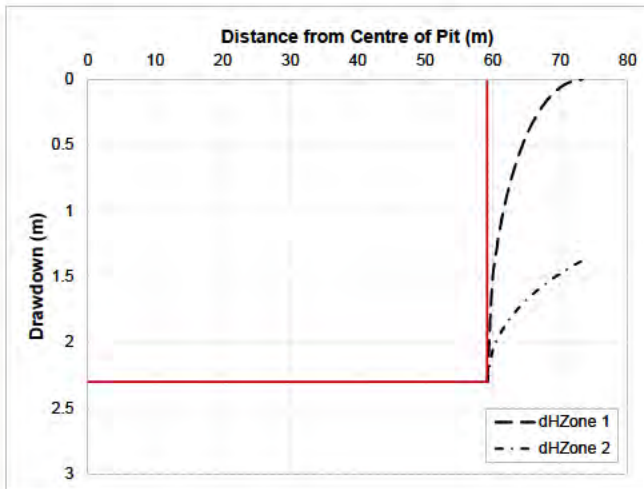
$$dH_{Zone2} = \frac{2(h_0 - d)}{\pi} \sin^{-1}\left(\frac{r_p}{r}\right)$$

$$m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	1.11E-08	m/s	recharge flux
K _{h1}	4.48E-07	m/s	horizontal hydraulic conductivity in Zone 1
K _{h2}	4.48E-07	m/s	horizontal hydraulic conductivity in Zone 2
K _{v2}	4.48E-08	m/s	vertical hydraulic conductivity in Zone 2
h ₀	2.3	m	initial saturated thickness above the base of Zone 1
h _p	0	m	saturated thickness at the pit wall
r _p	59.19487	m	effective pit radius
d	0	m	depth of the pit lake

r₀ is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Radius of influence r₀ calculated by iterating equation A in analysis sheet 1 73 m



Drawdown curves		
r	dH _{Zone 1}	dH _{Zone 2}
59.19487	2.3	2.3
59.9	1.6	2.1
60.6	1.3	2.0
61.3	1.1	1.9
62.0	0.9	1.9
62.7	0.8	1.8
63.4	0.6	1.8
64.1	0.5	1.7
64.8	0.4	1.7
65.5	0.4	1.7
66.2	0.3	1.6
66.9	0.2	1.6
67.7	0.2	1.6
68.4	0.14	1.5
69.1	0.10	1.5
69.8	0.07	1.5
70.5	0.04	1.5
71.2	0.02	1.4
71.9	0.01	1.4
72.6	0.00	1.4
73.3	0.00	1.4

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water inflow
 to a mine pit. Ground Water 38, no. 2: 311-314.

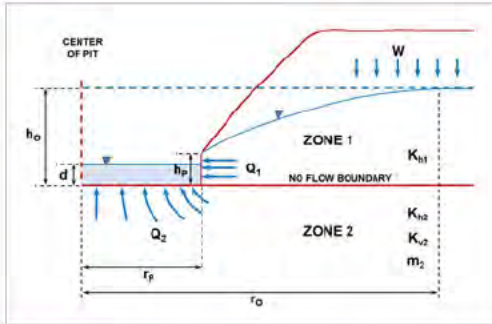
Analysed by: J. Ferry 8/06/2026
 Checked by: B. Sinclair 12/06/2026

Notes: The drawdown curves apply along the no-flow boundary line at an elevation equivalent to the base of the pit.
 The dH_{Zone2} line does not take into account recharge from above. In this situation the dH_{Zone 2} line is overly conservative.
 Drawdown projections are initial approximations only.

INFLOW TO OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
 PROJECT: Southern Links - Southern Block
 Project #: WGA242463
 Location: Artificial Wetland 2 Operational groundwater inflow
 Date: Monday, 8 June 2026
 Document #: WGA242463-RP-HG-0012_B



$$\begin{aligned} \text{A } h_o &= \sqrt{h_p^2 + \frac{W}{K_{h1}} \left[r_o^2 \ln \left(\frac{r_o}{r_p} \right) - \frac{(r_o^2 - r_p^2)}{2} \right]} \\ \text{B } Q_1 &= W \pi (r_o^2 - r_p^2) \\ \text{C } Q_2 &= 4 r_p \left(\frac{K_{h2}}{m_2} \right) (h_o - d) \\ \text{D } m_2 &= \sqrt{\frac{K_{h2}}{K_{h1}}} \end{aligned}$$

W	1.11E-08	m/s	recharge flux
K _{h1}	4.48E-07	m/s	horizontal hydraulic conductivity in Zone 1
K _{h2}	4.48E-07	m/s	horizontal hydraulic conductivity in Zone 2
K _{v2}	4.48E-08	m/s	vertical hydraulic conductivity in Zone 2
h _o	1.3	m	initial saturated thickness above the base of Zone 1
h _p	1.3	m	saturated thickness at the pit wall
r _p	59.2	m	effective pit radius
d	1.3	m	depth of the pit lake

r_o is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Inflow from Zone 1

Radius of influence r_o calculated by iterating equation A 59 m

Known h_o 1.3 m

h_o calculated using Equation A 1.3 m

Q₁ 1.2E-06 m³/s
0.11 m³/day

Inflow from Zone 2

Anisotropy parameter calculated using equation D 3.162278

Q₂ 0.0E+00 m³/s
0.00 m³/day

Total Pit Inflow

Q_{TOT} 1.2E-06 m³/s
0.11 m³/day

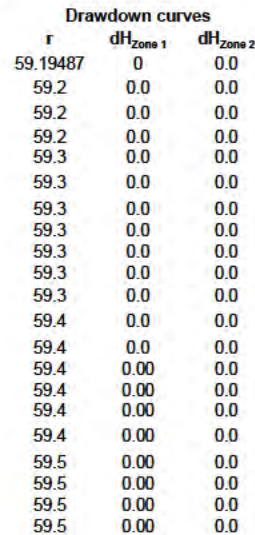
Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water inflow
 to a mine pit. Ground Water 38, no. 2: 311-314.

Analysed by: J. Ferry 8/06/2026
 Checked by: B. Sinclair 12/06/2026

Notes:

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$$m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

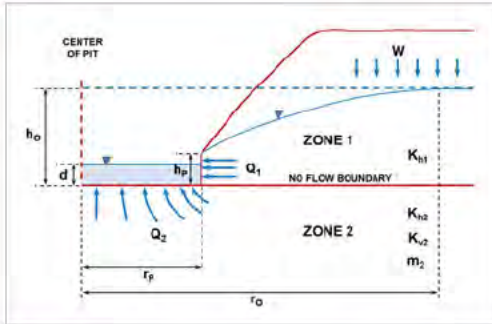
59 m

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INFLOW TO OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
 PROJECT: Southern Links - Southern Block
 Project #: WGA242463
 Location: Artificial Wetland 3 Dewatering for Dry Construction
 Date: Monday, 8 June 2026
 Document #: WGA242463-RP-HG-0012_B



$$A \quad h_o = \sqrt{h_p^2 + \frac{W}{K_{h1}} \left[r_o^2 \ln \left(\frac{r_o}{r_p} \right) - \frac{(r_o^2 - r_p^2)}{2} \right]}$$

$$B \quad Q_1 = W \pi (r_o^2 - r_p^2)$$

$$C \quad Q_2 = 4 r_p \left(\frac{K_{h2}}{m_2} \right) (h_o - d)$$

$$D \quad m_2 = \sqrt{\frac{K_{h2}}{K_{h1}}}$$

W	1.11E-08	m/s	recharge flux
K _{h1}	4.48E-07	m/s	horizontal hydraulic conductivity in Zone 1
K _{h2}	4.48E-07	m/s	horizontal hydraulic conductivity in Zone 2
K _{v2}	4.48E-08	m/s	vertical hydraulic conductivity in Zone 2
h _o	1.5	m	initial saturated thickness above the base of Zone 1
h _p	0	m	saturated thickness at the pit wall
r _p	57.7	m	effective pit radius
d	0	m	depth of the pit lake

r_o is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Inflow from Zone 1

Radius of influence r_o calculated by iterating equation A

67 m

Known h_o

1.5 m

h_o calculated using Equation A

1.5 m

Q₁ 4.0E-05 m³/s
3.49 m³/day

Inflow from Zone 2

Anisotropy parameter calculated using equation D

3.162278

Q₂ 4.9E-05 m³/s
4.24 m³/day

Total Pit Inflow

Q_{TOT} 8.9E-05 m³/s
7.73 m³/day

Reference: Marinelli, F. & Niccoli W. L. 2000.
Simple analytical equations for estimating ground water inflow to a mine pit. Ground Water 38, no. 2: 311-314.

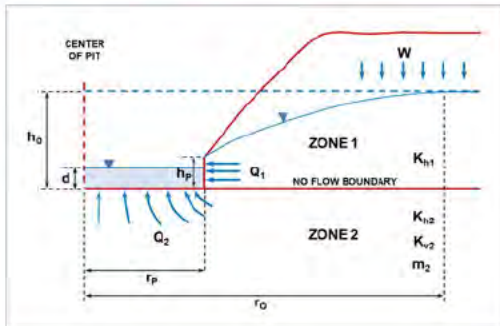
Analysed by: J. Ferry 8/06/2026
 Checked by: B. Sinclair 12/06/2026

Notes:

GROUNDWATER DRAWDOWN AROUND OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
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 Project #: WGA242463
 Location: Artificial Wetland 3 Dewatering for Dry Construction
 Date: Monday, 8 June 2026
 Document #: WGA242463-RP-HG-0012_B



$$dH_{Zone1} = h_0 - \sqrt{h_p^2 + \frac{W}{k_{h1}} \left[r_0^2 \ln \left(\frac{r}{r_p} \right) - \frac{(r^2 - r_p^2)}{2} \right]}$$

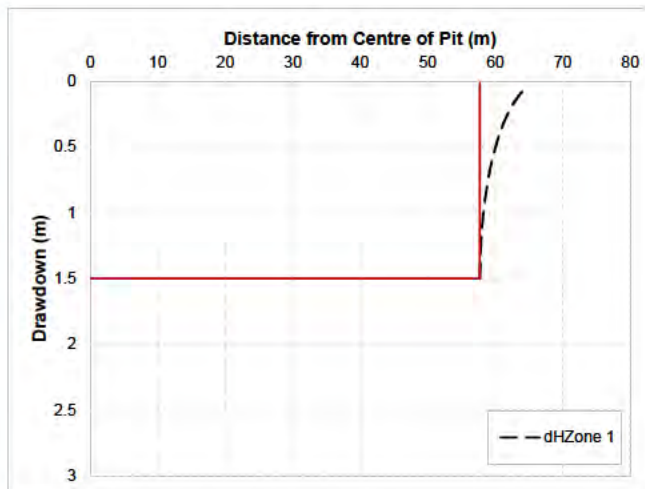
$$dH_{Zone2} = \frac{2(h_0 - d)}{\pi} \sin^{-1} \left(\frac{r_p}{r} \right)$$

$$m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	1.11E-08	m/s	recharge flux
K _{h1}	4.48E-07	m/s	horizontal hydraulic conductivity in Zone 1
K _{h2}	4.48E-07	m/s	horizontal hydraulic conductivity in Zone 2
K _{v2}	4.48E-08	m/s	vertical hydraulic conductivity in Zone 2
h ₀	1.5	m	initial saturated thickness above the base of Zone 1
h _p	0	m	saturated thickness at the pit wall
r _p	57.68946	m	effective pit radius
d	0	m	depth of the pit lake

r₀ is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Radius of influence r₀ calculated by iterating equation A in analysis sheet 1 67 m



Drawdown curves		
r	dH _{Zone 1}	dH _{Zone 2}
57.68946	1.5	1.5
58.0	1.1	1.4
59.0	0.7	1.3
60.0	0.5	1.2
61.0	0.3	1.2
62.0	0.2	1.1
63.0	0.1	1.1
64.0	0.1	1.1
65.0	0.0	1.0
66.0		1.0
67.0		1.0
68.0		1.0
69.0		0.9
70.0		0.9
71.0		0.9
72.0		0.9
73.0		0.9
74.0		0.9
75.0		0.8
76.0		0.8

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water inflow
 to a mine pit. Ground Water 38, no. 2: 311-314.

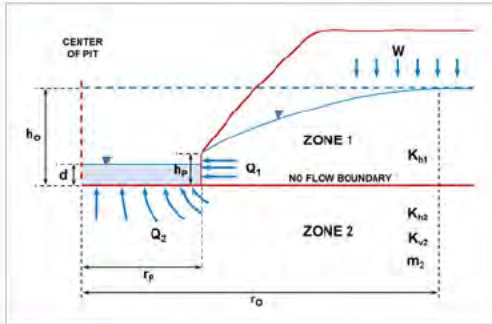
Analysed by: J. Ferry 8/06/2026
 Checked by: B. Sinclair 12/06/2026

Notes: The drawdown curves apply along the no-flow boundary line at an elevation equivalent to the base of the pit.
 The dH_{Zone2} line does not take into account recharge from above.
 Drawdown projections are initial approximations only.

INFLOW TO OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
 PROJECT: Southern Links - Southern Block
 Project #: WGA242463
 Location: Artificial Wetland 3 Operational Groundwater Inflows
 Date: Monday, 8 June 2026
 Document #: WGA242463-RP-HG-0012_B



$$A \quad h_o = \sqrt{h_p^2 + \frac{W}{K_{h1}} \left[r_o^2 \ln \left(\frac{r_o}{r_p} \right) - \frac{(r_o^2 - r_p^2)}{2} \right]}$$

$$B \quad Q_1 = W \pi (r_o^2 - r_p^2)$$

$$C \quad Q_2 = 4 r_p \left(\frac{K_{v2}}{m_2} \right) (h_o - d)$$

$$D \quad m_2 = \sqrt{\frac{K_{v2}}{K_{h2}}}$$

W	1.1E-08	m/s	recharge flux
K _{h1}	4.48E-07	m/s	horizontal hydraulic conductivity in Zone 1
K _{h2}	4.48E-07	m/s	horizontal hydraulic conductivity in Zone 2
K _{v2}	4.48E-08	m/s	vertical hydraulic conductivity in Zone 2
h _o	1.5	m	initial saturated thickness above the base of Zone 1
h _p	0.4	m	saturated thickness at the pit wall
r _p	57.7	m	effective pit radius
d	0.4	m	depth of the pit lake

r_o is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Inflow from Zone 1

Radius of influence r_o calculated by iterating equation A

67 m

Known h_o

1.5 m

h_o calculated using Equation A

1.5 m

Q₁ 3.9E-05 m³/s
3.4E+00 m³/day

Inflow from Zone 2

Anisotropy parameter calculated using equation D

3.162278

Q₂ 3.6E-05 m³/s
3.1E+00 m³/day

Total Pit Inflow

Q_{TOT} 7.5E-05 m³/s
6.5E+00 m³/day

Reference: Marinelli, F. & Niccoli W. L. 2000.
Simple analytical equations for estimating ground water inflow
to a mine pit. Ground Water 38, no. 2: 311-314.

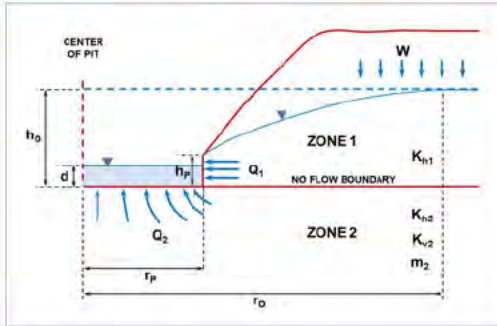
Analysed by: J. Ferry 8/06/2026
Checked by: B. Sinclair 12/06/2026

Notes: The hydraulic conductivity of 4.04E-04 used in this assessment is a minimum estimate.

GROUNDWATER DRAWDOWN AROUND OPEN PIT - APPROXIMATION

WGA

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 Project #: WGA242463
 Location: Artificial Wetland 3 Operational Groundwater Inflows
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$$dH_{Zone1} = h_0 - \sqrt{\frac{h_p^2}{K_{h1}} + \frac{W}{K_{h1}} \left[r_0^2 \ln\left(\frac{r}{r_p}\right) - \frac{(r^2 - r_p^2)}{2} \right]}$$

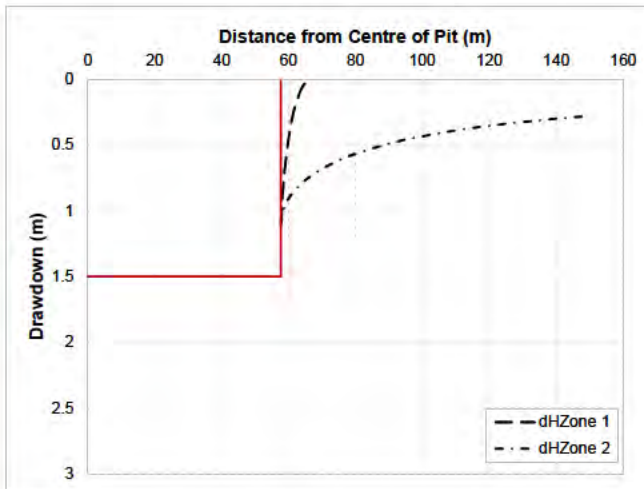
$$dH_{Zone2} = \frac{2(h_0 - d)}{\pi} \sin^{-1} \left(\frac{r_p}{r} \right)$$

$$m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	1.11E-08	m/s	recharge flux
K _{h1}	4.48E-07	m/s	horizontal hydraulic conductivity in Zone 1
K _{h2}	4.48E-07	m/s	horizontal hydraulic conductivity in Zone 2
K _{v2}	4.48E-08	m/s	vertical hydraulic conductivity in Zone 2
h ₀	1.5	m	initial saturated thickness above the base of Zone 1
h _p	0.4	m	saturated thickness at the pit wall
r _p	57.68946	m	effective pit radius
d	0.4	m	depth of the pit lake

r₀ is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Radius of influence r₀ calculated by iterating equation A in analysis sheet 1 67 m



Drawdown curves		
r	dH _{Zone 1}	dH _{Zone 2}
57.68946	1.1	1.1
58.0	0.9	1.0
58.4	0.8	1.0
59.0	0.6	1.0
60.0	0.4	0.9
61.0	0.3	0.9
62.0	0.2	0.8
64.0	0.1	0.8
66.0	0.0	0.7
68.0		0.7
70.0		0.7
72.0		0.7
75.0		0.6
80.0		0.6
90.0		0.5
100.0		0.4
110.0		0.4
120.0		0.4
130.0		0.3
140.0		0.3
150.0		0.3

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water inflow
 to a mine pit. Ground Water 38, no. 2: 311-314.

Analysed by: J. Ferry 8/06/2026
 Checked by: B. Sinclair 12/06/2026

Notes: The drawdown curves apply along the no-flow boundary line at an elevation equivalent to the base of the pit.
 The dH_{Zone2} line does not take into account recharge from above.
 Drawdown projections are initial approximations only.

APPENDIX F

GROUNDWATER MOUNDING ASSESSMENT



MOUNDSOLV Analysis for Artificial Wetland 2

Model Inputs

The site-specific input values for the Artificial Wetland 3 groundwater mounding assessment are presented in Table F1. The groundwater flow direction in relation to the orientation of Artificial Wetland 3 is presented in Figure F1 with the location of the nearest buildings and railway to the site.

Table F1: Inputs for Mounding Assessment – Basin A

MODEL INPUT PARAMETER	SCENARIO 1: 1 DAY EVENT	SCENARIO 2: 30 DAY WET PERIOD AND 335 DAY RECOVERY	INFORMATION SOURCE
Length (m)	137		Maven Design received 08/06/26
Width (m)	95		
Event Duration (days)	1	30	Scenario 1: 1-day storm event duration. Scenario 2: Approximate to 36 days, which is the number of average winter rain days. (NIWA Hamilton, AWS rainfall station 2112).
Maximum Acceptable Groundwater Mounding Height (m)	3.6		Taken as the distance from the winter water table (derived from the piezometric surface) to the top of the permanent water level provided by Maven.
Aquifer Specific Yield (m ³ /m ³)	0.2		Typical for aquifer type (Morris and Johnson 1967).
Aquifer Hydraulic Conductivity (m/day)	2.4		Geometric Mean of Hydraulic test results for Hinuera Formation intercepted at basin base.
Aquifer Hydraulic Gradient (m/m)	-0.0038		Calculated from interpreted winter piezometric surface.
Aquifer Dip Direction (degrees)	19.16		
Aquifer Saturated Thickness (m)	5.65		Estimated from Hinuera Formation in CMW CPT25-13 to modelled base depth of 10 m bgl
Rotation of the Infiltration Basin Length (degrees)	-39.5		From Maven basin design plans

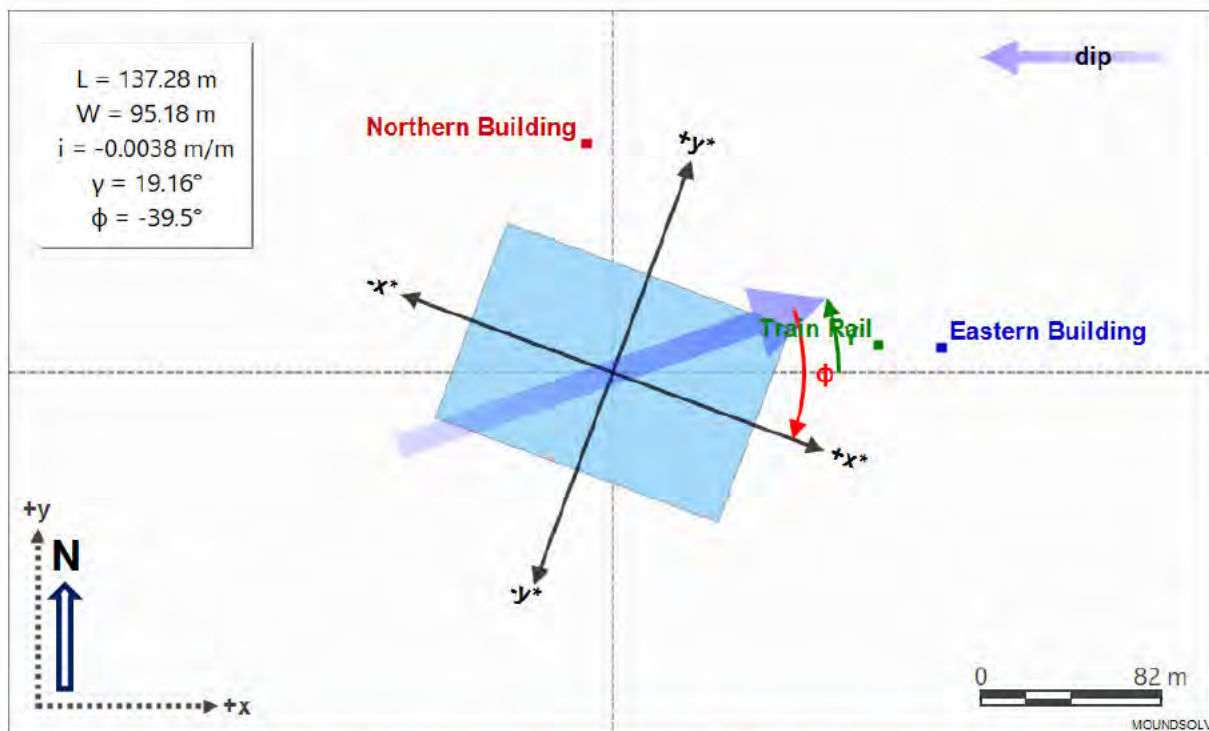


Figure F1: Artificial Wetland 3 and Closest Structures Relative to Groundwater Flow Direction

Mounding Assessment Results Summary

Modelled infiltration rates (Table F2) are considered to represent an average for the duration of the simulated rainfall event (1 day and 30 days). In effect, recharge through the floor of the basin is defined as being constant until the simulated storm event ceased, at which point the recharge immediately stops. Caveats regarding the use of this conceptualisation are provided later in this appendix.

Table F2: Summary of Mounding Assessment Results for Artificial Wetland 2

MODEL OUTPUT	SCENARIO 1: 1 DAY EVENT	SCENARIO 2: 30 DAY WET PERIOD	SCENARIO 2: 335 DAY RECOVERY	NOTES
Modelled Infiltration Rate (m/d)	0.72	0.04 (total of 1.2 m over 30 days)		Modelled with water levels in the basin reaching the permanent water level (outflow point).
Modelled Mounding at Artificial Wetland 3 (m)	3.6	3.6	0.23	
Maximum Modelled Mounding at Neighbouring Structures (m)	<0.01	0.49	0.21	Northern Building
	<0.01	0.39	0.21	Train Rail
	<0.01	0.14	0.19	Eastern Building

Artificial Wetland 3 Scenario 1 – Model Outputs

The modelling results, including the calculated mounding contours (Figure F2), mounding profiles (Figure F3 and Figure F4) and projected changes in groundwater levels at key points around the basin (Figure F5), indicate detectable groundwater mounding would not extend as far as nearby existing structures by the end of the 1-day rainfall event.

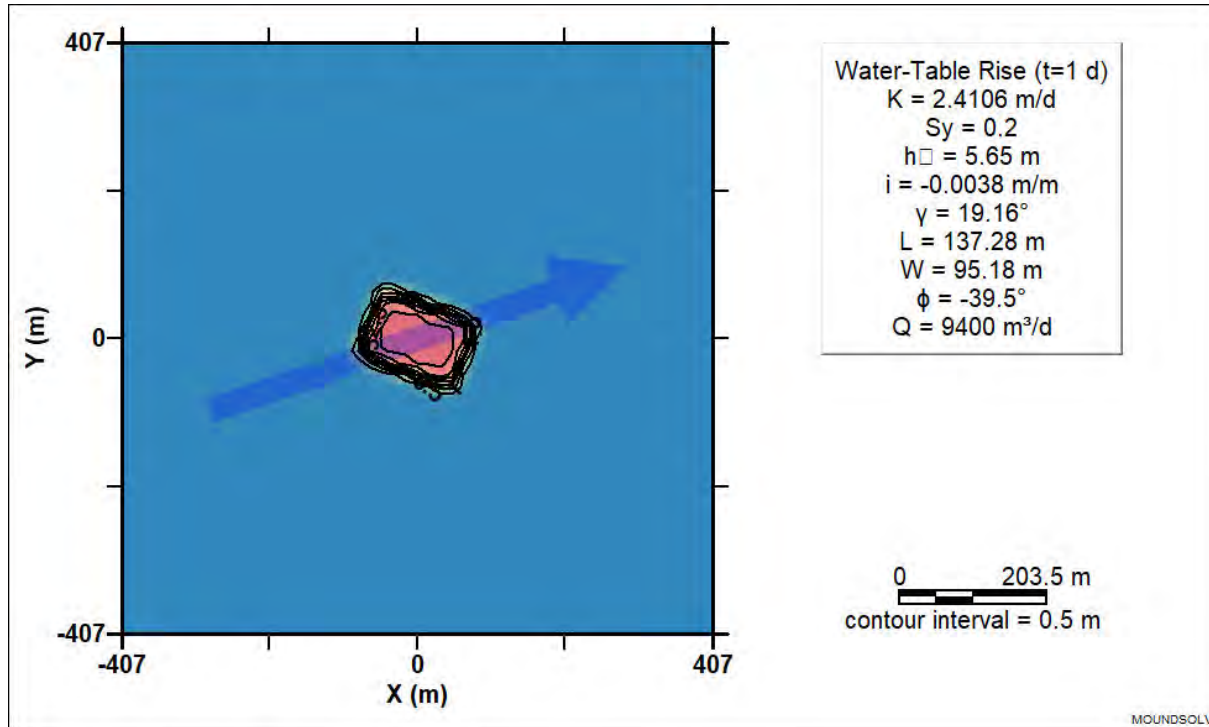


Figure F2: Calculated Mounding Contours at Artificial Wetland 3 at the End of a 1-day Storm Event

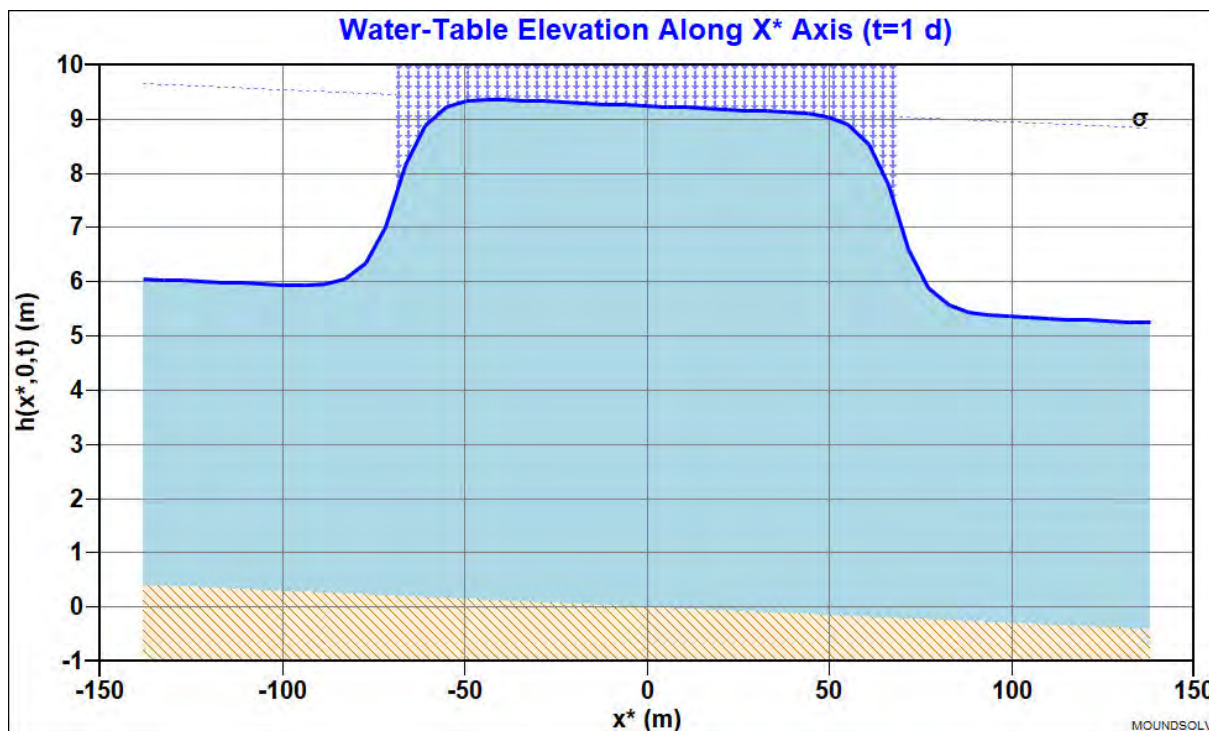


Figure F3: Calculated Mounding, Artificial Wetland 3, X-Axis Visualisation, Following a 1-day Storm Event

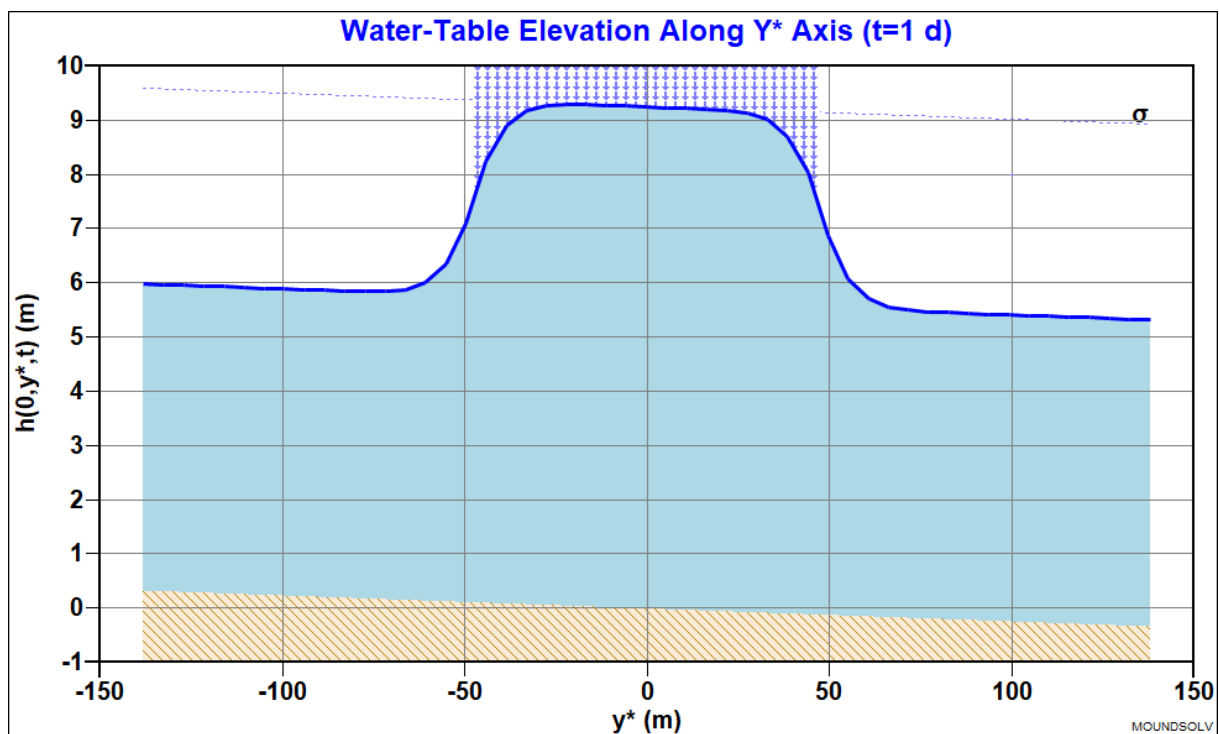


Figure F4: Calculated Mounding, Artificial Wetland 3, Y-Axis Visualisation, Following a 1-day Storm Event

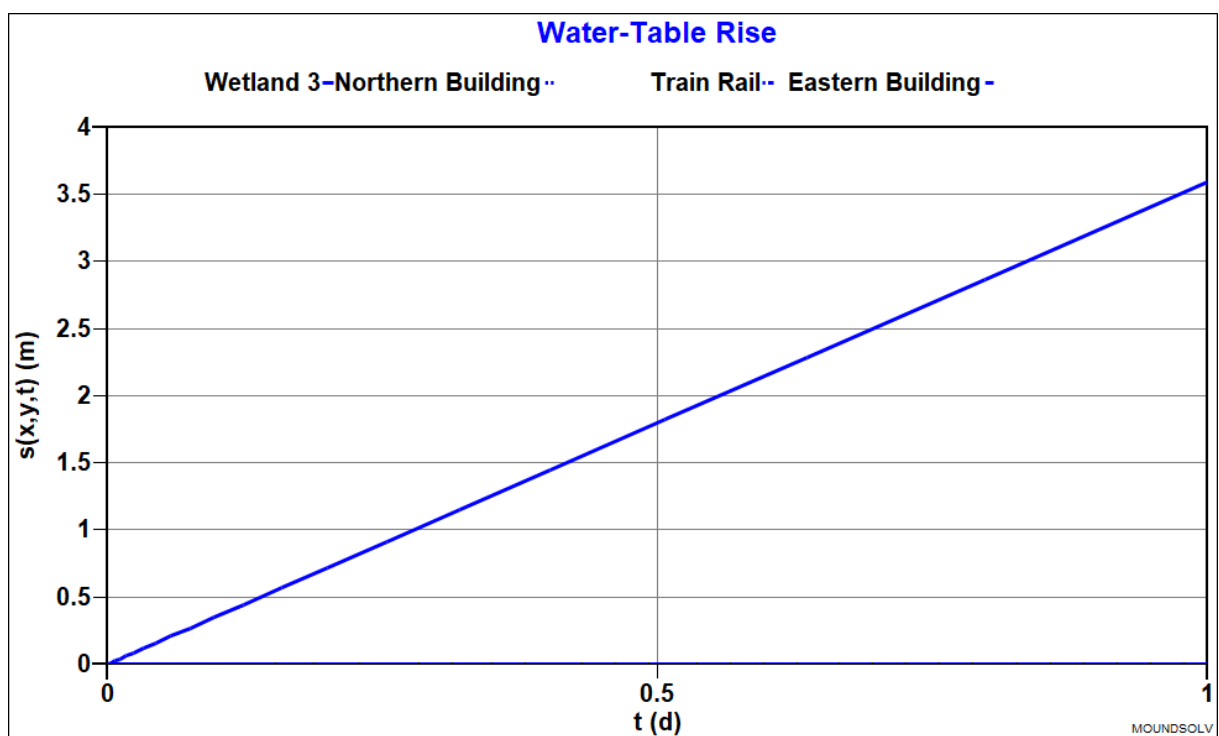


Figure F5: Groundwater Table Hydrographs at Artificial Wetland 3 in Response to 1 Day Event

Artificial Wetland 2 Scenario 3 – Model Outputs

The modelling results, including the calculated mounding contours (Figure F6), mounding profiles (Figure F7 and Figure F8) and projected changes in groundwater levels at key points around the basin during the recharge period (Figure F9), indicate groundwater mounding would extend as far as the nearest existing structures by the end of the simulated wet period.

Following the simulated wet period, the simulated groundwater levels beneath the basin decline by approximately 3.37 m over a period of 335 days (Figure F10). This decline in groundwater level beneath the basin is matched by an expansion of the area affected by groundwater mounding (Figure F10). The dissipation of the mounded groundwater under the basin results in continuing rises in simulated groundwater levels outside the basin for weeks to months (Figure F10). During the event recovery period, the peak increases in groundwater levels at the neighbouring structures do not exceed 0.75 m rise (Figure F10). Following a 335 day recovery period, the simulated rises in groundwater levels at neighbouring structures are less than 0.25 m (Figure F10).

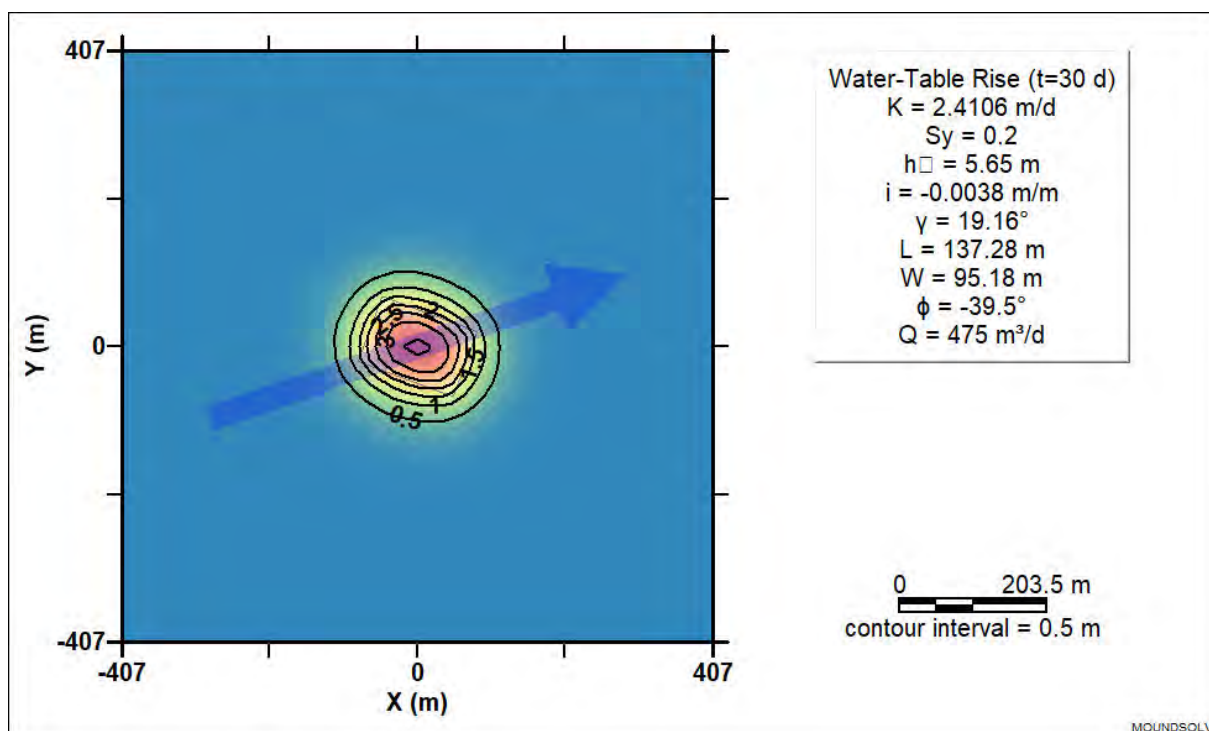


Figure F6: Calculated Mounding Contours at Artificial Wetland 3 at the end of 30 days

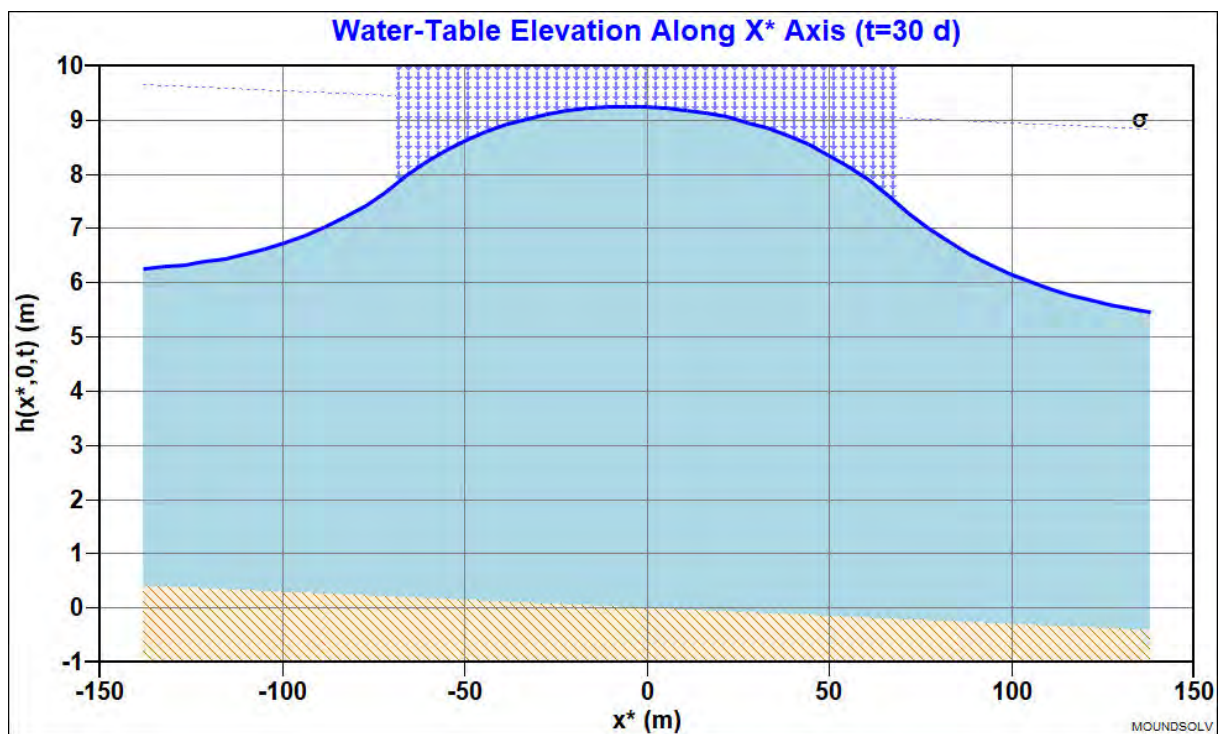


Figure F7: Calculated Mounding, Artificial Wetland 3, X-Axis Visualisation, Following 30 days

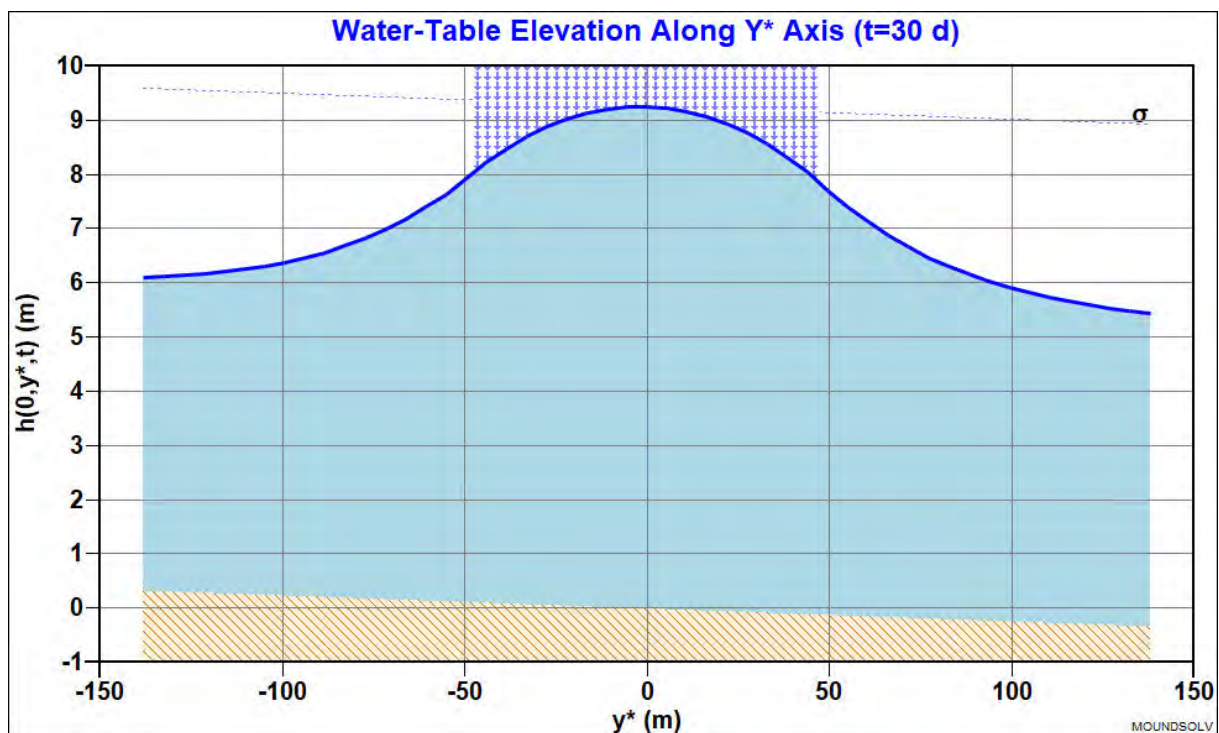


Figure F8: Calculated Mounding, Artificial Wetland 3, Y-Axis Visualisation, Following 30 days

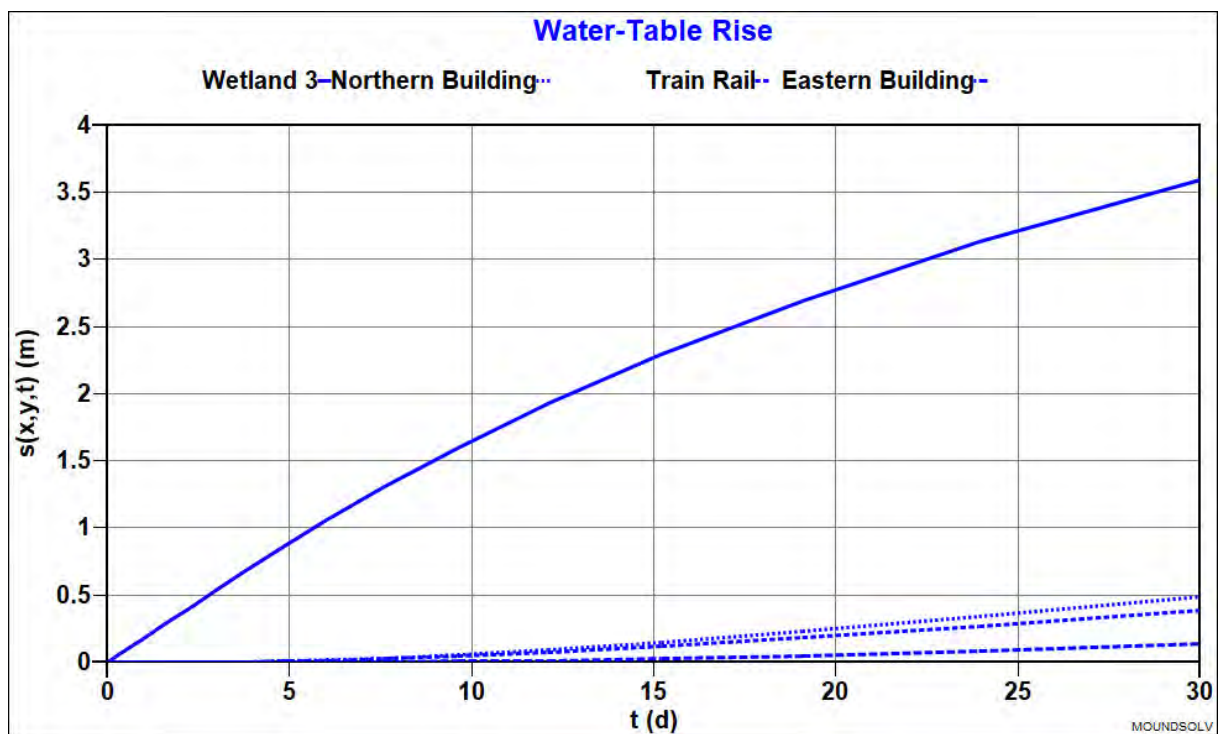


Figure F9: Groundwater Table Hydrographs at Artificial Wetland 3 in Response to 30 day event

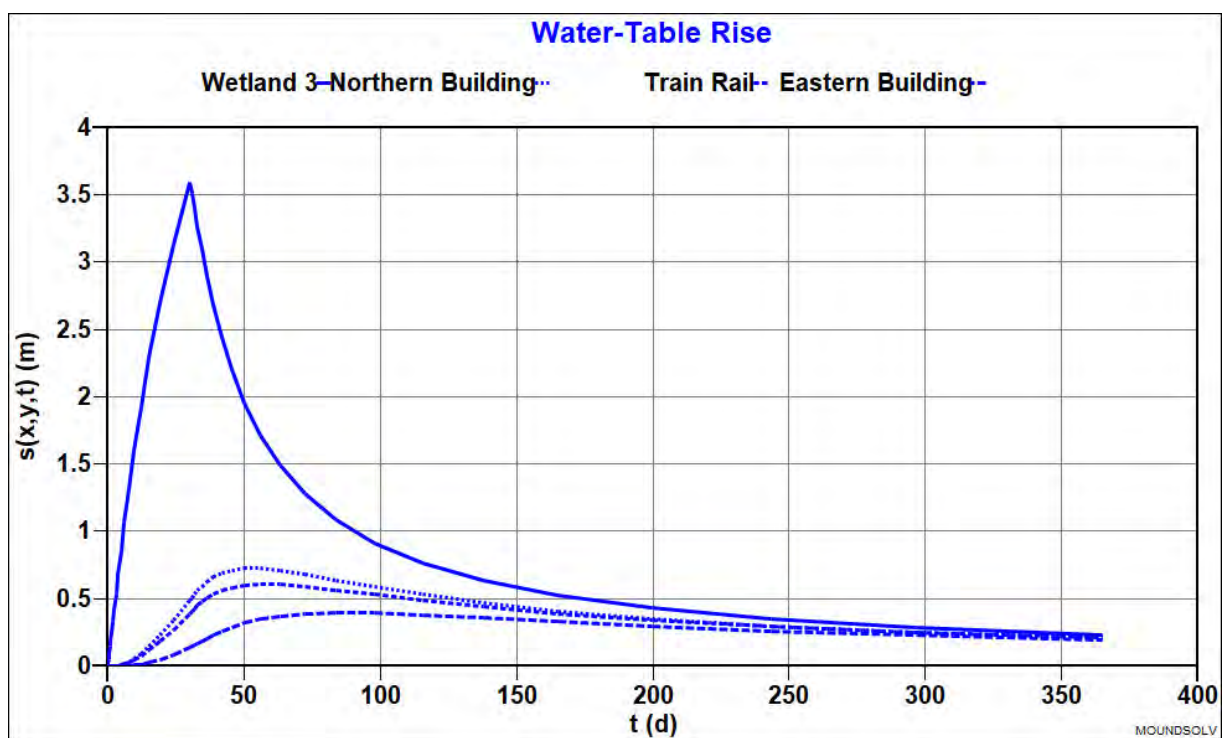


Figure F10: Groundwater Table Hydrographs at Artificial Wetland 3 in Response to 30 day event and 335 day recovery

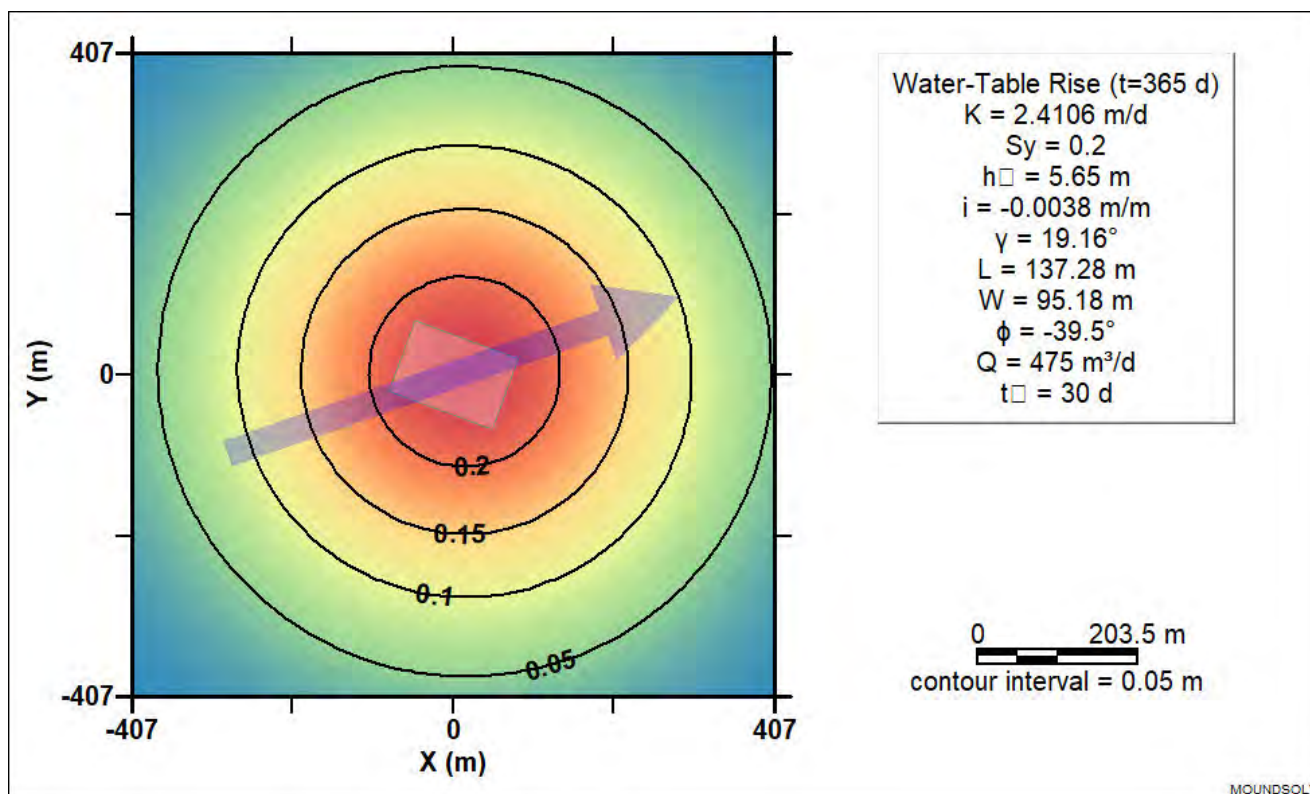


Figure F11: Calculated Mounding Contours at Artificial Wetland 3 335 days after a the 30 day wet period

Modelling Assumptions and Caveats

It is important to note the following assumptions incorporated in the Moundsolv simulations:

1. The storage capacity of the basin is not taken into account in simulation of the initial mounding. This means that the recharge rate is defined as being constant throughout the designated storm event. In effect, runoff entering the basin is simulated to initially recharge the underlying groundwater system until the induced groundwater mound intersects the floor of the basin. After that point, it is assumed that the rate of rise of water in the basin will match that of the surrounding groundwater, with no change to the infiltration rate through to the end of the designated recharge period and no account taken of storage of water in the basin. This conceptualisation does not reflect in detail the hydraulic processes associated with the basin operation. However, it does provide a reasonable indication of groundwater mounding in response to stormwater runoff entering the basin.
2. The volume of water stored in the artificial wetland basin is not taken into account in the modelling. This means that each model assumes recharge to groundwater under the basin ceases as soon as the designated storm recharge period ends. Any accumulated water in the basin is not taken into account in the simulation.
3. The MoundSolv model has no designated lateral hydraulic boundary conditions, but it does have a no-flow boundary defined for the base of the model. This means all water introduced to the model needs to be distributed within the defined model throughout the model run period. If there are drains or other potential groundwater discharge points within the modelled area, these are not taken into account in the mounding simulation.

The recharge rate derived for each storm event simulation and the extent of groundwater mounding derived by MoundSolv are primarily dependent on:

1. The length of the simulated storm event. The shorter the storm event, the greater the calculated infiltration rate but the more limited the eventual extent of groundwater mounding.
2. The hydraulic conductivity of the receiving aquifer. The higher the aquifer hydraulic conductivity, the greater the infiltration rate and the greater the eventual extent and magnitude of groundwater mounding.
3. The thickness of the receiving aquifer. The smaller the receiving aquifer thickness, the smaller the calculated infiltration rate and the smaller the eventual extent and magnitude of groundwater mounding.

The potential range in potential mounding in response to variations in these parameters could be investigated through a sensitivity analysis. However, in practical terms it would be more effective to undertake further focused site investigations during construction and to use the outcomes to optimise the final designs for the wetlands to ensure groundwater mounding does not impact nearby structures.

APPENDIX G

DRAWDOWN CALCULATIONS FOR WASTEWATER PUMP STATIONS



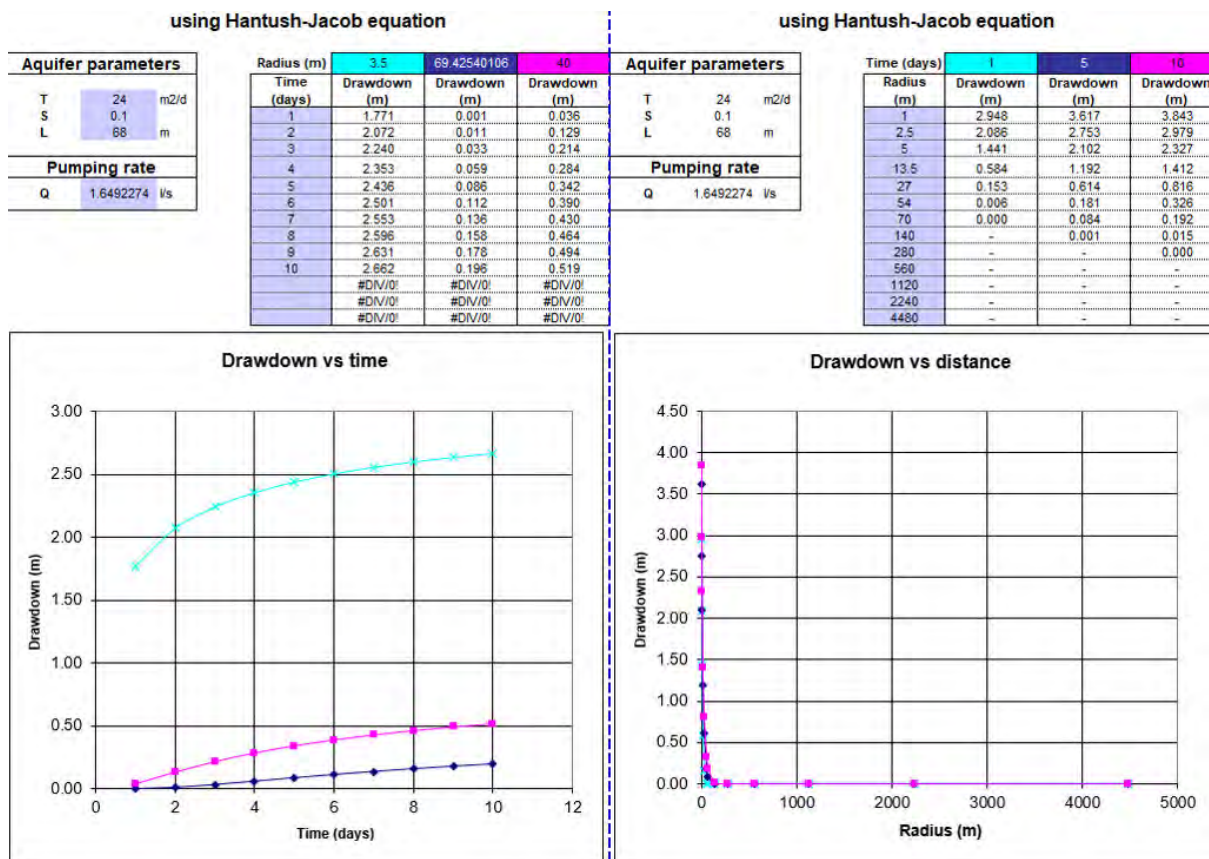


Figure G1: Northern WWPS B Calculation Sheets Following Three Days of Pumping to Achieve Dewatering

using Hantush-Jacob equation

Aquifer parameters		
T	24	m ² /d
S	0.1	
L	68	m
Pumping rate		
Q	1.3878765	l/s

Radius (m)	3.5	53.45375724	100
Time (days)	Drawdown (m)	Drawdown (m)	Drawdown (m)
1	1.491	0.005	0.000
2	1.744	0.038	0.000
3	1.885	0.080	0.003
4	1.980	0.120	0.007
5	2.050	0.156	0.014
6	2.105	0.188	0.022
7	2.148	0.215	0.031
8	2.184	0.240	0.040
9	2.214	0.261	0.049
10	2.240	0.279	0.057
	#DIV/0!	#DIV/0!	#DIV/0!
	#DIV/0!	#DIV/0!	#DIV/0!
	#DIV/0!	#DIV/0!	#DIV/0!

Aquifer parameters		
T	24	m ² /d
S	0.1	
L	68	m
Pumping rate		
Q	1.3878765	l/s

using Hantush-Jacob equation

Time (days)	1	5	10
Radius (m)	Drawdown (m)	Drawdown (m)	Drawdown (m)
1	2.481	3.044	3.234
2.5	1.755	2.317	2.507
5	1.213	1.769	1.958
13.5	0.491	1.003	1.188
27	0.129	0.517	0.687
54	0.005	0.152	0.274
56.9479075	0.003	0.133	0.249
113.895815	0.000	0.006	0.034
227.79163	-	0.000	0.000
455.58326	-	-	-
911.166521	-	-	-
1822.33304	-	-	-
3644.66608	-	-	-

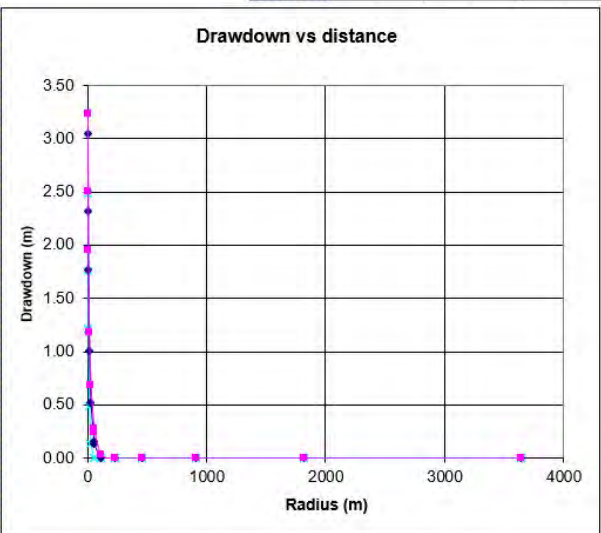
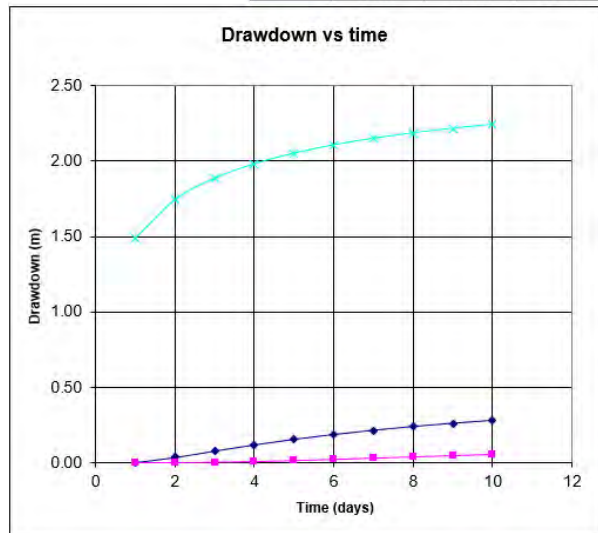


Figure G2: Northern WWPS B Calculation Sheets Following 10 Days of Pumping to Achieve Dewatering

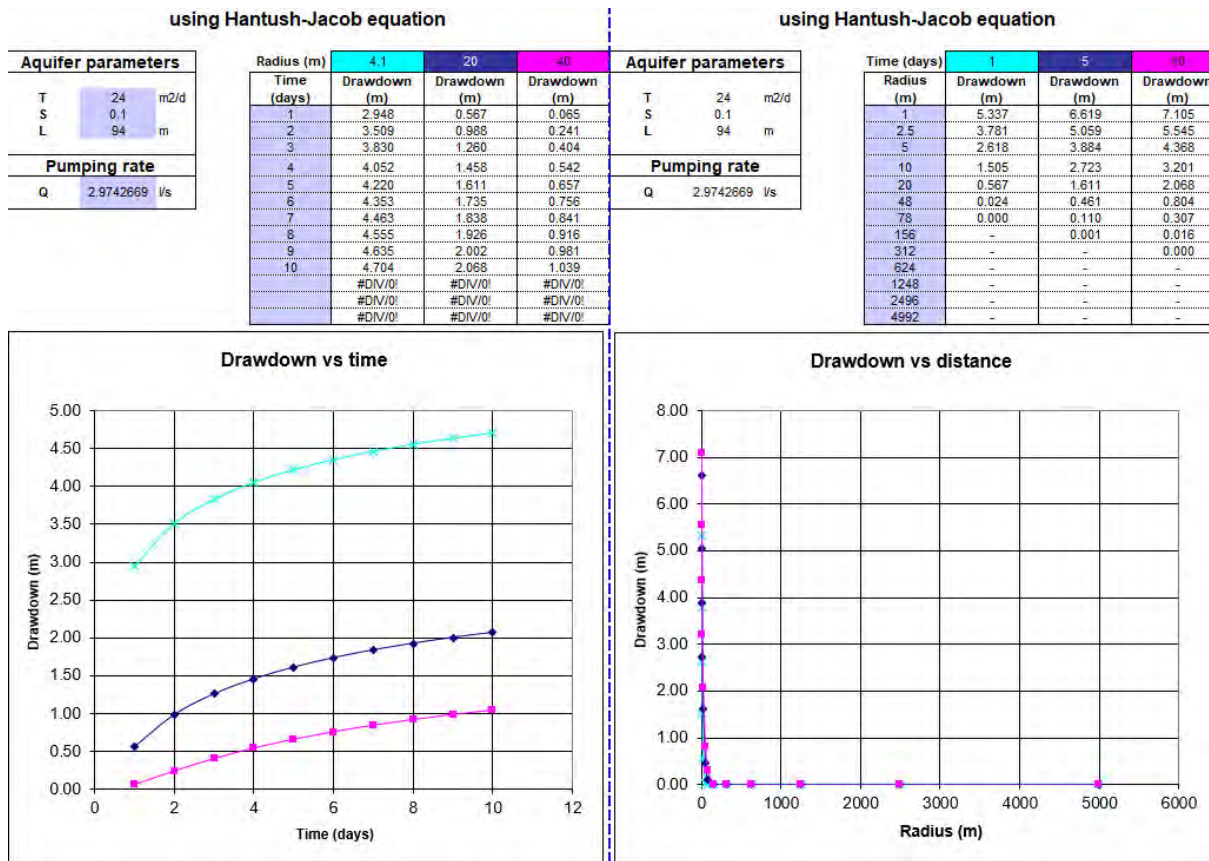


Figure G3: Central WWPS A Calculation Sheets Following Three Days of Pumping to Achieve Dewatering

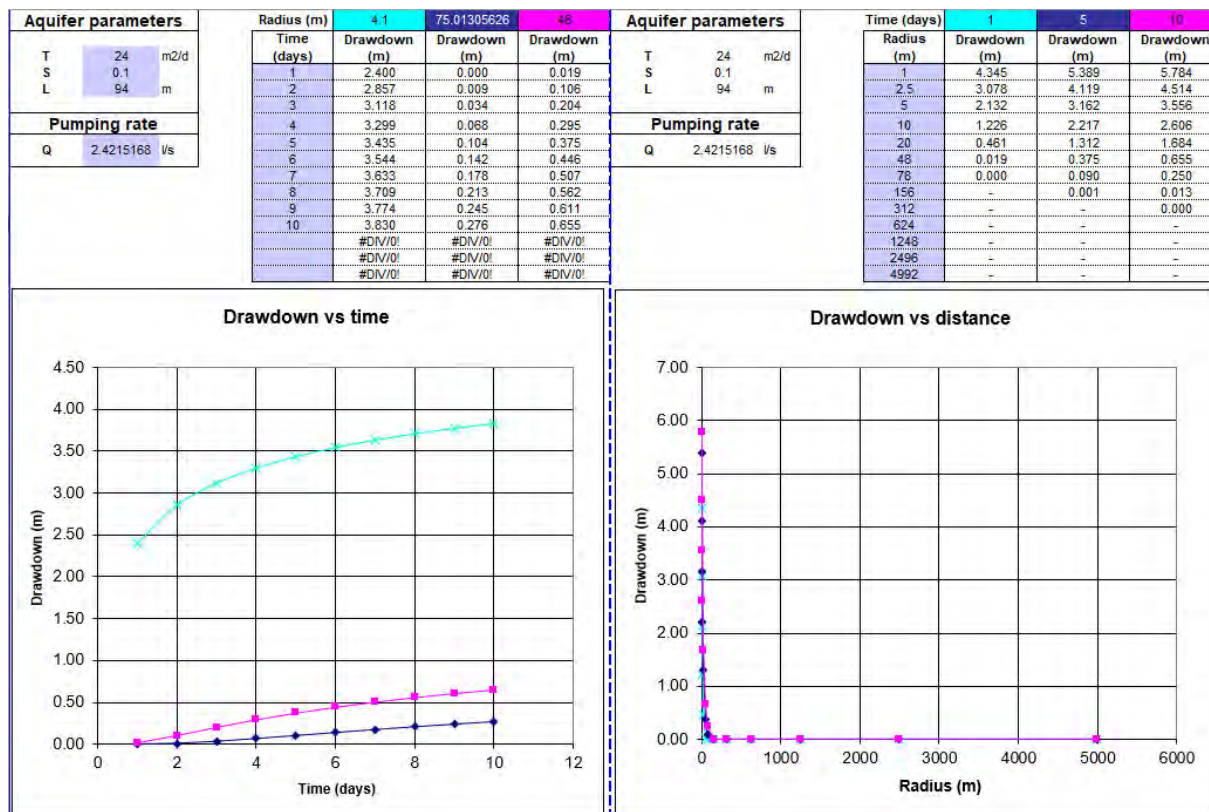
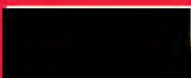


Figure G4: Central WWPS B Calculation Sheets Following 10 Days of Pumping to Achieve Dewatering



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