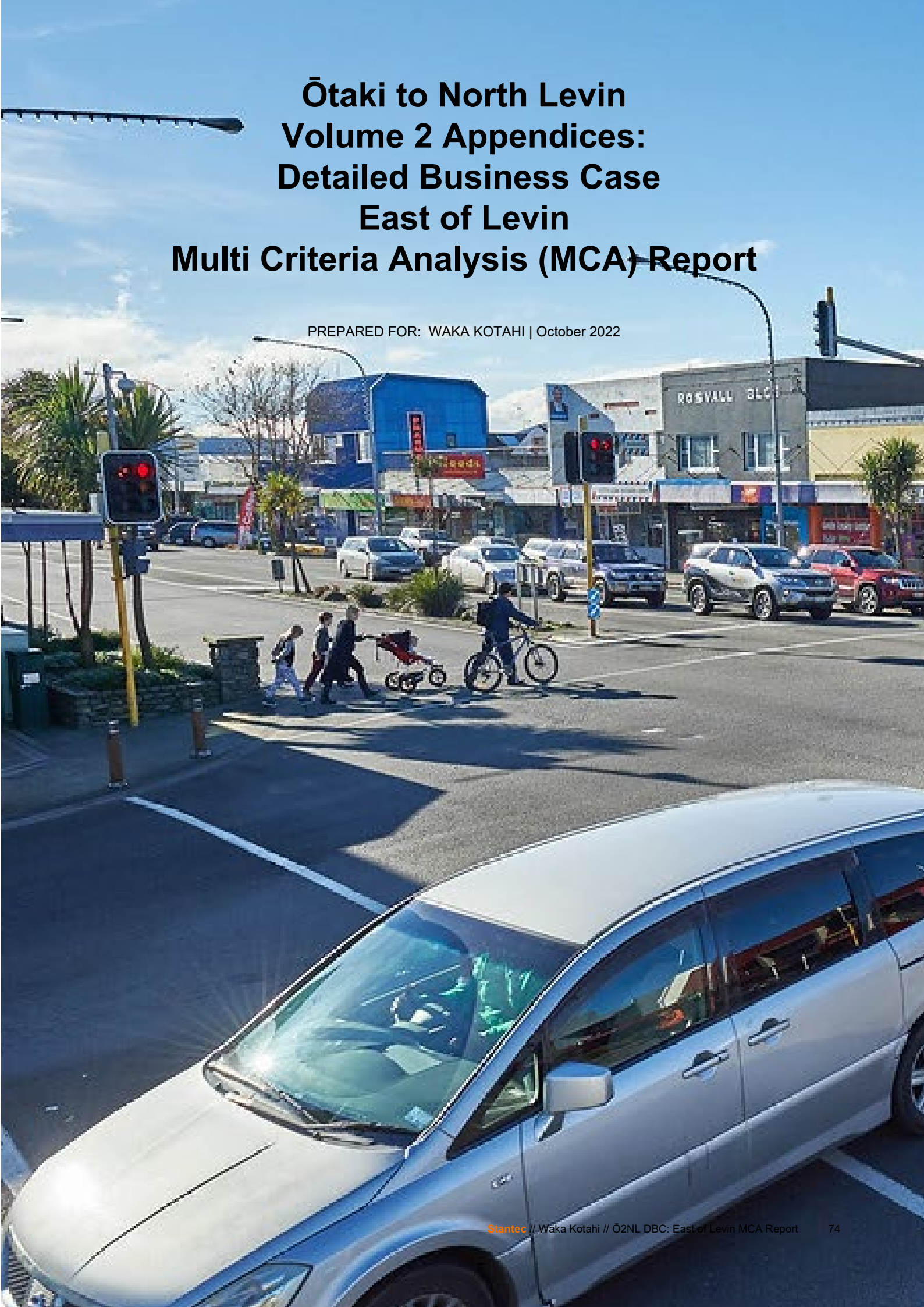
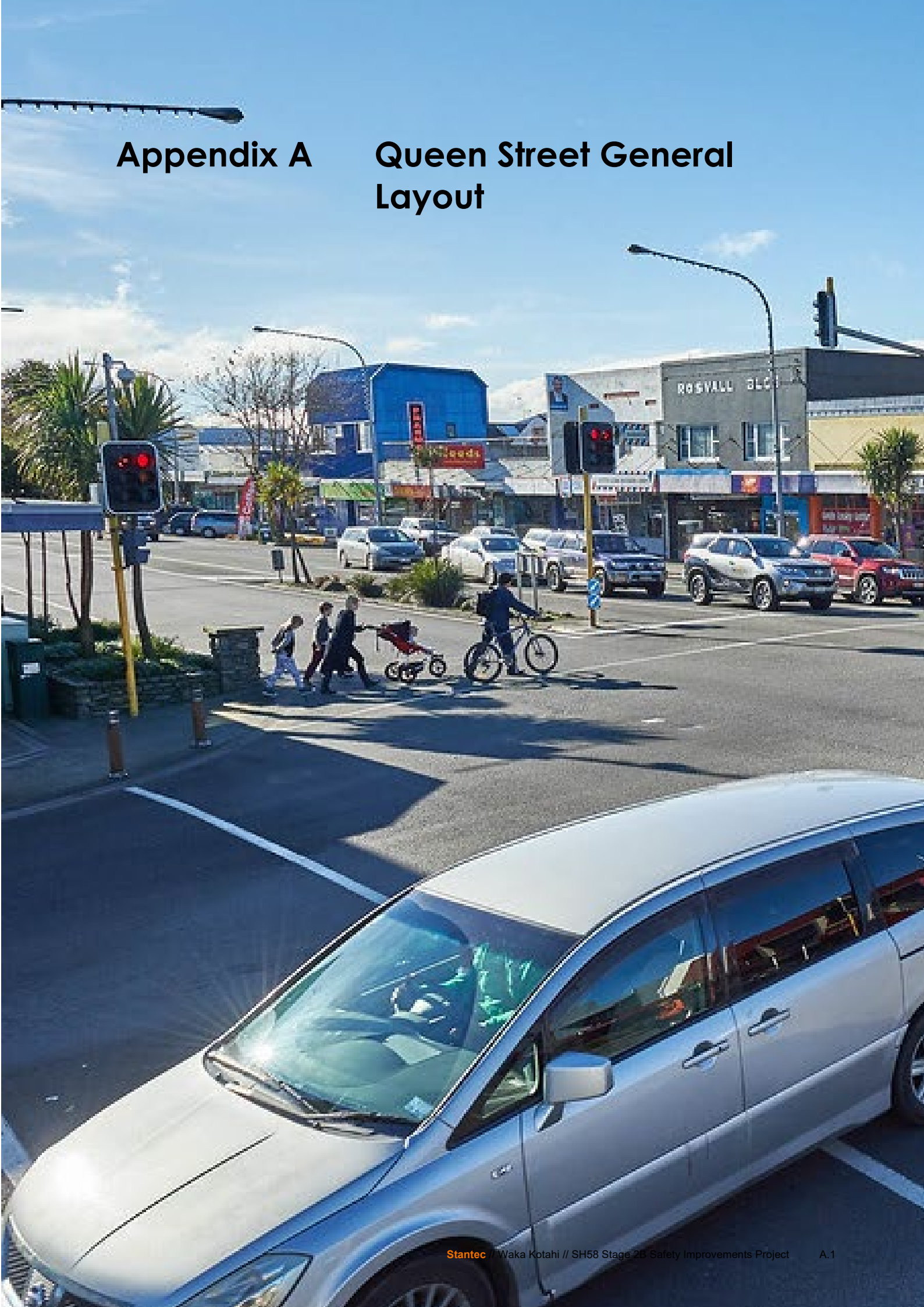
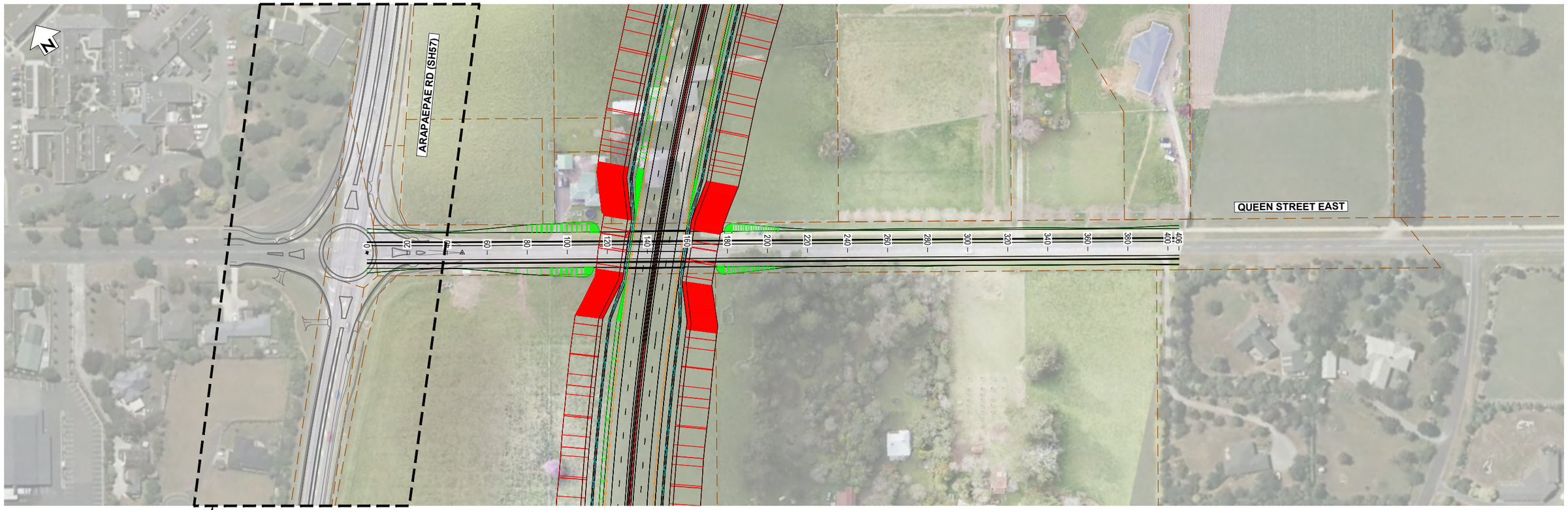
Ōtaki to North Levin
Volume 2 Appendices:
Detailed Business Case
East of Levin
Multi Criteria Analysis (MCA) Report

PREPARED FOR: WAKA KOTAHI | October 2022

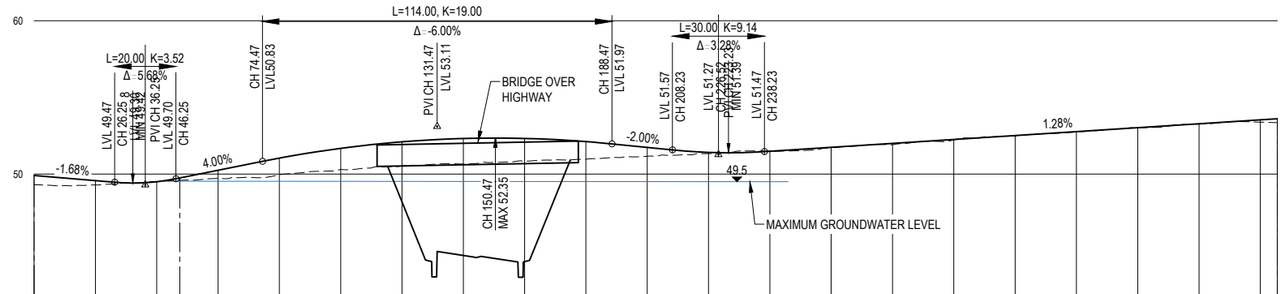


Appendix A Queen Street General Layout





ALREADY IN CONSTRUCTION.
NOT SUBJECT TO MCA



HAD = 42.00

-CUT +FILL	+0.60	+0.28	0.00	+0.15	+0.54	+1.08	+1.38	+1.57	+1.67	+1.48	+1.15	+0.57	+0.08	-0.01	+0.02	+0.08	+0.03	+0.04	+0.02	0.00	+0.02	+0.15	+0.25
FINISHED LEVEL	49.91	49.57	49.51	49.75	50.25	51.04	51.68	52.11	52.32	52.33	52.12	51.74	51.41	51.49	51.75	52.00	52.26	52.51	52.77	53.03	53.28	53.54	53.61
GROUND LEVEL	49.31	49.29	49.51	49.60	49.71	49.96	50.30	50.53	50.65	50.85	50.97	51.16	51.33	51.50	51.72	51.92	52.23	52.48	52.75	53.03	53.26	53.39	53.36
CHAINAGE	0.00	20.00	40.00	47.52	60.00	80.00	100.00	120.00	140.00	160.00	180.00	200.00	220.00	240.00	260.00	280.00	300.00	320.00	340.00	360.00	380.00	400.00	405.52
VERTICAL GEOMETRY		L=27.82 -1.7%	L=20.00, Δ=5.68% K=3.52	L=28.22 4.0%		L=114.00, Δ=-6.00% K=19.00						L=19.76 -2.0%	L=30.00, Δ=3.28% K=9.14		L=191.86 1.3%								
HORIZONTAL GEOMETRY		47.52m 121°16'53"				358.00m 120°56'12"																	

LONGITUDINAL SECTION - Q0 - Queen H
SCALES: HOR 1:1000 VERT 1:200

LEGEND

CUT

FILL

NOTES / DESIGN ASSUMPTIONS

1. LONGSECTION IS FOR SURFACE OF LOCAL ROAD ONLY.
2. ORIGINAL DBC OPTION WITH STANDARD EARTHWORKS TRENCH IS NOT TECHNICALLY FEASIBLE DUE TO MAXIMUM GROUNDWATER LEVELS.

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE
A	ISSUED FOR INFORMATION	SS	JP	JP	21.09.21

SURVEYED		
DESIGNED	Melissa Nel	
DRAWN	Steve Sutton	
CAD REVIEW		
DESIGN CHECK		
DESIGN REVIEW		
APPROVED		
PROF REGISTRATION:		

Stantec

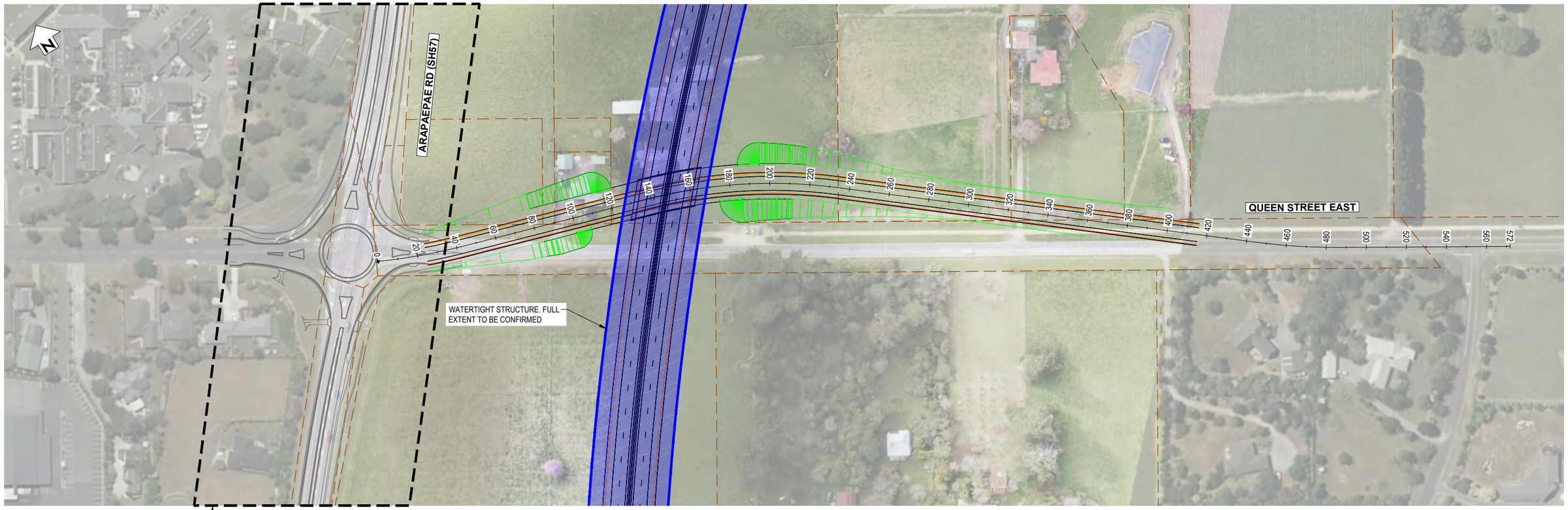
Client: WAKA KOTAHI NZ TRANSPORT AGENCY

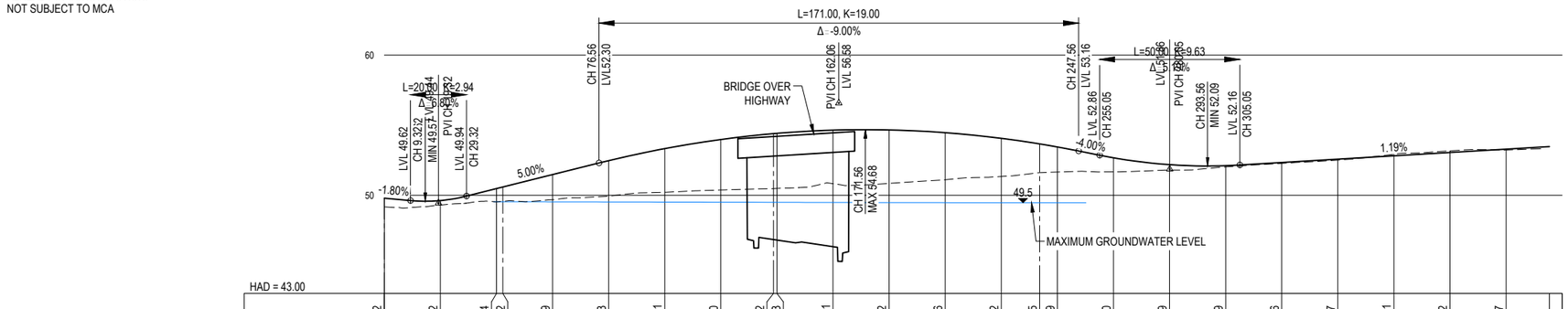
WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

OPTION Q0 - QUEEN STREET
HIGHWAY FULLY BELOW GRADE (DBC)

Status Stamp: **WORKING PLOT**
Date Stamp:
Scales: AS SHOWN
Drawing No.: 310203848-01-001-SK1000
Rev.: A

pw:\\stantec-ap-pw.bentley.com:stantec-ap-pw-01\Documents\New Zealand Clients\NZTA (New Zealand Transport Agency)\310203848 - Otaki to North of Levin DBC\01\Optioneering East Levin MCA\310203848-01-001-SK1000





ALREADY IN CONSTRUCTION.
NOT SUBJECT TO MCA

HAD = 43.00

CHAINAGE	-CUT +FILL	FINISHED LEVEL	GROUND LEVEL
0.00	+0.62	49.79	49.17
20.00	+0.32	49.62	49.30
40.00	+0.94	50.47	49.53
42.27	+1.02	50.59	49.57
60.00	+1.79	51.47	49.68
80.00	+2.53	52.47	49.94
100.00	+3.11	53.33	50.21
120.00	+3.60	53.98	50.38
138.76	+3.92	54.39	50.48
140.00	+3.93	54.41	50.49
160.00	+3.81	54.64	50.83
180.00	+3.82	54.66	50.84
200.00	+3.36	54.46	51.11
220.00	+2.72	54.06	51.34
233.68	+2.05	53.66	51.61
240.00	+1.79	53.44	51.66
260.00	+1.00	52.67	51.67
280.00	+0.39	52.18	51.79
300.00	+0.09	52.11	52.02
320.00	+0.06	52.33	52.27
340.00	+0.07	52.57	52.51
360.00	-0.11	52.81	52.93
380.00	-0.12	53.05	53.17
400.00	+0.07	53.29	53.22
415.44		53.47	
420.00			

VERTICAL GEOMETRY
L=1 -1.
L=20.00, Δ=6.80% K=2.94
L=47.24 5.0%
L=171.00, Δ=-9.00% K=19.00
L=7.49 -4.0%
L=50.00, Δ=5.19% K=9.63
L=110.39 1.2%

HORIZONTAL GEOMETRY
R 285.00 A 42.27
96.49m 106°57'52"
R 250.00 A 94.92
211.63m 128°43'05"

LONGITUDINAL SECTION - Q1 - Queen H
SCALES: HOR 1:1000 VERT 1:200

LEGEND

🟥	CUT
🟩	FILL

NOTES / DESIGN ASSUMPTIONS

1. LONGSECTION IS FOR SURFACE OF LOCAL ROAD ONLY.
2. BURIED STRUCTURES ARE WATERTIGHT AND GROUNDWATER DOES NOT ENTER.
3. BUOYANCY RESTRAINED VIA SCREW ANCHORS.
4. STORMWATER WOULD BE LOCALLY COLLECTED WITHIN THE STRUCTURE AND DISCHARGED VIA MECHANICAL MEANS.
5. SURFACE FLOOD WATERS WOULD BE INTERCEPTED, AND ROUTED AWAY/AROUND FROM BURIED STRUCTURES.
6. EXTENT OF WATERTIGHT STRUCTURE TO BE CONFIRMED BUT REQUIRED FOR FULL EXTENT OF INTERFACE WITH HIGH GROUNDWATER.
7. QUEEN STREET WOULD BE REDUCED TO 50 OR 60km/h LEGAL SPEED LIMIT.
8. WALKING AND CYCLING (W&C) FACILITIES WOULD BE PROVIDED ON THE QUEEN STREET OVERBRIDGE.
9. QUEEN STREET IS REALIGNED NORTHWARDS TO AVOID IMPACT ON PROUSE FRONTAGE.
10. SURFACE FLOOD WATERS / FLOW PATHS TO BE MAINTAINED WITH USE OF CULVERTS OR SIPHONS.

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE
A	ISSUED FOR INFORMATION	SS	JP	JP	21.09.21

SURVEYED	
DESIGNED	Melissa Nel
DRAWN	Steve Sutton
CAD REVIEW	
DESIGN CHECK	
DESIGN REVIEW	
APPROVED	
PROF REGISTRATION:	

Stantec

Client:
WAKA KOTAHI NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

OPTION Q1 - QUEEN STREET
HIGHWAY PARTIALLY BELOW GRADE

Status Stamp **WORKING PLOT**
Date Stamp
Scales AS SHOWN
Drawing No. 310203848-01-001-SK1001
Rev. A

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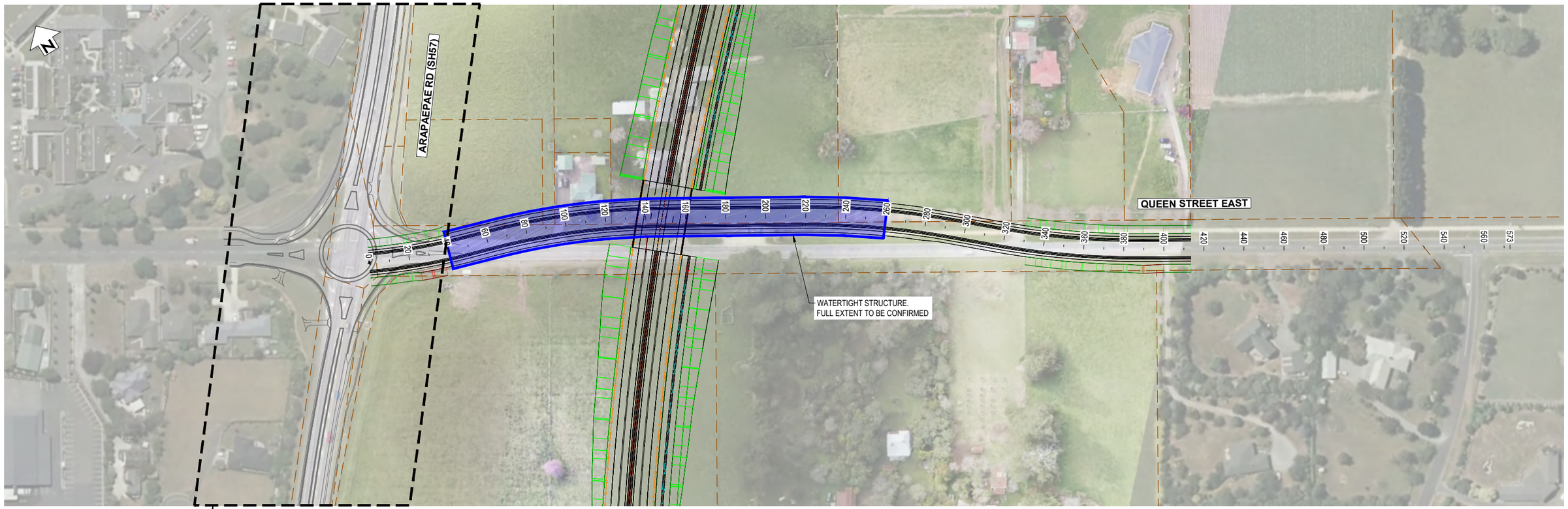

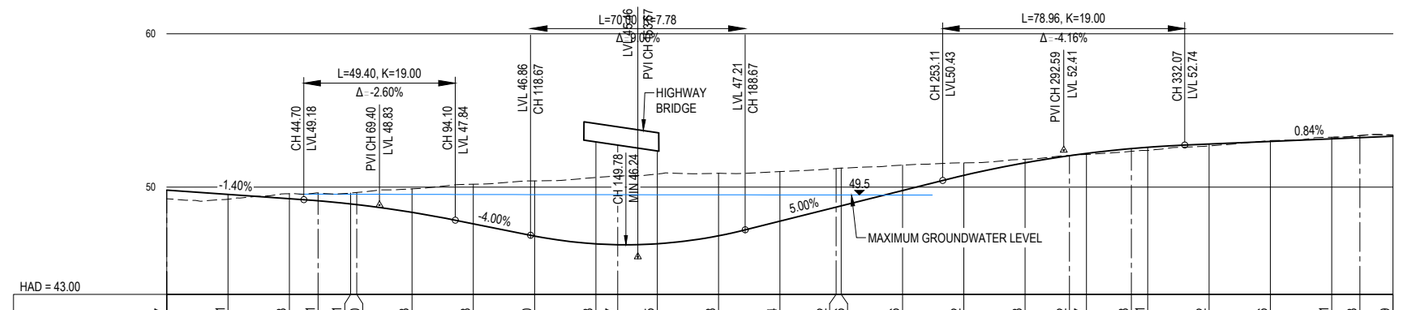

HAD = 43.00

-CUT +FILL	+0.57	+0.31	-0.33	-0.51	-0.71	-0.80	-1.53	-2.58	-3.60	-4.33	-4.47	-4.55	-4.08	-3.24	-2.52	-2.46	-1.66	-0.82	-0.23	-0.02	+0.07	+0.18	+0.21	+0.12	-0.06	-0.11	-0.13	-0.09
FINISHED LEVEL	49.80	49.52	49.24	49.10	48.90	48.85	48.35	47.61	46.81	46.30	46.24	46.30	46.82	47.78	48.69	48.78	49.78	50.76	51.59	52.05	52.20	52.51	52.60	52.81	52.97	53.14	53.22	53.31
GROUND LEVEL	49.24	49.21	49.57	49.61	49.61	49.65	49.88	50.19	50.41	50.63	50.71	50.85	50.90	51.01	51.21	51.24	51.44	51.58	51.81	52.07	52.13	52.33	52.39	52.68	53.03	53.25	53.36	53.40
CHAINAGE	0.00	20.00	40.00	49.37	60.00	61.98	80.00	100.00	120.00	140.00	147.09	160.00	180.00	200.00	218.33	220.00	240.00	260.00	280.00	294.45	300.00	314.65	320.00	340.00	360.00	380.00	389.21	400.00
VERTICAL GEOMETRY		L=44.86 -1.4%		L=49.40, Δ=-2.60% K=19.00			L=24.56 -4.0%		L=70.00, Δ=9.00% K=7.78					L=64.45 5.0%			L=78.96, Δ=-4.16% K=19.00					L=81.43 0.8%						
HORIZONTAL GEOMETRY		R 300.00 A 49.37		12.61m 106°46'45"			R 350.00 A 85.11			71.23m 120°42'45"			R 400.00 A 76.13		20.19m 131°37'00"		R 400.00 A 74.56		183.73m 120°56'12"									

LONGITUDINAL SECTION - Q2 - Queen H
SCALES: HOR 1:1000 VERT 1:200

LEGEND

CUT

FILL

NOTES / DESIGN ASSUMPTIONS

1. LONGSECTION IS FOR SURFACE OF LOCAL ROAD ONLY.
2. BURIED STRUCTURES ARE WATERTIGHT AND GROUNDWATER DOES NOT ENTER.
3. BUOYANCY RESTRAINED VIA SCREW ANCHORS.
4. STORMWATER WOULD BE LOCALLY COLLECTED WITHIN THE STRUCTURE AND DISCHARGED VIA MECHANICAL MEANS.
5. SURFACE FLOOD WATERS WOULD BE INTERCEPTED, AND ROUTED AWAY/AROUND FROM BURIED STRUCTURES.
6. EXTENT OF WATERTIGHT STRUCTURE TO BE CONFIRMED BUT REQUIRED FOR FULL EXTENT OF INTERFACE WITH HIGH GROUNDWATER.
7. QUEEN STREET WOULD BE REDUCED TO 50 OR 60km/h LEGAL SPEED LIMIT.
8. WALKING AND CYCLING FACILITIES WOULD BE PROVIDED ON THE QUEEN STREET UNDERPASS.
9. QUEEN STREET IS REALIGNED NORTHWARDS TO AVOID IMPACT ON PROUSE FRONTAGE.

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE
A	ISSUED FOR INFORMATION	SS	JP	JP	21.09.21

SURVEYED		
DESIGNED	Melissa Nel	
DRAWN	Steve Sutton	
CAD REVIEW		
DESIGN CHECK		
DESIGN REVIEW		
APPROVED		
PROF REGISTRATION:		

Stantec

Client: WAKA KOTAHI NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

OPTION Q2 - QUEEN STREET
LOCAL ROAD PARTIALLY BELOW GRADE

Status Stamp: **WORKING PLOT**
Date Stamp:
Scales: AS SHOWN
Drawing No.: 310203848-01-001-SK1002
Rev.: A

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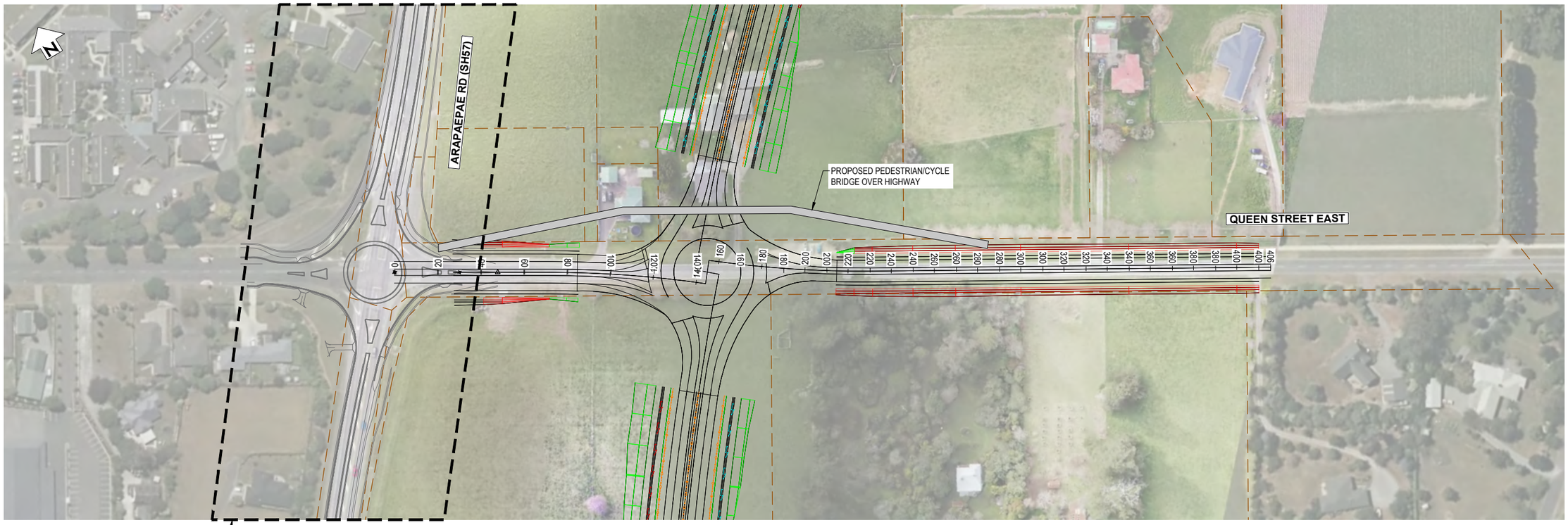


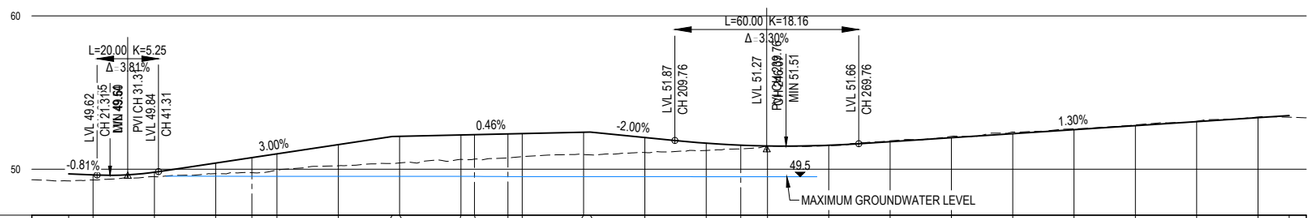
ALREADY IN CONSTRUCTION.
NOT SUBJECT TO MCA

LEGEND

🟥	CUT
🟩	FILL

NOTES / DESIGN ASSUMPTIONS

1. LONGSECTION IS FOR SURFACE OF LOCAL ROAD ONLY.
2. QUEEN STREET WOULD BE REDUCED TO 50 OR 60km/h LEGAL SPEED LIMIT.
3. WALKING AND CYCLING FACILITIES WOULD BE PROVIDED ON A SEPARATE BRIDGE.
4. SURFACE FLOOD WATERS / FLOW PATHS TO BE MAINTAINED WITH USE OF CULVERTS.



-CUT +FILL		+0.46	+0.34	+0.29	+0.69	+0.98	+1.06	+1.38	+1.75	+1.73	+1.59	+1.59	+1.57	+1.50	+1.45	+1.49	+0.98	+0.47	+0.25	+0.02	+0.03	-0.05	-0.09	-0.10	-0.05	-0.05	-0.02	-0.04	+0.11	
FINISHED LEVEL		49.70	49.63	49.80	50.40	50.76	51.00	51.60	52.13	52.14	52.23	52.25	52.30	52.32	52.41	52.42	52.07	51.69	51.57	51.52	51.56	51.80	52.06	52.32	52.58	52.84	53.10	53.36	53.49	
GROUND LEVEL	49.31	49.23	49.29	49.51	49.71	49.77	49.94	50.22	50.38	50.41	50.65	50.66	50.73	50.82	50.96	50.93	51.08	51.22	51.32	51.50	51.53	51.85	52.14	52.42	52.63	52.89	53.12	53.40	53.39	53.35
CHAINAGE	0.00	12.03	20.00	40.00	60.00	71.83	80.00	100.00	117.60	120.00	140.00	144.41	155.35	160.00	180.00	182.16	200.00	220.00	231.27	240.00	260.00	280.00	300.00	320.00	340.00	360.00	380.00	400.00	410.20	415.76

VERTICAL GEOMETRY	L=9 -0.	L=20.00, Δ=3.81% K=5.25	L=76.29 3.0%	L=64.56 0.5%	L=27.60 -2.0%	L=60.00, Δ=3.30% K=18.16	L=140.44 1.3%

HORIZONTAL GEOMETRY	71.83m 121°16'53"	R 500.00 A 72.58	10.93m 39°28'36"	R 500.00 A 75.93	184.49m 120°43'07"

LONGITUDINAL SECTION - Q3 - Queen H
SCALES: HOR 1:1000 VERT 1:200

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE
A	ISSUED FOR INFORMATION	SS	JP	JP	21.09.21

SURVEYED	
DESIGNED	Melissa Nel
DRAWN	Steve Sutton
CAD REVIEW	
DESIGN CHECK	
DESIGN REVIEW	
APPROVED	
PROF REGISTRATION:	

Stantec

Client:
WAKA KOTAHI NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

OPTION Q3 - QUEEN STREET
AT-GRADE: ROUNDABOUT

Status Stamp: **WORKING PLOT**
Date Stamp:
Scales: AS SHOWN
Drawing No.: 310203848-01-001-SK1003
Rev.: A

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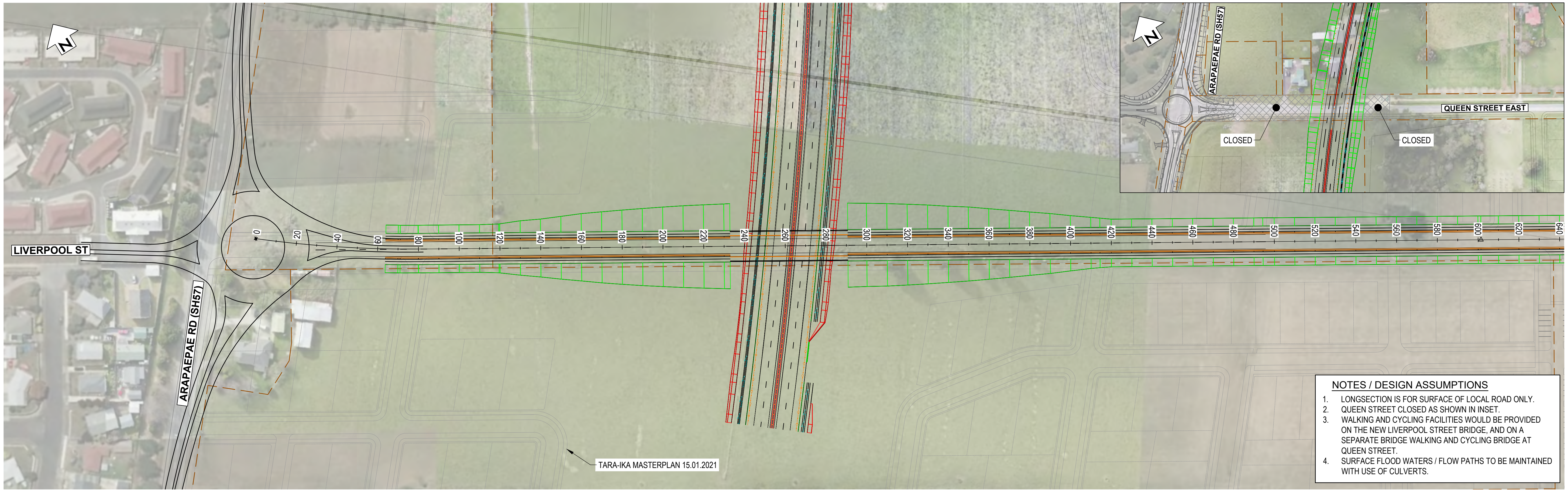
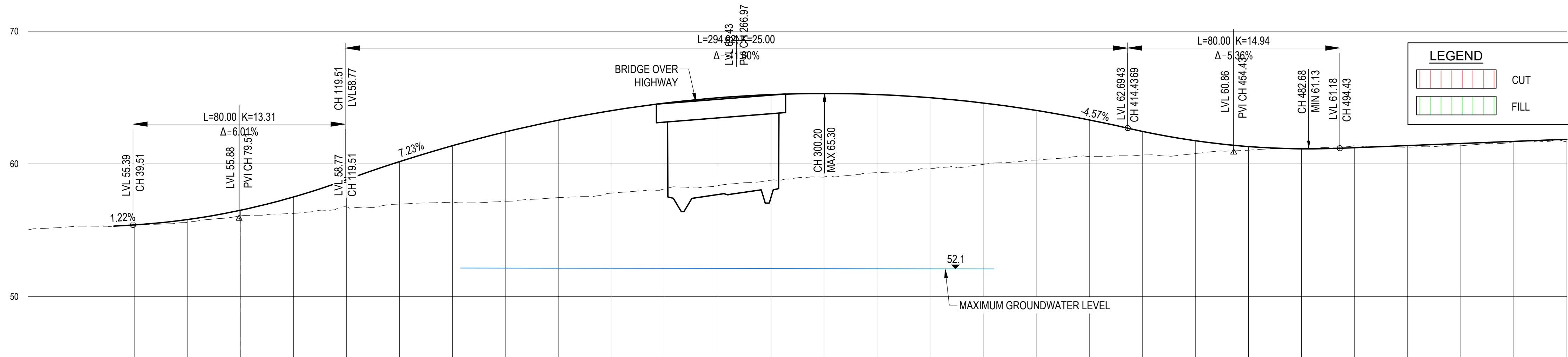


NOTES / DESIGN ASSUMPTIONS

1. LONGSECTION IS FOR SURFACE OF LOCAL ROAD ONLY.
2. QUEEN STREET CLOSED AS SHOWN IN INSET.
3. WALKING AND CYCLING FACILITIES WOULD BE PROVIDED ON THE NEW LIVERPOOL STREET BRIDGE, AND ON A SEPARATE BRIDGE WALKING AND CYCLING BRIDGE AT QUEEN STREET.
4. SURFACE FLOOD WATERS / FLOW PATHS TO BE MAINTAINED WITH USE OF CULVERTS.



LEGEND

CUT

FILL

HAD = 45.00

-CUT +FILL			+0.01	+0.02	+0.20	+0.42	+0.42	+1.23	+2.05	+3.20	+4.25	+5.23	+5.83	+6.21	+6.45	+6.62
FINISHED LEVEL			55.31	55.40	55.80	56.50	56.50	57.50	58.81	60.17	61.37	62.41	63.29	64.01	64.58	64.98
GROUND LEVEL	55.03	55.31	55.30	55.38	55.60	56.08	56.09	56.27	56.76	56.97	57.12	57.18	57.46	57.80	58.12	58.36
CHAINAGE	0.00	20.00	32.30	40.00	60.00	79.92	80.00	100.00	120.00	140.00	160.00	180.00	200.00	220.00	240.00	260.00

-CUT +FILL	+6.45	+6.29	+5.88	+5.35	+4.62	+3.74	+2.75	+1.77	+0.96	+0.28	-0.02	-0.14	+0.13	+0.18	+0.04	+0.12
FINISHED LEVEL	65.22	65.30	65.22	64.98	64.59	64.03	63.31	62.45	61.74	61.30	61.13	61.22	61.38	61.54	61.69	61.85
GROUND LEVEL	58.77	59.01	59.34	59.63	59.96	60.29	60.56	60.68	60.79	61.03	61.16	61.36	61.25	61.36	61.66	61.74
CHAINAGE	280.00	300.00	320.00	340.00	360.00	380.00	400.00	420.00	440.00	460.00	480.00	500.00	520.00	540.00	560.00	580.00

VERTICAL GEOMETRY: L=7.21 1.2% — L=80.00, Δ=6.01% K=13.31 — L=0.00 7.2% — L=294.92, Δ=-11.80% K=25.00 — L=0.00 -4.6% — L=80.00, Δ=5.36% K=14.94 — L=315.11 0.8%

HORIZONTAL GEOMETRY: R 550.00 A 79.92 — 521.48m 120°46'50"

LONGITUDINAL SECTION - Q4 - Liverpool H
SCALES: HOR 1:1000 VERT 1:200

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE
A	ISSUED FOR INFORMATION	SS	JP	JP	21.09.21

SURVEYED	
DESIGNED	Melissa Nel
DRAWN	Steve Sutton
CAD REVIEW	
DESIGN CHECK	
DESIGN REVIEW	
APPROVED	
PROF REGISTRATION:	

Stantec

Client: WAKA KOTAHI NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

OPTION Q4 - LIVERPOOL STREET
AT-GRADE: CLOSE QUEEN, UPGRADE LIVERPOOL

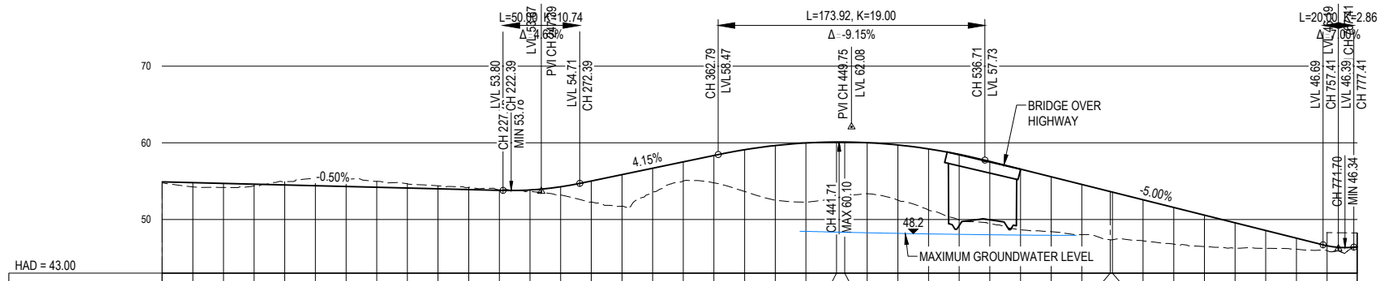
Status Stamp: **WORKING PLOT**
Date Stamp:
Scales: AS SHOWN
Drawing No.: 310203848-01-001-SK1004
Rev.: A

LEGEND

🟥	CUT
🟩	FILL

NOTES / DESIGN ASSUMPTIONS

1. LONGSECTION IS FOR SURFACE OF LOCAL ROAD ONLY.
2. HIGHWAY IS AT-GRADE THROUGH QUEEN STREET.
3. QUEEN STREET CLOSED AS SHOWN IN INSET.
4. WALKING AND CYCLING FACILITIES WOULD BE PROVIDED ON A SEPARATE BRIDGE WALKING AND CYCLING BRIDGE AT QUEEN STREET.
5. QUEEN STREET VEHICLE CONNECTION IS REALIGNED NORTHWARDS.
6. AS SHOWN, REALIGNED LOCAL ROAD RISES OVER NEW HIGHWAY WHICH STAYS AT-GRADE.
7. ALTERNATIVELY, THE LOCAL ROAD COULD STAY AT GROUND LEVEL AND THE HIGHWAY COULD BE RAISED.
8. SURFACE FLOOD WATERS / FLOW PATHS TO BE MAINTAINED WITH USE OF CULVERTS.



HAD = 43.00

-CUT +FILL	+0.11		+0.55	+0.53	+0.22	-0.44	-0.90	-0.96	-0.76	-0.57	-0.38	-0.28
FINISHED LEVEL	54.91		54.81	54.71	54.61	54.51	54.41	54.31	54.21	54.11	54.01	53.91
GROUND LEVEL	54.80	54.79	54.25	54.18	54.39	54.95	55.31	55.27	54.97	54.68	54.39	54.19
CHAINAGE	0.00	0.03	20.00	40.00	60.00	80.00	100.00	120.00	140.00	160.00	180.00	200.00

-CUT +FILL	-0.06	+0.21	+1.06	+2.75	+4.13	+3.16	+2.50	+3.57	+5.44	+7.13	+7.71	+7.28
FINISHED LEVEL	53.81	53.85	54.27	55.03	55.86	56.69	57.52	58.35	59.10	59.65	59.98	60.10
GROUND LEVEL	53.87	53.64	53.21	52.28	51.73	53.53	55.02	54.78	53.66	52.52	52.27	52.82
CHAINAGE	220.00	240.00	260.00	280.00	300.00	320.00	340.00	360.00	380.00	400.00	420.00	440.00

-CUT +FILL	+7.08	+6.64	+7.19	+7.97	+8.54	+8.09	+7.92	+7.14	+6.53	+6.28	+6.21
FINISHED LEVEL	60.10	60.02	59.72	59.21	58.49	57.56	56.56	55.56	54.56	53.64	53.56
GROUND LEVEL	53.02	53.37	52.53	51.24	49.95	49.47	48.65	48.42	48.04	47.36	47.36
CHAINAGE	445.28	460.00	480.00	500.00	520.00	540.00	560.00	580.00	600.00	618.56	620.00

-CUT +FILL	+5.34	+4.78	+4.09	+3.31	+2.33	+1.45	+0.63	+0.02
FINISHED LEVEL	52.56	51.56	50.56	49.56	48.56	47.56	46.58	46.44
GROUND LEVEL	47.23	46.79	46.47	46.25	46.24	46.11	45.95	46.41
CHAINAGE	640.00	660.00	680.00	700.00	720.00	740.00	760.00	779.67

VERTICAL GEOMETRY	L=222.36 -0.5%	L=50.00, Δ=4.65% K=10.74	L=90.40 4.2%	L=173.92, Δ=-9.15% K=19.00	L=220.70 -5.0%	L=20.00, Δ=7.00% K=2.86

HORIZONTAL GEOMETRY	445.28m 4°35'53"	R 250.00 A 173.29	161.11m 324°52'59"

LONGITUDINAL SECTION - Q5 - Queen H
SCALES: HOR 1:2000 VERT 1:400

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE
A	ISSUED FOR INFORMATION	SS	JP	JP	21.09.21

SURVEYED	
DESIGNED	Melissa Nel
DRAWN	Steve Sutton
CAD REVIEW	
DESIGN CHECK	
DESIGN REVIEW	
APPROVED	
PROF REGISTRATION:	

Stantec

Client:
WAKA KOTAHI NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

OPTION Q5 - QUEEN STREET
AT-GRADE: QUEEN DIVERTED NORTH

Status Stamp: WORKING PLOT
Date Stamp:
Scales: AS SHOWN
Drawing No.: 310203848-01-001-SK1005
Rev.: A

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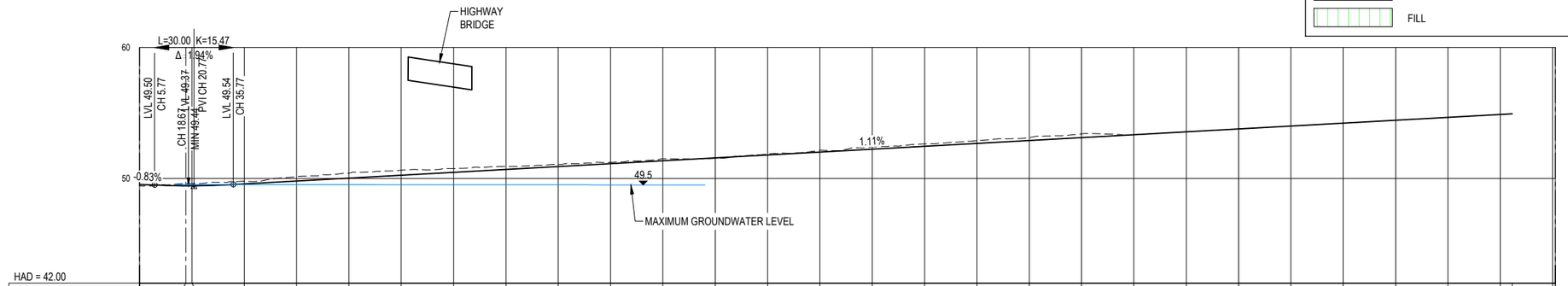
ALREADY IN CONSTRUCTION.
NOT SUBJECT TO MCA

NOTES / DESIGN ASSUMPTIONS

1. LONGSECTION IS FOR SURFACE OF LOCAL ROAD ONLY.
2. QUEEN STREET REMAINS AT EXISTING GRADE, WITH HIGHWAY RISING OVER THE LOCAL ROAD.
3. WALKING AND CYCLING FACILITIES WOULD BE PROVIDED ON QUEEN STREET.
4. HIGHWAY BRIDGE TOTAL SPAN HAS BEEN EXTENDED TO 70m LENGTH TO PROVIDE A MORE OPEN STRUCTURE.
5. SURFACE FLOOD WATERS / FLOW PATHS TO BE MAINTAINED WITH USE OF CULVERTS.

LEGEND

🟥	CUT
🟩	FILL



-CUT +FILL	+0.11	-0.16	-0.17	-0.21	-0.34	-0.37	-0.39	-0.29	-0.25	-0.18	-0.11	-0.15	+0.04	-0.07	-0.13	-0.19	-0.17	-0.21	-0.22	-0.28											
FINISHED LEVEL	49.54	49.44	49.44	49.58	49.80	50.03	50.25	50.47	50.69	50.91	51.13	51.35	51.57	51.79	52.02	52.24	52.46	52.68	52.90	53.12	53.34	53.56	53.78	54.01	54.23	54.45	54.67	54.89	54.94		
GROUND LEVEL	49.43	49.60	49.61	49.79	50.15	50.40	50.63	50.76	50.94	51.09	51.24	51.50	51.53	51.87	52.15	52.43	52.63	52.89	53.12	53.40											
CHAINAGE	0.00	17.69	20.00	40.00	60.00	80.00	100.00	120.00	140.00	160.00	180.00	200.00	220.00	240.00	260.00	280.00	300.00	320.00	340.00	360.00	380.00	400.00	420.00	440.00	460.00	480.00	500.00	520.00	524.55	540.00	541.08
VERTICAL GEOMETRY	L=5.7 -0.8%	L=30.00, Δ=1.94% K=15.47		L=488.78 1.1%																											
HORIZONTAL GEOMETRY	17.69m 121°16'53"	523.39m 120°56'12"																													

LONGITUDINAL SECTION - Q6 - Queen H
SCALES: HOR 1:1000 VERT 1:200

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE
A	ISSUED FOR INFORMATION	SS	JP	JP	21.09.21

SURVEYED	
DESIGNED	Melissa Nel
DRAWN	Steve Sutton
CAD REVIEW	
DESIGN CHECK	
DESIGN REVIEW	
APPROVED	
PROF REGISTRATION:	

Stantec

Client:
WAKA KOTAHI NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

OPTION Q6 - QUEEN STREET
HIGHWAY OVER TOP

Status Stamp
WORKING PLOT

Date Stamp

Scales AS SHOWN

Drawing No. 310203848-01-001-SK1006
Rev. A

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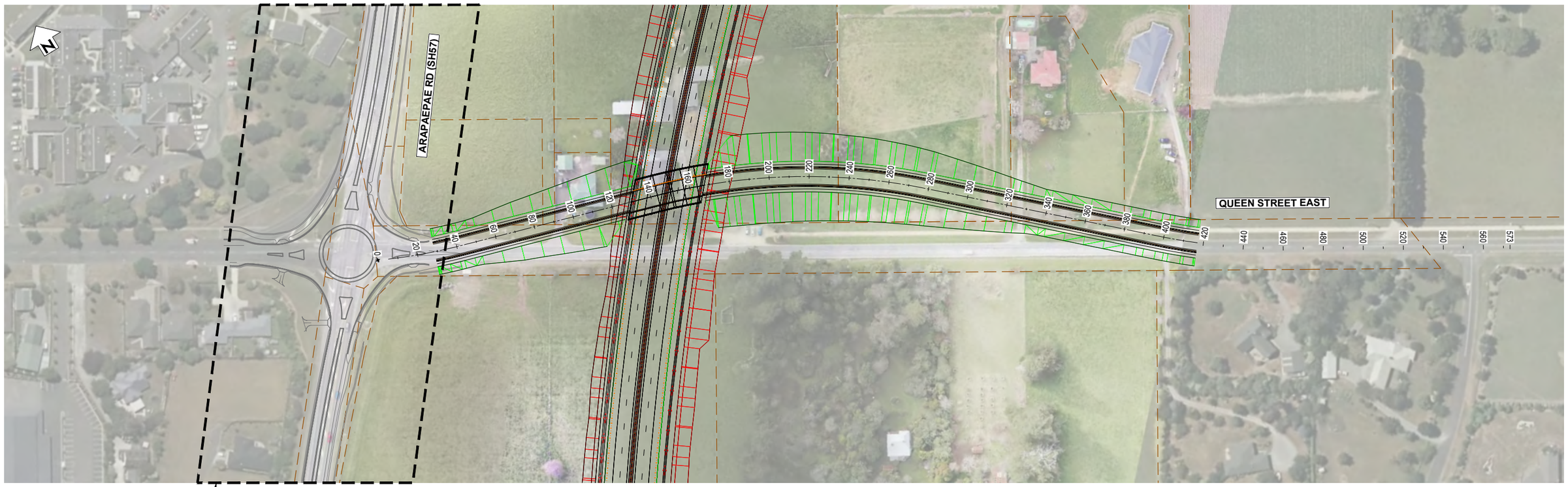
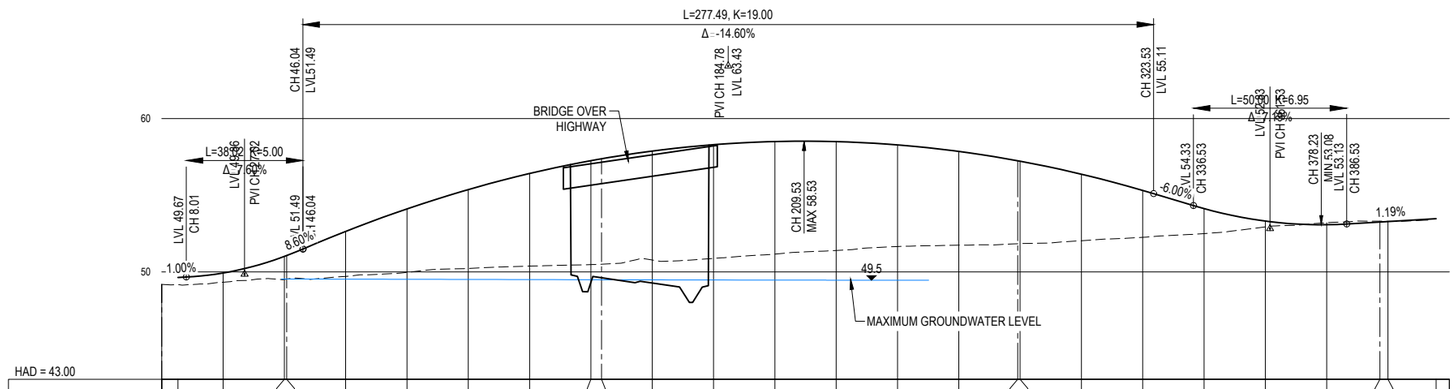


ALREADY IN CONSTRUCTION.
NOT SUBJECT TO MCA



HAD = 43.00

-CUT +FILL		+0.47	+0.60	+1.50	+1.53	+2.94	+4.14	+5.14	+6.04	+6.77	+6.87	+7.10	+7.42	+7.35
FINISHED LEVEL		49.64	49.93	51.01	51.07	52.64	54.11	55.37	56.42	57.25	57.38	57.88	58.30	58.50
GROUND LEVEL	49.19	49.17	49.33	49.51	49.54	49.71	49.97	50.23	50.38	50.48	50.51	50.78	50.88	51.16
CHAINAGE	0.00	5.27	20.00	40.00	40.76	60.00	80.00	100.00	120.00	140.00	143.46	160.00	180.00	200.00

-CUT +FILL	+7.10	+6.62	+6.11	+5.41	+5.37	+4.34	+3.06	+1.63	+0.38	-0.13	-0.06	-0.02		
FINISHED LEVEL	58.50	58.28	57.86	57.25	57.22	56.37	55.32	54.13	53.31	53.08	53.25	53.29	53.47	
GROUND LEVEL	51.40	51.66	51.74	51.84	51.85	52.04	52.26	52.50	52.93	53.21	53.31	53.30		
CHAINAGE	220.00	240.00	260.00	279.20	280.00	300.00	320.00	340.00	360.00	380.00	397.35	400.00	415.68	420.00

VERTICAL GEOMETRY	L=2.74 1.0%	L=38.02, Δ=7.60% K=5.00	L=0.00 8.6%	L=277.49, Δ=-14.60% K=19.00	L=13.00 -6.0%	L=50.00, Δ=7.19% K=6.95
						L=29.15 1.2%

HORIZONTAL GEOMETRY	R 275.85 A 40.76	102.70m 106°55'28"	R 300.00 A 135.74	118.15m 132°50'49"	R 300.00 A 62.36

LONGITUDINAL SECTION - Q7 - Queen H
SCALES: HOR 1:1000 VERT 1:200

LEGEND

🟥	CUT
🟩	FILL

NOTES / DESIGN ASSUMPTIONS

1. LONGSECTION IS FOR SURFACE OF LOCAL ROAD ONLY.
2. QUEEN STREET WOULD BE REDUCED TO 50 OR 60KM/H LEGAL SPEED LIMIT.
3. WALKING & CYCLING (W&C) FACILITIES WOULD BE PROVIDED ON THE QUEEN STREET OVERBRIDGE.
4. QUEEN STREET IS REALIGNED NORTHWARDS TO AVOID IMPACT ON PROUSE FRONTAGE.
5. SURFACE FLOOD WATERS / FLOW PATHS TO BE MAINTAINED WITH USE OF CULVERTS.

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE
A	ISSUED FOR INFORMATION	SS	JP	JP	21.09.21

SURVEYED	
DESIGNED	Melissa Nel
DRAWN	Steve Sutton
CAD REVIEW	
DESIGN CHECK	
DESIGN REVIEW	
APPROVED	
PROF REGISTRATION:	

Stantec

Client:
WAKA KOTAHI
NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

OPTION Q7 - QUEEN STREET
LOCAL ROAD OVER TOP

Status Stamp **WORKING PLOT**
Date Stamp
Scales AS SHOWN
Drawing No. 310203848-01-001-SK1007
Rev. A

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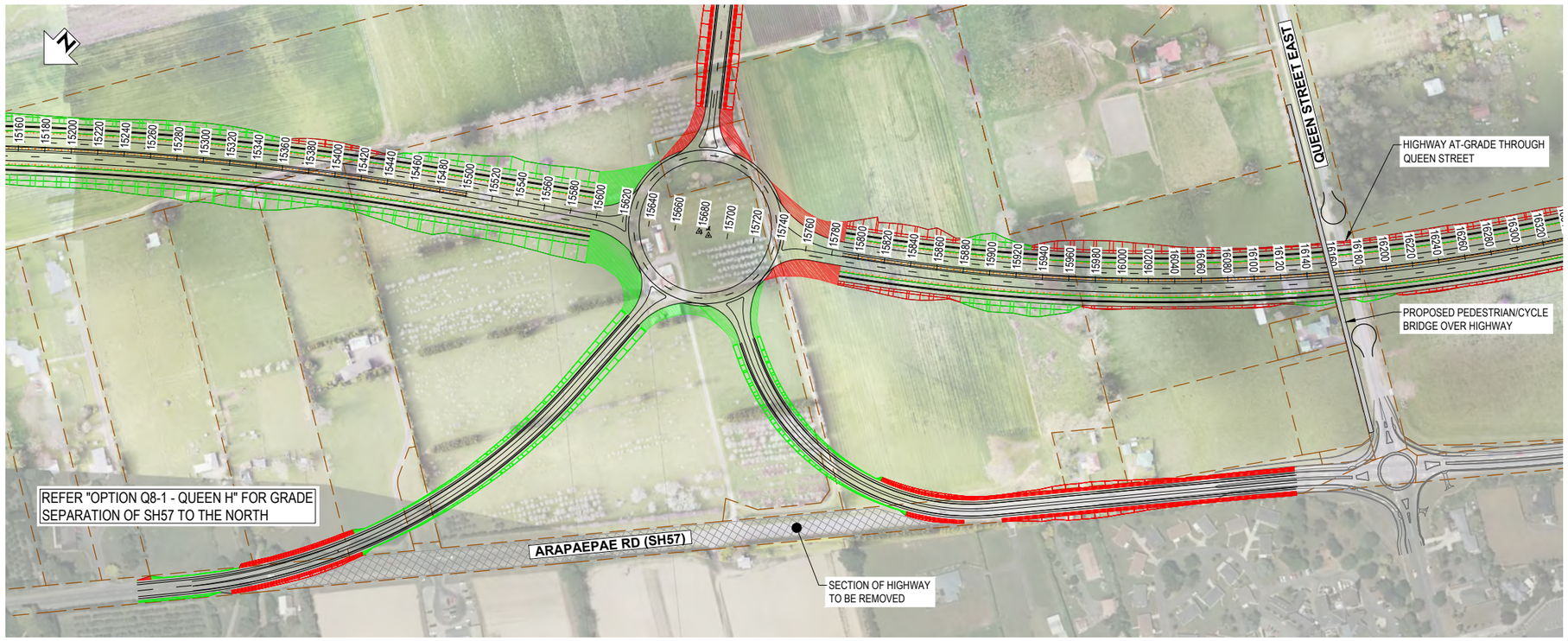
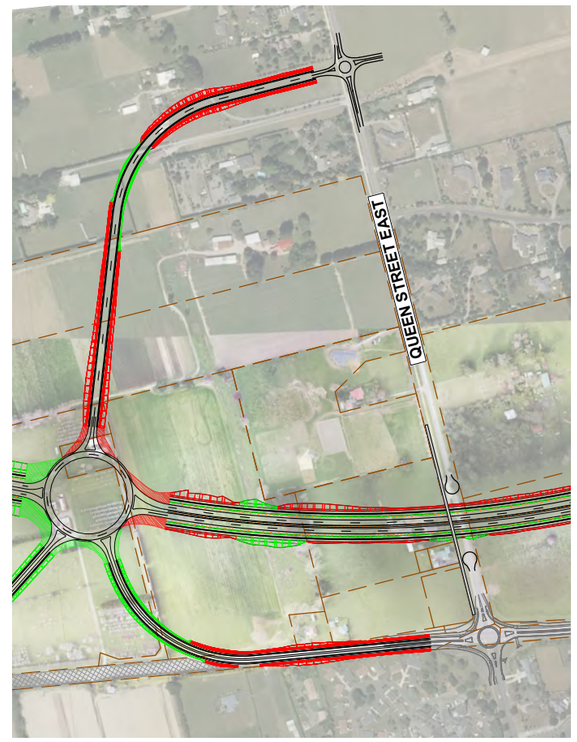
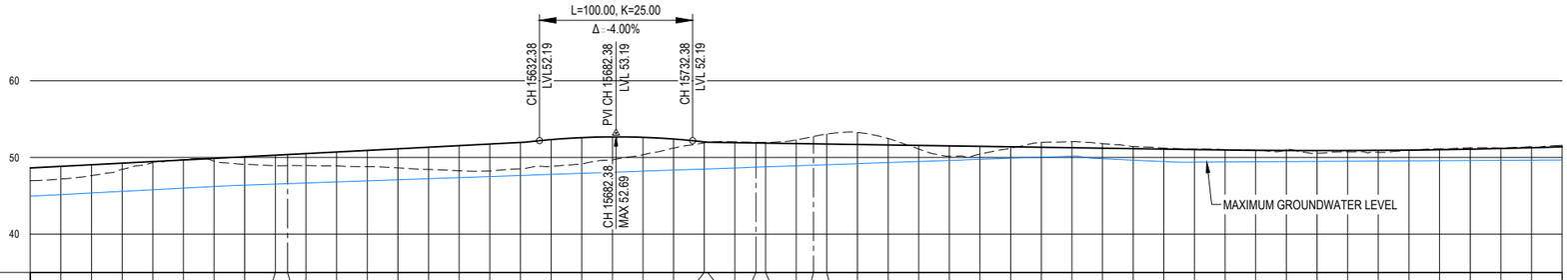




LEGEND

🟥	CUT
🟩	FILL



-CUT +FILL	+1.65	+1.66	+1.41	+0.81	+0.09	-0.03	+0.36	+0.98	+1.37	+1.44	+1.55	+1.81	+2.11	+2.49
FINISHED LEVEL	48.64	48.84	49.05	49.26	49.47	49.68	49.88	50.09	50.30	50.38	50.51	50.72	50.93	51.13
GROUND LEVEL	46.98	47.19	47.64	48.45	49.38	49.70	49.52	49.11	48.93	48.95	48.95	48.91	48.81	48.64
CHAINAGE	15300.00	15320.00	15340.00	15360.00	15380.00	15400.00	15420.00	15440.00	15460.00	15467.92	15480.00	15500.00	15520.00	15540.00

-CUT +FILL	+2.91	+3.29	+3.52	+3.44	+3.49	+3.43	+3.00	+2.27	+1.18	+0.12	-0.01	-0.10	-0.09	-0.09
FINISHED LEVEL	51.34	51.55	51.76	51.97	52.33	52.59	52.69	52.63	52.41	52.04	51.99	51.94	51.90	51.88
GROUND LEVEL	48.44	48.26	48.24	48.52	48.84	49.16	49.69	50.36	51.23	51.92	52.00	52.04	51.99	51.97
CHAINAGE	15560.00	15580.00	15600.00	15620.00	15640.00	15660.00	15680.00	15700.00	15720.00	15740.00	15742.22	15760.00	15773.77	15780.00

-CUT +FILL	-0.48	-0.95	-1.30	-1.56	-0.85	+0.47	+1.37	+1.03	+0.21	-0.65	-0.79	-0.59	-0.28	-0.12
FINISHED LEVEL	51.82	51.79	51.76	51.70	51.64	51.58	51.52	51.46	51.40	51.34	51.28	51.22	51.16	51.10
GROUND LEVEL	52.30	52.73	53.06	53.26	52.49	51.11	50.15	50.43	51.19	51.99	52.07	51.81	51.44	51.21
CHAINAGE	15800.00	15811.27	15820.00	15840.00	15860.00	15880.00	15900.00	15920.00	15940.00	15960.00	15980.00	16000.00	16020.00	16040.00

-CUT +FILL	-0.06	-0.05	+0.01	-0.16	+0.35	+0.15	+0.26	+0.02	-0.11	-0.19	-0.07	-0.14	-0.19
FINISHED LEVEL	51.04	50.98	50.94	50.91	50.90	50.91	50.93	50.96	51.02	51.09	51.17	51.27	51.39
GROUND LEVEL	51.10	51.03	50.93	51.07	50.55	50.75	50.67	50.94	51.13	51.28	51.24	51.41	51.58
CHAINAGE	16060.00	16080.00	16100.00	16120.00	16140.00	16160.00	16180.00	16200.00	16220.00	16240.00	16260.00	16280.00	16300.00

VERTICAL GEOMETRY: L=1342.48 1.0% | L=0.10 K 2.0% | L=9.79 6% | L=100.00, Δ=-4.00% K=25.00 | L=9.84 -2.0% | L=326.48 -0.3% | L=330.48, Δ=1.32% K=250.00

HORIZONTAL GEOMETRY: R 2500.00 A 509.80 | 305.85m 234°10'36" | S 37.50 | R 1500.00 A 606.03

LONGITUDINAL SECTION - Q8 - Highway H
SCALES: HOR 1:2000 VERT 1:400

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE
A	ISSUED FOR INFORMATION	SS	JP	JP	21.09.21

SURVEYED
DESIGNED Melissa Nel
DRAWN Steve Sutton
CAD REVIEW
DESIGN CHECK
DESIGN REVIEW
APPROVED
PROF REGISTRATION:

Stantec

Client:
WAKA KOTAHI NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

OPTION Q8 - QUEEN STREET
AT-GRADE: 5-ARM ROUNDABOUT, SHIFT SH57 CONNECTION SOUTH

Status Stamp
WORKING PLOT
Date Stamp
Scales AS SHOWN
Drawing No. 310203848-01-001-SK1008
Rev. A

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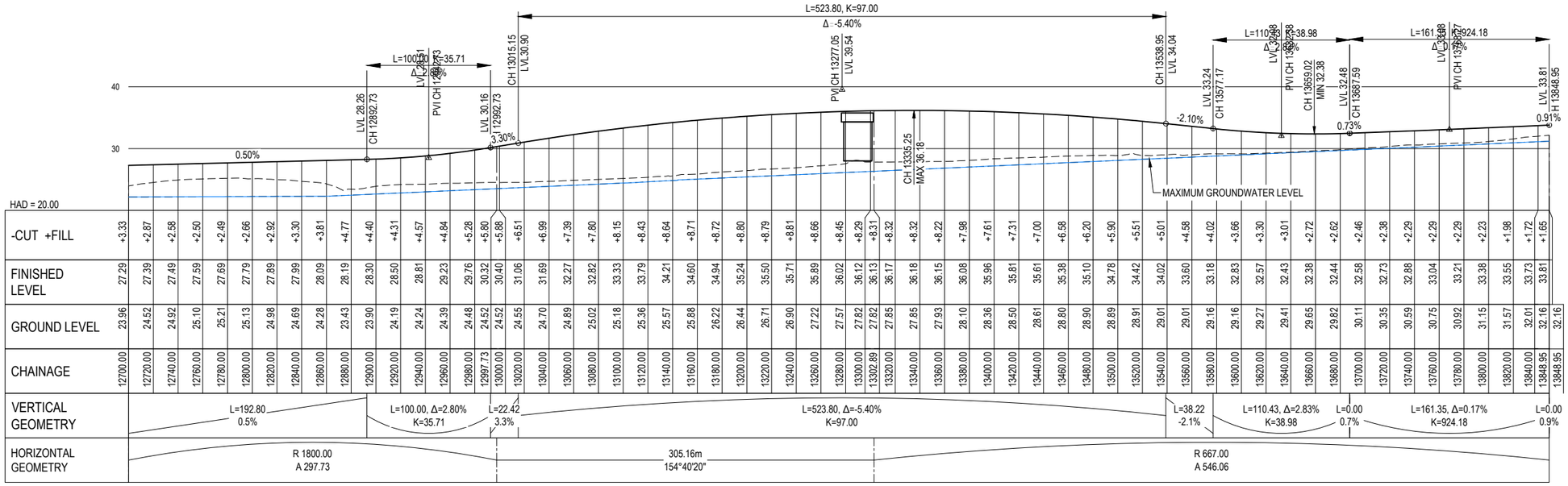
LEGEND

CUT

FILL



-CUT +FILL	+3.33	+2.87	+2.58	+2.50	+2.49	+2.66	+2.92	+3.30	+3.81	+4.77	+4.40	+4.31	+4.57	+4.84	+5.28	+5.80	+5.88	+6.51	+6.99	+7.39	+7.80	+8.15	+8.43	+8.64	+8.71	+8.72	+8.80	+8.79	+8.81	+8.66	+8.45	+8.29	+8.31	+8.32	+8.32	+8.22	+7.98	+7.61	+7.31	+7.00	+6.58	+6.20	+5.90	+5.51	+5.01	+4.58	+4.02	+3.66	+3.30	+3.01	+2.72	+2.62	+2.46	+2.38	+2.29	+2.29	+2.29	+2.23	+1.98	+1.72	+1.65
FINISHED LEVEL	27.29	27.39	27.49	27.59	27.69	27.79	27.89	27.99	28.09	28.19	28.30	28.50	28.81	29.23	29.76	30.32	30.40	31.06	31.69	32.27	32.82	33.33	33.79	34.21	34.60	34.94	35.24	35.50	35.71	35.89	36.02	36.12	36.13	36.17	36.18	36.15	36.08	35.96	35.81	35.61	35.38	35.10	34.78	34.42	34.02	33.60	33.18	32.83	32.57	32.43	32.38	32.44	32.58	32.73	32.88	33.04	33.21	33.38	33.55	33.73	33.81
GROUND LEVEL	23.96	24.52	24.92	25.10	25.21	25.13	24.98	24.69	24.28	23.43	23.90	24.19	24.24	24.39	24.48	24.52	24.52	24.55	24.70	24.89	25.02	25.18	25.36	25.57	25.88	26.22	26.44	26.71	26.90	27.22	27.57	27.82	27.82	27.85	27.85	27.93	28.10	28.36	28.50	28.61	28.80	28.90	28.89	28.91	29.01	29.01	29.16	29.16	29.27	29.41	29.65	29.82	30.11	30.35	30.59	30.75	30.92	31.15	31.57	32.01	32.16	32.16
CHAINAGE	12700.00	12720.00	12740.00	12760.00	12780.00	12800.00	12820.00	12840.00	12860.00	12880.00	12900.00	12920.00	12940.00	12960.00	12980.00	12997.73	13000.00	13020.00	13040.00	13060.00	13080.00	13100.00	13120.00	13140.00	13160.00	13180.00	13200.00	13220.00	13240.00	13260.00	13280.00	13300.00	13302.89	13320.00	13340.00	13360.00	13380.00	13400.00	13420.00	13440.00	13460.00	13480.00	13500.00	13520.00	13540.00	13560.00	13580.00	13600.00	13620.00	13640.00	13660.00	13680.00	13700.00	13720.00	13740.00	13760.00	13780.00	13800.00	13820.00	13840.00	13848.95	13848.95

LONGITUDINAL SECTION - Q8-1 - Highway H
SCALES: HOR 1:2000 VERT 1:400

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE
A	ISSUED FOR INFORMATION	SS	JP	JP	21.09.21

SURVEYED		
DESIGNED	Melissa Nel	
DRAWN	Steve Sutton	
CAD REVIEW		
DESIGN CHECK		
DESIGN REVIEW		
APPROVED		
PROF REGISTRATION:		

Stantec

Client: WAKA KOTAHI NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

OPTION Q8-1 - QUEEN STREET
AT-GRADE: 5-ARM ROUNDABOUT, SHIFT SH57 CONNECTION SOUTH

Status Stamp: **WORKING PLOT**
Date Stamp:
Scales: AS SHOWN
Drawing No.: 310203848-01-001-SK1009
Rev.: A

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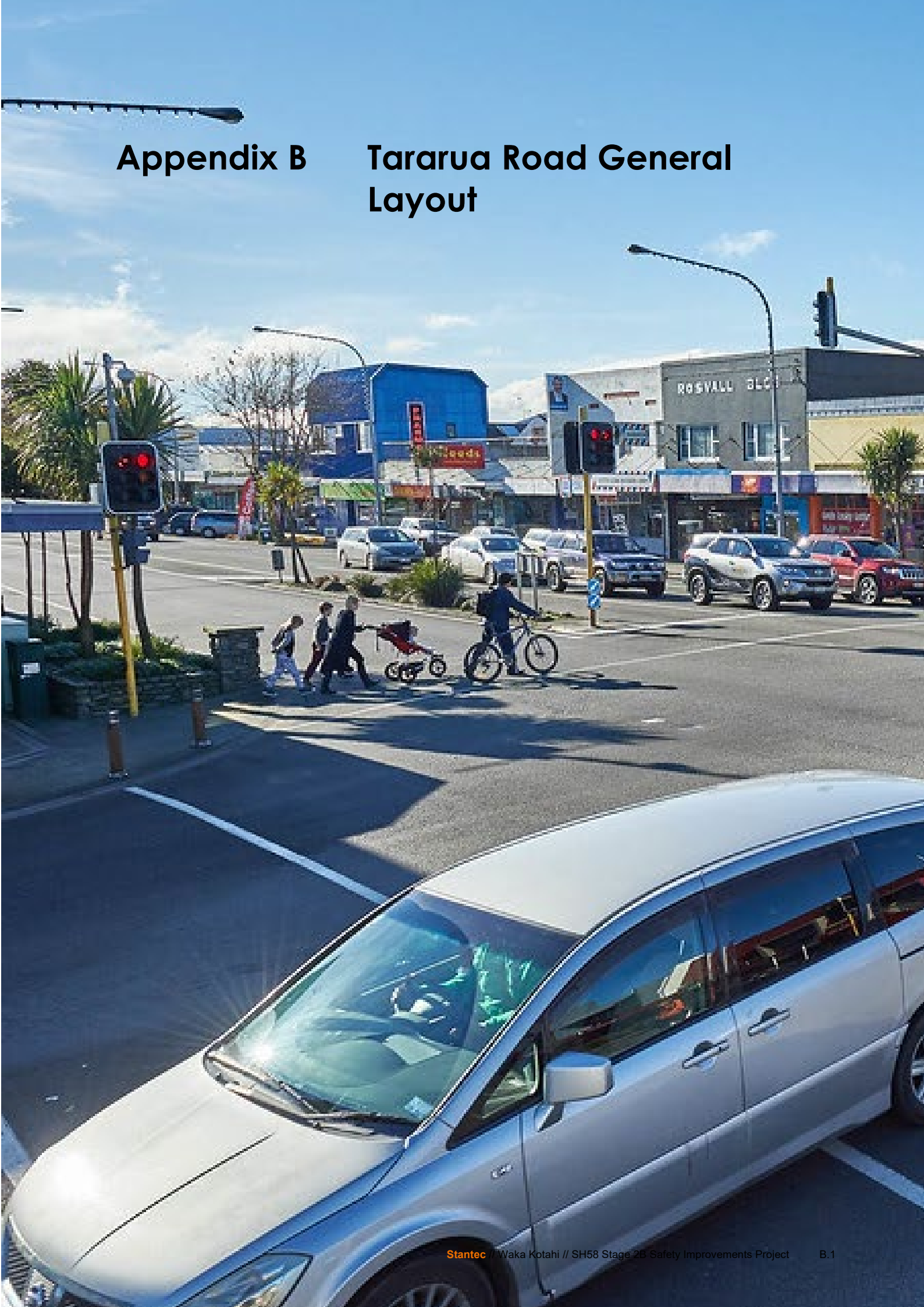
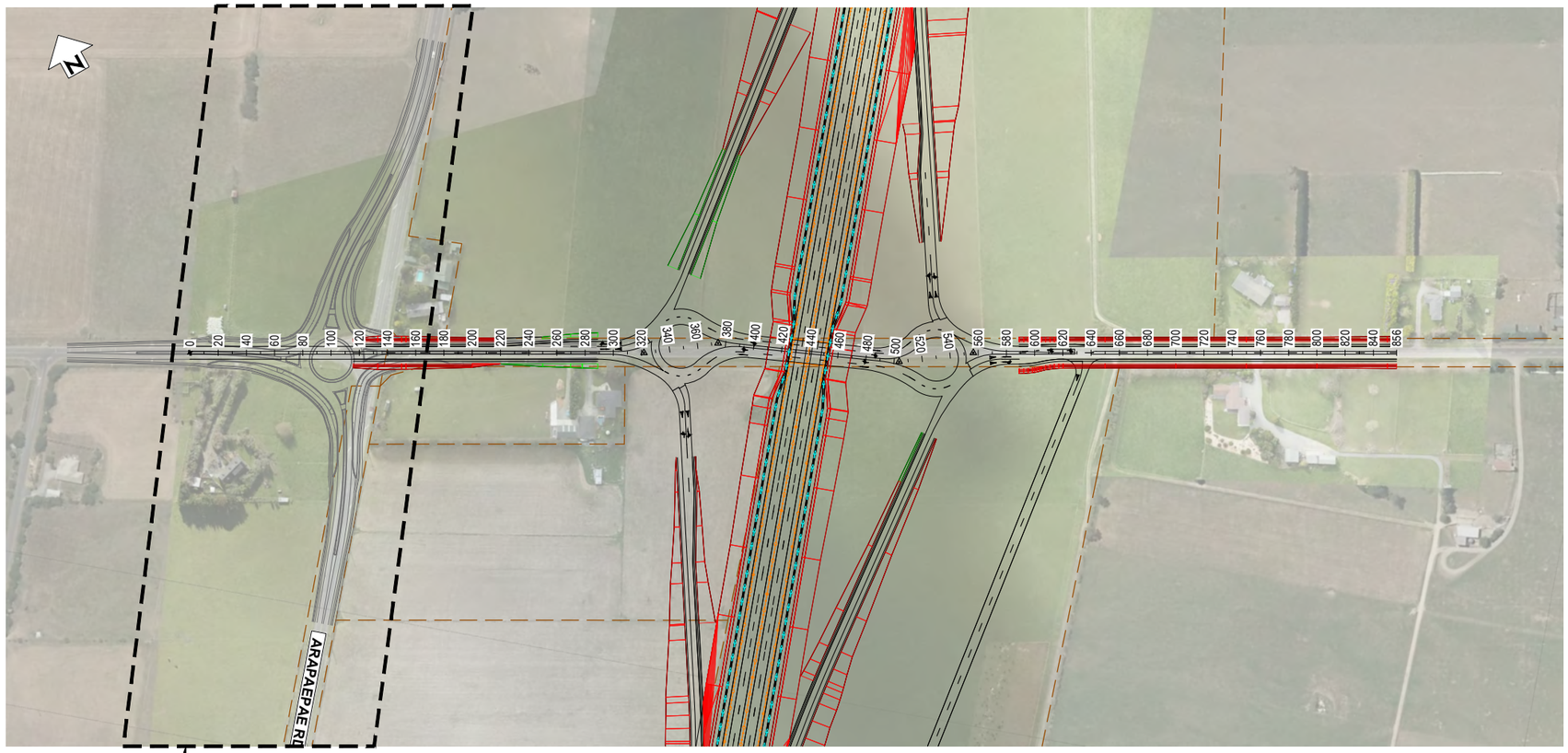
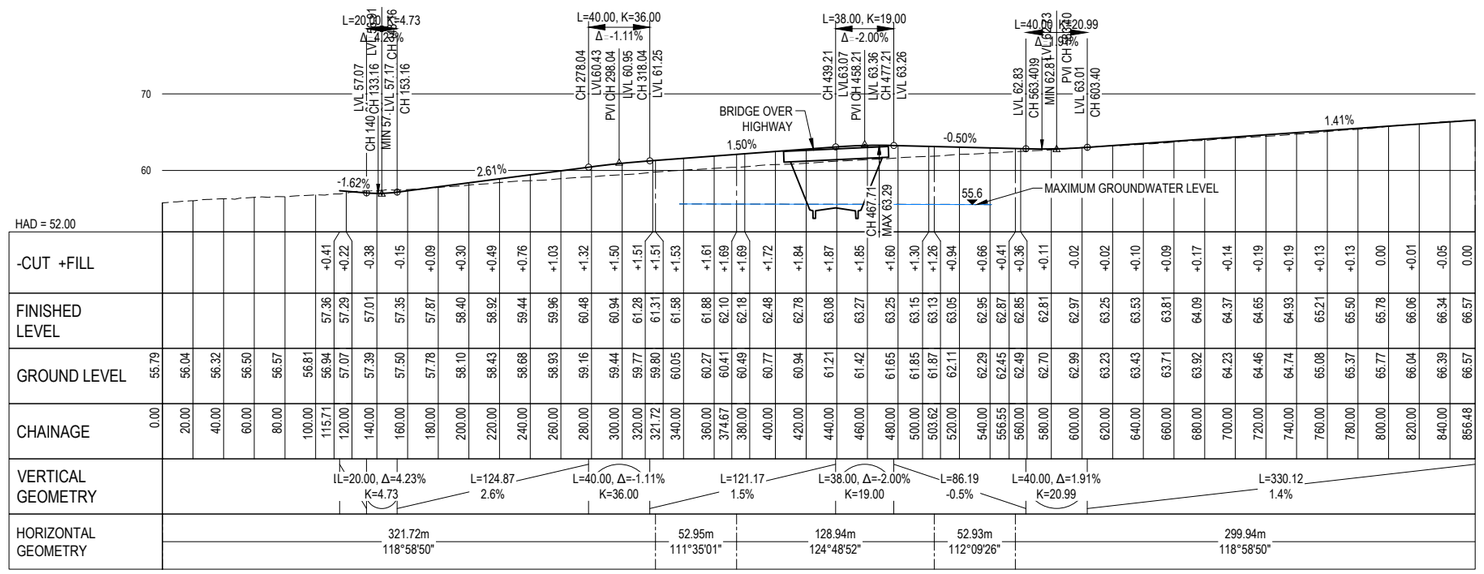
Appendix B Tararua Road General Layout







LEGEND

🟥	CUT
🟩	FILL

NOTES / DESIGN ASSUMPTIONS

1. LONGSECTION IS FOR SURFACE OF LOCAL ROAD ONLY.
2. ORIGINAL DBC OPTION WITH STANDARD EARTHWORKS TRENCH IS NOT TECHNICALLY FEASIBLE DUE TO MAXIMUM GROUNDWATER LEVELS.

-CUT +FILL							+0.41	+0.22	-0.38	-0.15	+0.09	+0.30	+0.49
FINISHED LEVEL							57.36	57.29	57.01	57.35	57.87	58.40	58.92
GROUND LEVEL	55.79	56.04	56.32	56.50	56.57	56.81	56.94	57.07	57.39	57.50	57.78	58.10	58.43
CHAINAGE	0.00	20.00	40.00	60.00	80.00	100.00	115.71	120.00	140.00	160.00	180.00	200.00	220.00

-CUT +FILL	+0.76	+1.03	+1.32	+1.50	+1.51	+1.51	+1.53	+1.61	+1.69	+1.69	+1.72	+1.84
FINISHED LEVEL	59.44	59.96	60.48	60.94	61.28	61.31	61.58	61.88	62.10	62.18	62.48	62.78
GROUND LEVEL	58.68	58.93	59.16	59.44	59.77	59.80	60.05	60.27	60.41	60.49	60.77	60.94
CHAINAGE	240.00	260.00	280.00	300.00	320.00	321.72	340.00	360.00	374.67	380.00	400.00	420.00

-CUT +FILL	+1.87	+1.85	+1.60	+1.30	+1.26	+0.94	+0.66	+0.41	+0.36	+0.11	-0.02	+0.02
FINISHED LEVEL	63.08	63.27	63.25	63.15	63.13	63.05	62.95	62.87	62.85	62.81	62.97	63.25
GROUND LEVEL	61.21	61.42	61.65	61.86	61.87	62.11	62.29	62.45	62.49	62.70	62.99	63.23
CHAINAGE	440.00	460.00	480.00	500.00	503.62	520.00	540.00	556.55	560.00	580.00	600.00	620.00

-CUT +FILL	+0.10	+0.09	+0.17	+0.14	+0.19	+0.19	+0.13	+0.13	0.00	+0.01	-0.05	0.00
FINISHED LEVEL	63.53	63.81	64.09	64.37	64.65	64.93	65.21	65.50	65.78	66.06	66.34	66.57
GROUND LEVEL	63.43	63.71	63.92	64.23	64.46	64.74	65.08	65.37	65.77	66.04	66.39	66.57
CHAINAGE	640.00	660.00	680.00	700.00	720.00	740.00	760.00	780.00	800.00	820.00	840.00	856.48

VERTICAL GEOMETRY	L=20.00, Δ=4.23% K=4.73	L=124.87 2.6%	L=40.00, Δ=-1.11% K=36.00	L=121.17 1.5%	L=38.00, Δ=-2.00% K=19.00	L=86.19 -0.5%	L=40.00, Δ=1.91% K=20.99	L=330.12 1.4%

HORIZONTAL GEOMETRY	321.72m 118°58'50"	52.95m 111°35'01"	128.94m 124°48'52"	52.93m 112°09'26"	299.94m 118°58'50"

LONGITUDINAL SECTION - T0 - Tararua H
SCALES: HOR 1:2000 VERT 1:400

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE
A	ISSUED FOR INFORMATION	SS	JP	JP	21.09.21

SURVEYED
DESIGNED Melissa Nel
DRAWN Steve Sutton
CAD REVIEW
DESIGN CHECK
DESIGN REVIEW
APPROVED
PROF REGISTRATION:

Stantec

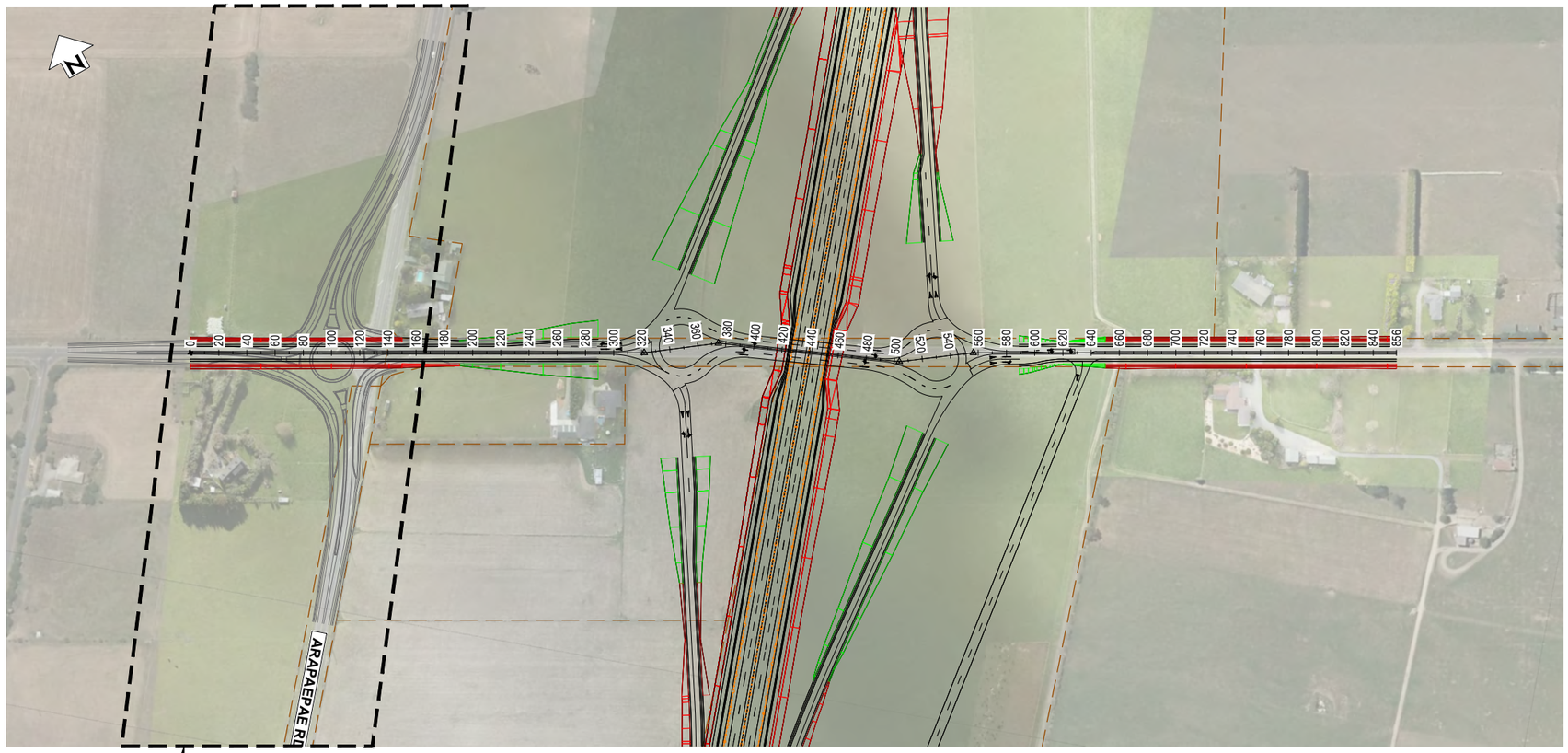
Client:
WAKA KOTAHI NZ TRANSPORT AGENCY

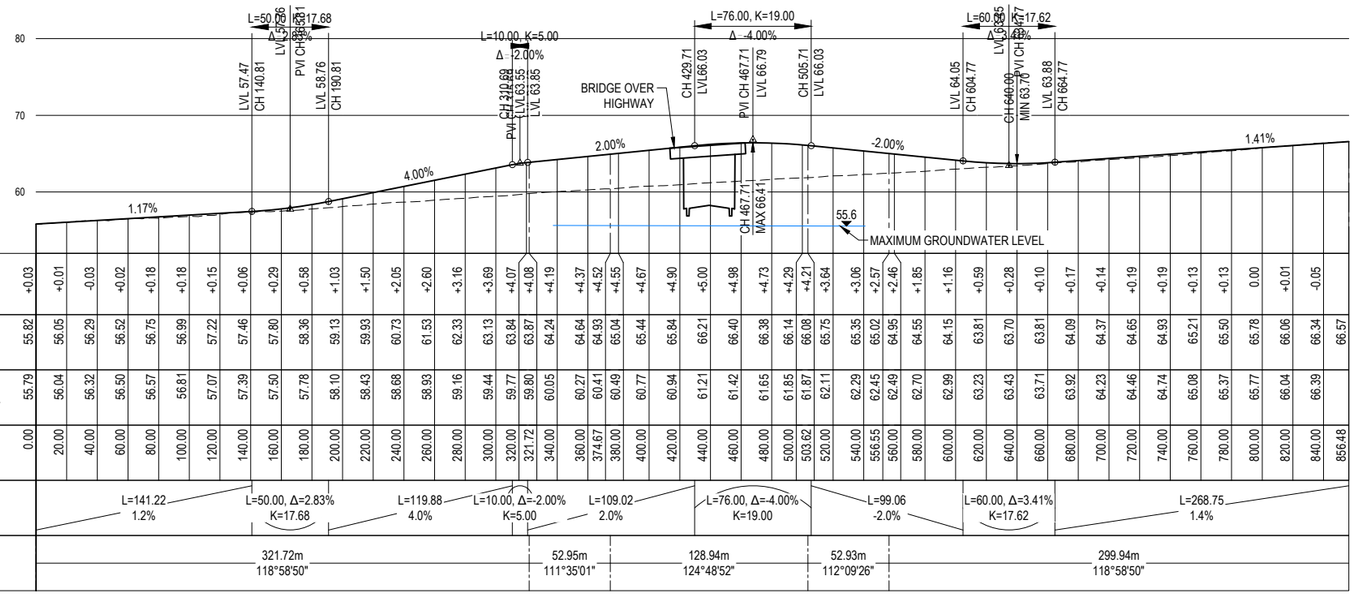
WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

OPTION T0 - TARARUA ROAD
HIGHWAY FULLY BELOW GRADE (DBC)

Status Stamp: **WORKING PLOT**
Date Stamp
Scales: AS SHOWN
Drawing No. 310203848-01-001-SK1010
Rev. A

pw:\\stantec-ap-pw.bentley.com:stantec-ap-pw-01\Documents\New Zealand Clients\NZTA (New Zealand Transport Agency)\310203848 - Otaki to North of Levin DBC\01\Optioneering East Levin MCA\310203848-01-001-SK1000





LEGEND

🟥	CUT
🟩	FILL

NOTES / DESIGN ASSUMPTIONS

1. LONGSECTION IS FOR SURFACE OF LOCAL ROAD ONLY.
2. HIGHWAY PARTIALLY BELOW GRADE, BUT SHALLOWER THAN ESTIMATED MAX GROUNDWATER.
3. WALKING AND CYCLING (W&C) FACILITIES TO BE PROVIDED ON TARARUA ROAD.
4. SURFACE FLOOD WATERS / FLOW PATHS TO BE MAINTAINED WITH USE OF CULVERTS OR SIPHONS.

-CUT +FILL	+0.03	+0.01	-0.03	+0.02	+0.18	+0.18	+0.15	+0.06	+0.29	+0.58	+1.03	+1.50
FINISHED LEVEL	55.82	56.05	56.29	56.52	56.75	56.99	57.22	57.46	57.80	58.36	59.13	59.93
GROUND LEVEL	55.79	56.04	56.32	56.50	56.57	56.81	57.07	57.39	57.50	57.78	58.10	58.43
CHAINAGE	0.00	20.00	40.00	60.00	80.00	100.00	120.00	140.00	160.00	180.00	200.00	220.00

-CUT +FILL	+2.05	+2.60	+3.16	+3.69	+4.07	+4.08	+4.19	+4.37	+4.52	+4.55	+4.67	+4.90
FINISHED LEVEL	60.73	61.53	62.33	63.13	63.84	63.87	64.24	64.64	64.93	65.04	65.44	65.84
GROUND LEVEL	58.68	58.93	59.16	59.44	59.77	59.80	60.05	60.27	60.41	60.49	60.77	60.94
CHAINAGE	240.00	260.00	280.00	300.00	320.00	321.72	340.00	360.00	374.67	380.00	400.00	420.00

-CUT +FILL	+5.00	+4.98	+4.73	+4.29	+4.21	+3.64	+3.06	+2.57	+2.46	+1.85	+1.16	+0.59
FINISHED LEVEL	66.21	66.40	66.38	66.14	66.08	65.75	65.35	65.02	64.95	64.55	64.15	63.81
GROUND LEVEL	61.21	61.42	61.65	61.85	61.87	62.11	62.29	62.45	62.49	62.70	62.99	63.23
CHAINAGE	440.00	460.00	480.00	500.00	503.62	520.00	540.00	556.55	560.00	580.00	600.00	620.00

-CUT +FILL	+0.28	+0.10	+0.17	+0.14	+0.19	+0.19	+0.13	+0.13	0.00	+0.01	-0.05	
FINISHED LEVEL	63.70	63.81	64.09	64.37	64.65	64.93	65.21	65.50	65.78	66.06	66.34	66.57
GROUND LEVEL	63.43	63.71	63.92	64.23	64.46	64.74	65.08	65.37	65.77	66.04	66.39	
CHAINAGE	640.00	660.00	680.00	700.00	720.00	740.00	760.00	780.00	800.00	820.00	840.00	856.48

VERTICAL GEOMETRY	L=141.22 1.2%	L=50.00, Δ=2.83% K=17.68	L=119.88 4.0%	L=10.00, Δ=-2.00% K=5.00	L=109.02 2.0%	L=76.00, Δ=-4.00% K=19.00	L=99.06 -2.0%	L=60.00, Δ=3.41% K=17.62	L=268.75 1.4%

HORIZONTAL GEOMETRY	321.72m 118°58'50"	52.95m 111°35'01"	128.94m 124°48'52"	52.93m 112°09'26"	299.94m 118°58'50"

LONGITUDINAL SECTION - T1 - Tararua H
SCALES: HOR 1:2000 VERT 1:400

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE
A	ISSUED FOR INFORMATION	SS	JP	JP	21.09.21

SURVEYED	
DESIGNED	Melissa Nel
DRAWN	Steve Sutton
CAD REVIEW	
DESIGN CHECK	
DESIGN REVIEW	
APPROVED	
PROF REGISTRATION:	

Stantec

Client:
WAKA KOTAHI NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

OPTION T1 - TARARUA ROAD
HIGHWAY PARTIALLY BELOW GRADE

Status Stamp: WORKING PLOT
Date Stamp:
Scales: AS SHOWN
Drawing No.: 310203848-01-001-SK1011
Rev.: A

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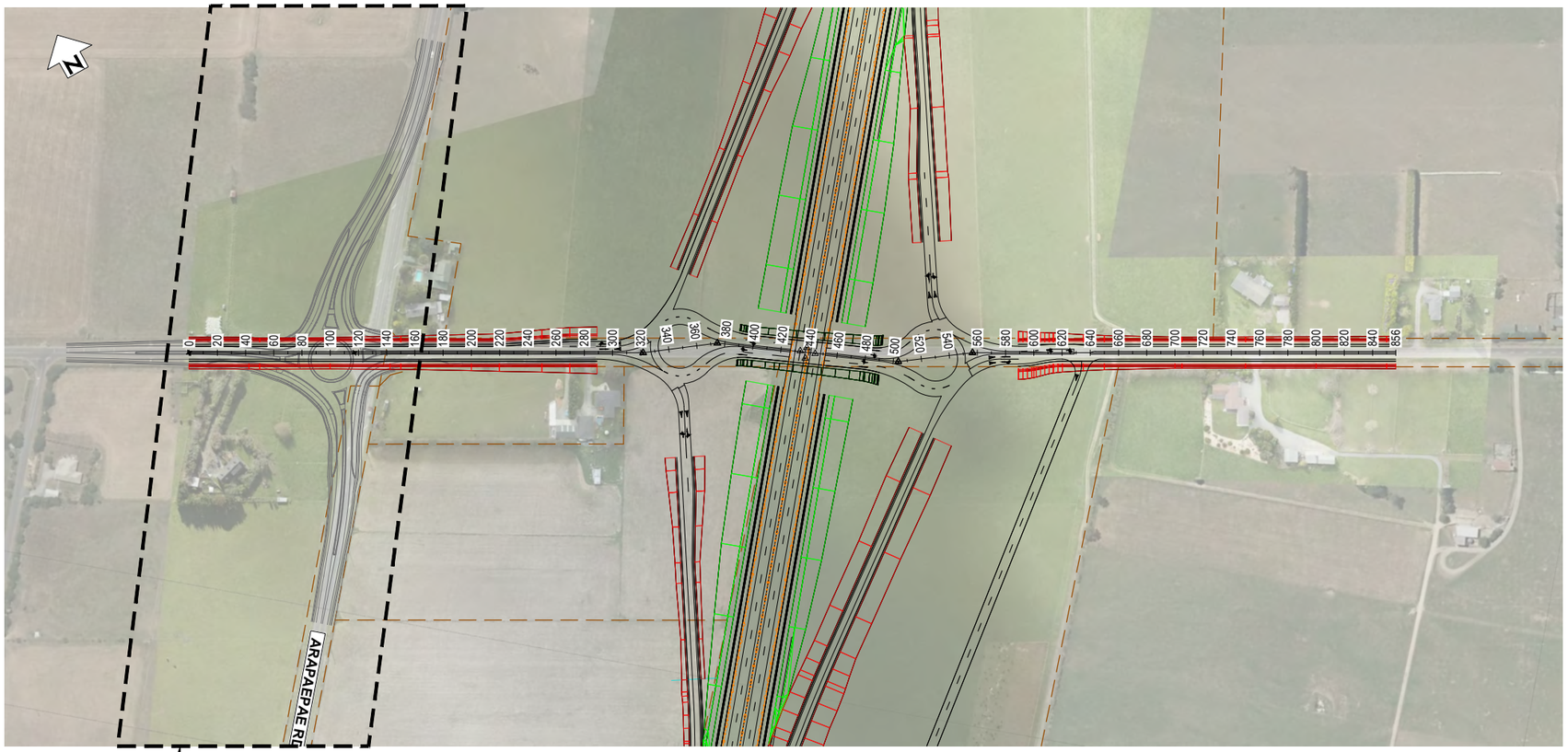
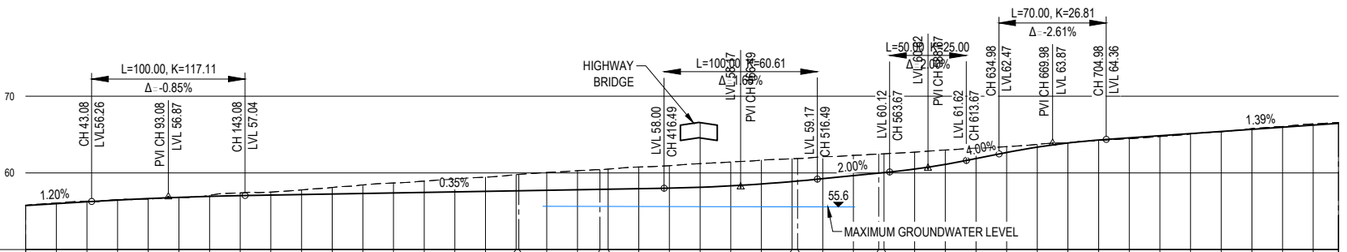


AREA NOT SUBJECT TO MCA



HAD = 50.00

-CUT +FILL	-0.04	-0.06	-0.09	-0.04	+0.08	0.00	-0.13	-0.36	-0.40	-0.61	-0.86	-1.12
FINISHED LEVEL	55.75	55.99	56.23	56.46	56.65	56.81	56.94	57.03	57.10	57.17	57.24	57.31
GROUND LEVEL	55.79	56.04	56.32	56.50	56.57	56.81	57.07	57.39	57.50	57.78	58.10	58.43
CHAINAGE	0.00	20.00	40.00	60.00	80.00	100.00	120.00	140.00	160.00	180.00	200.00	220.00

-CUT +FILL	-1.30	-1.48	-1.64	-1.85	-2.11	-2.13	-2.32	-2.47	-2.56	-2.62	-2.83	-2.93
FINISHED LEVEL	57.38	57.45	57.52	57.59	57.66	57.67	57.73	57.80	57.85	57.87	57.94	58.01
GROUND LEVEL	58.68	58.93	59.16	59.44	59.77	59.80	60.05	60.27	60.41	60.49	60.77	60.94
CHAINAGE	240.00	260.00	280.00	300.00	320.00	321.72	340.00	360.00	374.67	380.00	400.00	420.00

-CUT +FILL	-3.08	-3.12	-3.09	-2.98	-2.94	-2.86	-2.65	-2.48	-2.44	-2.21	-1.88	-1.36
FINISHED LEVEL	58.13	58.31	58.55	58.87	58.93	59.24	59.64	59.97	60.04	60.50	61.11	61.87
GROUND LEVEL	61.21	61.42	61.65	61.85	61.87	62.11	62.29	62.45	62.49	62.70	62.99	63.23
CHAINAGE	440.00	460.00	480.00	500.00	503.62	520.00	540.00	556.55	560.00	580.00	600.00	620.00

-CUT +FILL	-0.76	-0.36	-0.03	+0.05	+0.11	+0.10	+0.04	+0.03	-0.10	-0.09	-0.16	
FINISHED LEVEL	62.67	63.35	63.89	64.28	64.56	64.84	65.12	65.40	65.68	65.95	66.23	66.46
GROUND LEVEL	63.43	63.71	63.92	64.23	64.46	64.74	65.08	65.37	65.77	66.04	66.39	
CHAINAGE	640.00	660.00	680.00	700.00	720.00	740.00	760.00	780.00	800.00	820.00	840.00	856.48

VERTICAL GEOMETRY
L=47.22 1.2%
L=100.00, Δ=-0.85% K=117.11
L=273.41 0.4%
L=100.00, Δ=1.65% K=60.61
L=47.18 2.0%
L=50.00, Δ=2.00 K=25.00
L=21.31 4.0%
L=70.00, Δ=-2.61% K=26.81
L=202.71 1.4%

HORIZONTAL GEOMETRY
321.72m 118°58'50"
52.95m 111°35'01"
128.94m 124°48'52"
52.93m 112°09'26"
299.94m 118°58'50"

LONGITUDINAL SECTION - T2 - Tararua H
SCALES: HOR 1:2000 VERT 1:400

LEGEND
🟥 CUT
🟩 FILL

NOTES / DESIGN ASSUMPTIONS
1. LONGSECTION IS FOR SURFACE OF LOCAL ROAD ONLY.
2. TARARUA ROAD PARTIALLY BELOW GRADE, BUT SHALLOWER THAN ESTIMATED MAX GROUNDWATER.
3. WALKING AND CYCLING (W&C) FACILITIES TO BE PROVIDED ON TARARUA ROAD.
4. SURFACE FLOOD WATERS / FLOW PATHS TO BE MAINTAINED WITH USE OF CULVERTS OR SIPHONS.

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE
A	ISSUED FOR INFORMATION	SS	JP	JP	21.09.21

SURVEYED	
DESIGNED	Melissa Nel
DRAWN	Steve Sutton
CAD REVIEW	
DESIGN CHECK	
DESIGN REVIEW	
APPROVED	
PROF REGISTRATION:	

Stantec

Client:
WAKA KOTAHI
NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

OPTION T2 - TARARUA ROAD
LOCAL ROAD PARTIALLY BELOW GRADE

Status Stamp **WORKING PLOT**
Date Stamp
Scales AS SHOWN
Drawing No. 310203848-01-001-SK1012
Rev. A

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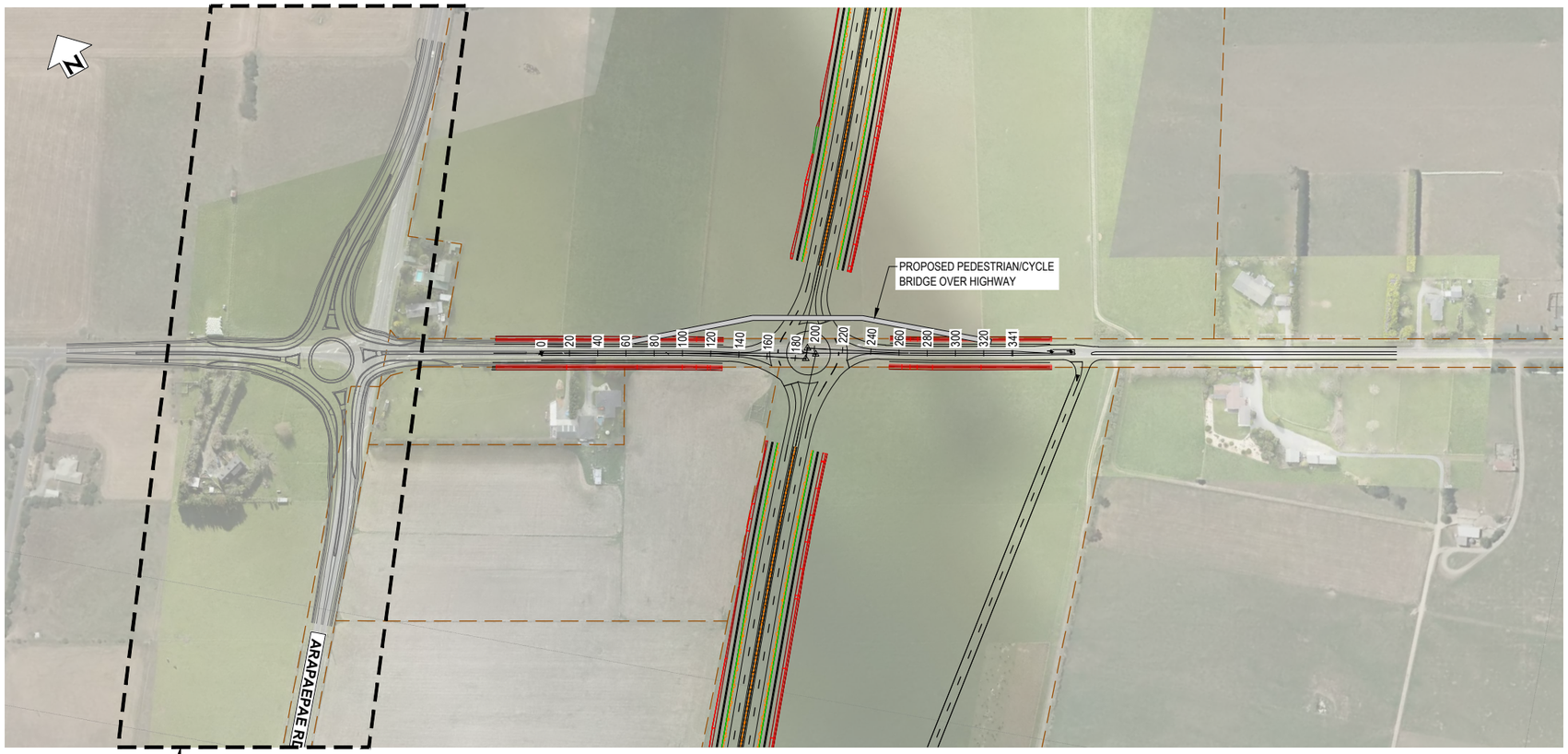
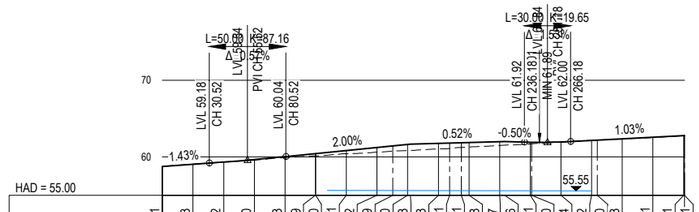


LEGEND

🟥	CUT
🟩	FILL

NOTES / DESIGN ASSUMPTIONS

1. LONGSECTION IS FOR SURFACE OF LOCAL ROAD ONLY.
2. SURFACE FLOOD WATERS / FLOW PATHS TO BE MAINTAINED WITH USE OF CULVERTS.
3. WALKING AND CYCLING FACILITIES WOULD BE PROVIDED ON A SEPARATE BRIDGE.



-CUT +FILL	-0.01	-0.03	-0.02	+0.10	+0.13	+0.29	+0.30	+0.41	+0.62	+0.69	+0.80	+0.83	+0.73	+0.71	+0.61	+0.58	+0.47	+0.46	+0.21	+0.20	+0.04	-0.02	0.00	+0.03	+0.01	-0.01	-0.01
FINISHED LEVEL	58.74	59.03	59.32	59.65	60.03	60.42	60.43	60.83	61.23	61.43	61.63	61.66	61.76	61.80	61.84	61.86	61.97	61.98	61.90	61.90	61.94	62.14	62.18	62.34	62.55	62.75	62.76
GROUND LEVEL	58.75	59.06	59.34	59.55	59.90	60.13	60.13	60.41	60.61	60.74	60.83	60.84	61.03	61.09	61.23	61.28	61.50	61.53	61.69	61.70	61.91	62.15	62.18	62.32	62.54	62.76	62.77
CHAINAGE	0.00	20.00	40.00	60.00	80.00	99.83	100.00	120.00	140.00	150.31	160.00	161.86	180.00	187.43	195.06	200.00	220.00	223.20	240.00	240.84	260.00	280.00	283.72	300.00	320.00	340.00	340.57

VERTICAL GEOMETRY: L=31.8 1.4% | L=50.00, Δ=0.57% K=87.16 | L=81.33 2.0% | L=61.34 0.5% | L L=30.00, Δ=1.53% K=19.65 | L=78.23 1.0%

HORIZONTAL GEOMETRY: 99.83m 118°58'50" | R 800.00 A 50.48 | 37.12 122°35' | 7.63m 38°03'0 | 45.78m 122°03'07" | R 800.00 A 42.88 | 56.84m 118°58'50"

LONGITUDINAL SECTION - T3 - Tararua H
SCALES: HOR 1:2000 VERT 1:400

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE
A	ISSUED FOR INFORMATION	SS	JP	JP	21.09.21

SURVEYED	
DESIGNED	Melissa Nel
DRAWN	Steve Sutton
CAD REVIEW	
DESIGN CHECK	
DESIGN REVIEW	
APPROVED	
PROF REGISTRATION:	

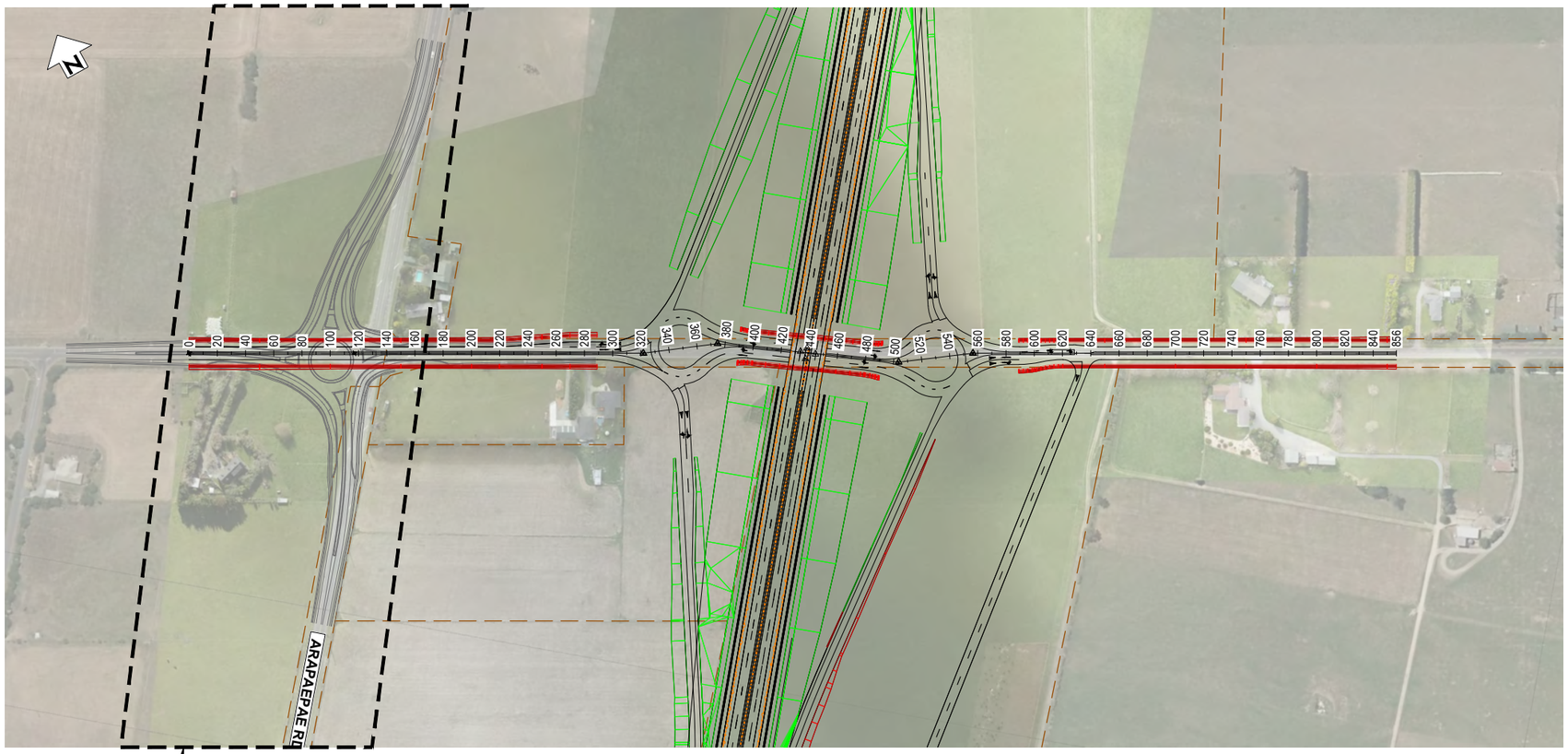
Stantec

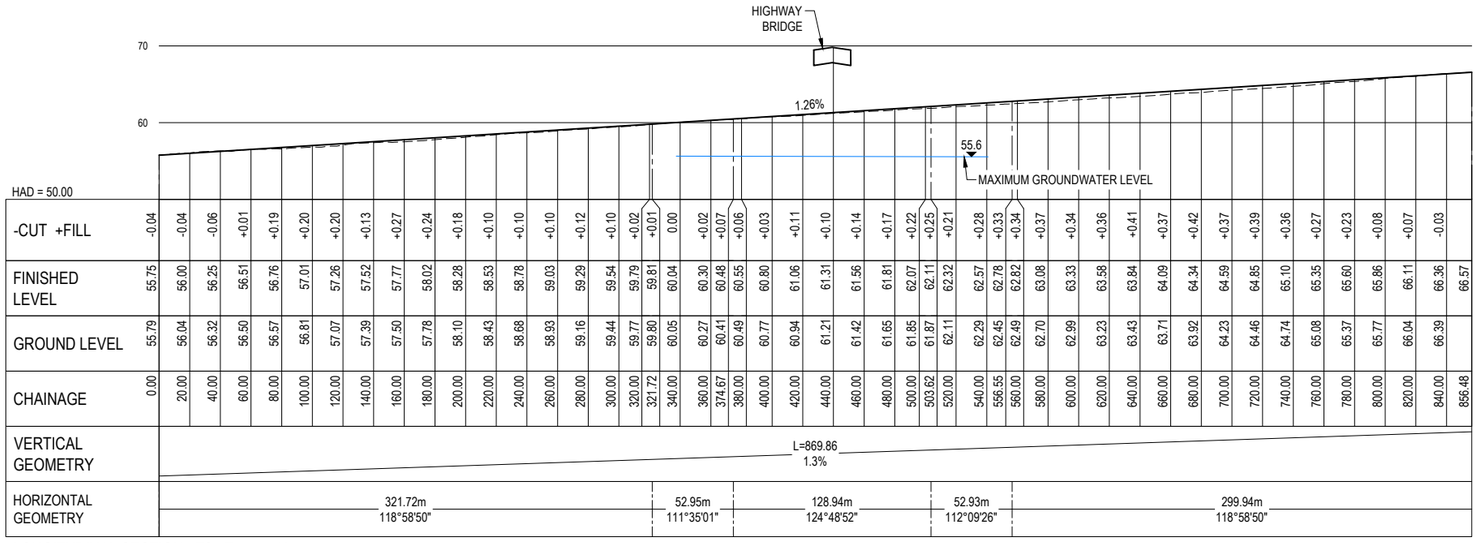
Client:
WAKA KOTAHI NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

OPTION T3 - TARARUA ROAD
AT-GRADE: ROUNDABOUT

Status Stamp: **WORKING PLOT**
Date Stamp
Scales: AS SHOWN
Drawing No.: 310203848-01-001-SK1013
Rev.: A





HAD = 50.00

-CUT +FILL	-0.04	-0.04	-0.06	+0.01	+0.19	+0.20	+0.20	+0.13	+0.27	+0.24	+0.18	+0.10	+0.10	+0.10	+0.12	+0.10	+0.02	+0.01	0.00	+0.02	+0.07	+0.06
FINISHED LEVEL	55.75	56.00	56.25	56.51	56.76	57.01	57.26	57.52	57.77	58.02	58.28	58.53	58.78	59.03	59.29	59.54	59.79	59.81	60.04	60.30	60.48	60.55
GROUND LEVEL	55.79	56.04	56.32	56.50	56.57	56.81	57.07	57.39	57.50	57.78	58.10	58.43	58.68	58.93	59.16	59.44	59.77	59.80	60.05	60.27	60.41	60.49
CHAINAGE	0.00	20.00	40.00	60.00	80.00	100.00	120.00	140.00	160.00	180.00	200.00	220.00	240.00	260.00	280.00	300.00	320.00	321.72	340.00	360.00	374.67	380.00

-CUT +FILL	+0.03	+0.11	+0.10	+0.14	+0.17	+0.22	+0.25	+0.21	+0.28	+0.33	+0.34	+0.37	+0.34	+0.36	+0.41	+0.37	+0.42	+0.37	+0.39	+0.36	+0.27	+0.23	+0.08	+0.07	-0.03	
FINISHED LEVEL	60.80	61.06	61.31	61.56	61.81	62.07	62.11	62.32	62.57	62.78	62.82	63.08	63.33	63.58	63.84	64.09	64.34	64.59	64.85	65.10	65.35	65.60	65.86	66.11	66.36	66.57
GROUND LEVEL	60.77	60.94	61.21	61.42	61.65	61.85	61.87	62.11	62.29	62.45	62.49	62.70	62.99	63.23	63.43	63.71	63.92	64.23	64.46	64.74	65.08	65.37	65.77	66.04	66.39	
CHAINAGE	400.00	420.00	440.00	460.00	480.00	500.00	503.62	520.00	540.00	556.55	560.00	580.00	600.00	620.00	640.00	660.00	680.00	700.00	720.00	740.00	760.00	780.00	800.00	820.00	840.00	856.48

VERTICAL GEOMETRY
L=869.86
1.3%

HORIZONTAL GEOMETRY
321.72m 118°58'50"
52.95m 111°35'01"
128.94m 124°48'52"
52.93m 112°09'26"
299.94m 118°58'50"

LONGITUDINAL SECTION - T6 - Tararua H
SCALES: HOR 1:2000 VERT 1:400

LEGEND
🟥 CUT
🟩 FILL

NOTES / DESIGN ASSUMPTIONS
1. LONGSECTION IS FOR SURFACE OF LOCAL ROAD ONLY.
2. SURFACE FLOOD WATERS / FLOW PATHS TO BE MAINTAINED WITH USE OF CULVERTS.
3. WALKING AND CYCLING FACILITIES WOULD BE PROVIDED ON TARARUA ROAD.

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE
A	ISSUED FOR INFORMATION	SS	JP	JP	21.09.21

SURVEYED
DESIGNED Melissa Nel
DRAWN Steve Sutton
CAD REVIEW
DESIGN CHECK
DESIGN REVIEW
APPROVED
PROF REGISTRATION:

Client:

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

OPTION T6 - TARARUA ROAD
HIGHWAY OVER TOP

Status Stamp **WORKING PLOT**
Date Stamp
Scales AS SHOWN
Drawing No. 310203848-01-001-SK1014
Rev. A

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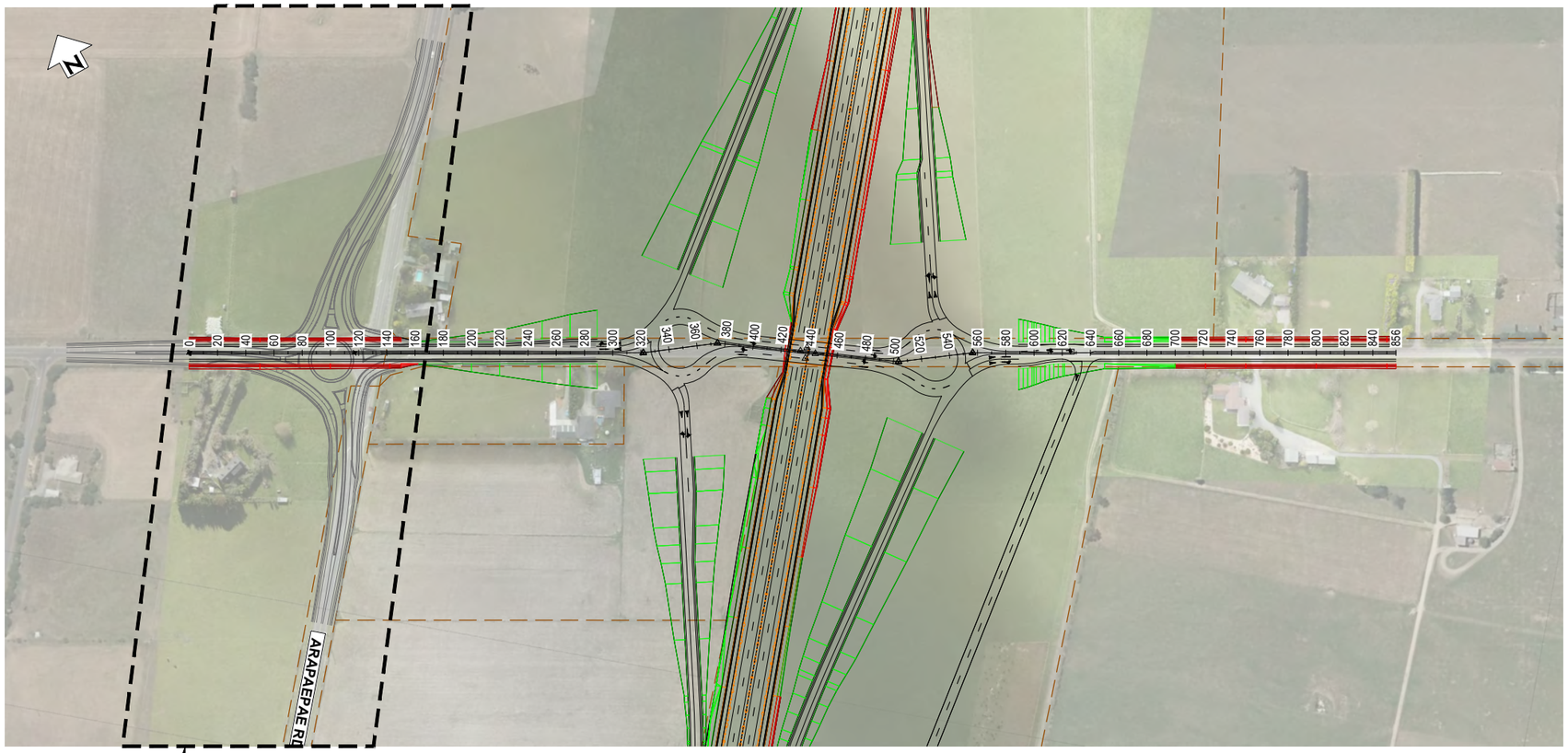
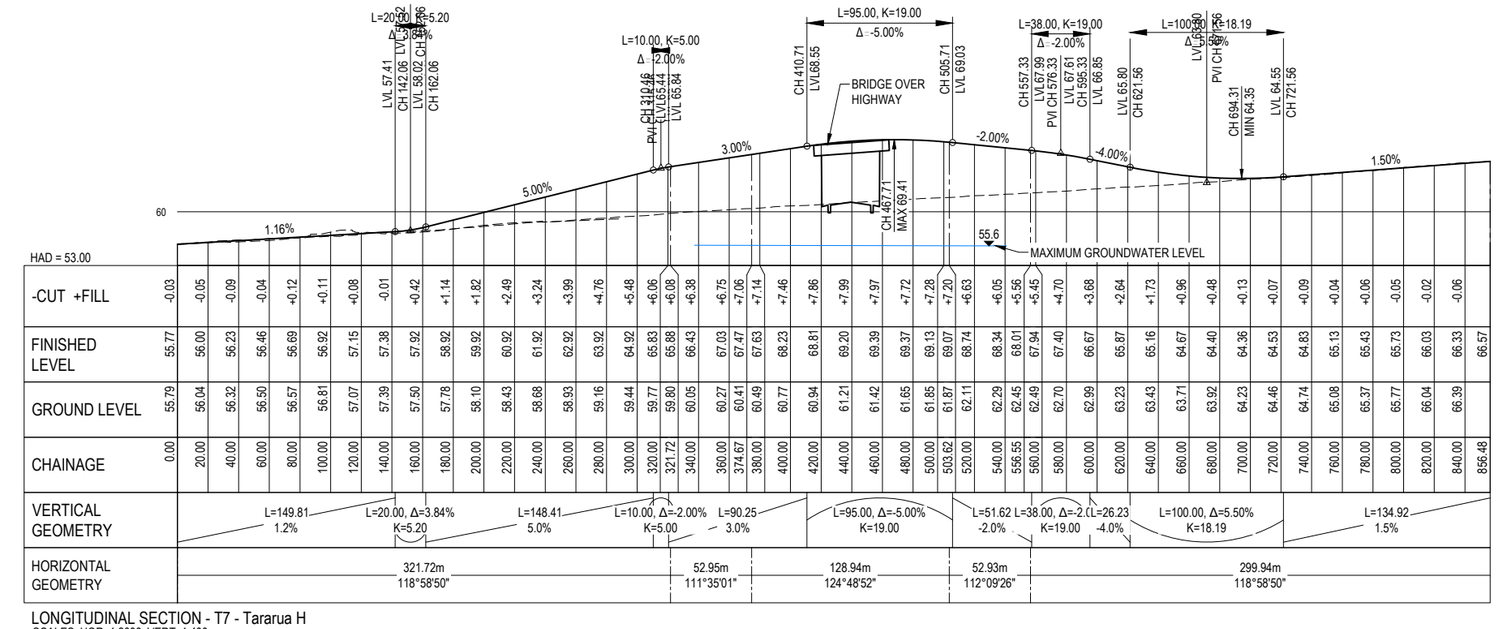




AREA NOT SUBJECT TO MCA

-CUT +FILL	-0.03	-0.05	-0.09	-0.04	+0.12	+0.11	+0.08	-0.01	+0.42	+1.14	+1.82	+2.49	+3.24	+3.99	+4.76	+5.48
FINISHED LEVEL	55.77	56.00	56.23	56.46	56.69	56.92	57.15	57.38	57.92	58.92	59.92	60.92	61.92	62.92	63.92	64.92
GROUND LEVEL	55.79	56.04	56.32	56.50	56.57	56.81	57.07	57.39	57.50	57.78	58.10	58.43	58.68	58.93	59.16	59.44
CHAINAGE	0.00	20.00	40.00	60.00	80.00	100.00	120.00	140.00	160.00	180.00	200.00	220.00	240.00	260.00	280.00	300.00

-CUT +FILL	+6.06	+6.08	+6.38	+6.75	+7.06	+7.14	+7.46	+7.86	+7.99	+7.97	+7.72	+7.28	+7.20	+6.63	+6.05	+5.56
FINISHED LEVEL	65.83	65.88	66.43	67.03	67.47	67.63	68.23	68.81	69.20	69.39	69.37	69.13	69.07	68.74	68.34	68.01
GROUND LEVEL	59.77	59.80	60.05	60.27	60.41	60.49	60.77	60.94	61.21	61.42	61.65	61.85	61.87	62.11	62.29	62.45
CHAINAGE	320.00	321.72	340.00	360.00	374.67	380.00	400.00	420.00	440.00	460.00	480.00	500.00	503.62	520.00	540.00	556.55

-CUT +FILL	+5.45	+4.70	+3.68	+2.64	+1.73	+0.96	+0.48	+0.13	+0.07	+0.09	+0.04	+0.06	-0.05	-0.02	-0.06	
FINISHED LEVEL	67.94	67.40	66.67	65.87	65.16	64.67	64.40	64.36	64.53	64.83	65.13	65.43	65.73	66.03	66.33	66.57
GROUND LEVEL	62.49	62.70	62.99	63.23	63.43	63.71	63.92	64.23	64.46	64.74	65.08	65.37	65.77	66.04	66.39	
CHAINAGE	560.00	580.00	600.00	620.00	640.00	660.00	680.00	700.00	720.00	740.00	760.00	780.00	800.00	820.00	840.00	856.48

VERTICAL GEOMETRY
L=149.81 1.2%
L=20.00, Δ=3.84% K=5.20
L=148.41 5.0%
L=10.00, Δ=-2.00% K=5.00
L=90.25 3.0%
L=95.00, Δ=-5.00% K=19.00
L=51.62 -2.0%
L=38.00, Δ=-2.0 K=19.00
L=26.23 -4.0%
L=100.00, Δ=5.50% K=18.19
L=134.92 1.5%

HORIZONTAL GEOMETRY
321.72m 118°58'50"
52.95m 111°35'01"
128.94m 124°48'52"
52.93m 112°09'26"
299.94m 118°58'50"

LONGITUDINAL SECTION - T7 - Tararua H
SCALES: HOR 1:2000 VERT 1:400

LEGEND
🟥 CUT
🟩 FILL

NOTES / DESIGN ASSUMPTIONS
1. LONGSECTION IS FOR SURFACE OF LOCAL ROAD ONLY.
2. SURFACE FLOOD WATERS / FLOW PATHS TO BE MAINTAINED WITH USE OF CULVERTS.
3. WALKING AND CYCLING FACILITIES WOULD BE PROVIDED ON TARARUA ROAD.

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE
A	ISSUED FOR INFORMATION	SS	JP	JP	21.09.21

SURVEYED
DESIGNED Melissa Nel
DRAWN Steve Sutton
CAD REVIEW
DESIGN CHECK
DESIGN REVIEW
APPROVED
PROF REGISTRATION:

Stantec

Client:
WAKA KOTAHI NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

OPTION T7 - TARARUA ROAD
LOCAL ROAD OVER TOP

Status Stamp
WORKING PLOT
Date Stamp
Scales AS SHOWN
Drawing No. 310203848-01-001-SK1015
Rev. A

pw:\\stantec-ap-pw.bentley.com:stantec-ap-pw-01\Documents\New Zealand Clients\NZTA (New Zealand Transport Agency)\310203848 - Otaki to North of Levin DBC\01\Optioneering East Levin MCA\310203848-01-001-SK1000

Appendix C MCA Workshop Attendees

MCA Workshop Attendees – Wednesday 13 October 2021

MCA assessors

Selwyn Blackmore (facilitator)

Lachie Grant

Adam Forbes

Lisa Rimmer

Gavin Lister

Daniel Parker

Daniel Haigh

Jamie Povall

Michael Smith

Siobhan Karaitiana

Di Rump

Sam Rudge

Dhimantha Ranatunga

Steve Donaldson

Sarah MacCormick

Paige Rundle

Observers

James Wallace

Chris Hansen

Peter Roan

Graeme McIndoe

Helen Anderson

Michael Horne

Fraser Fleming

Waka Kotahi observers

Rob Napier

Greg Lee

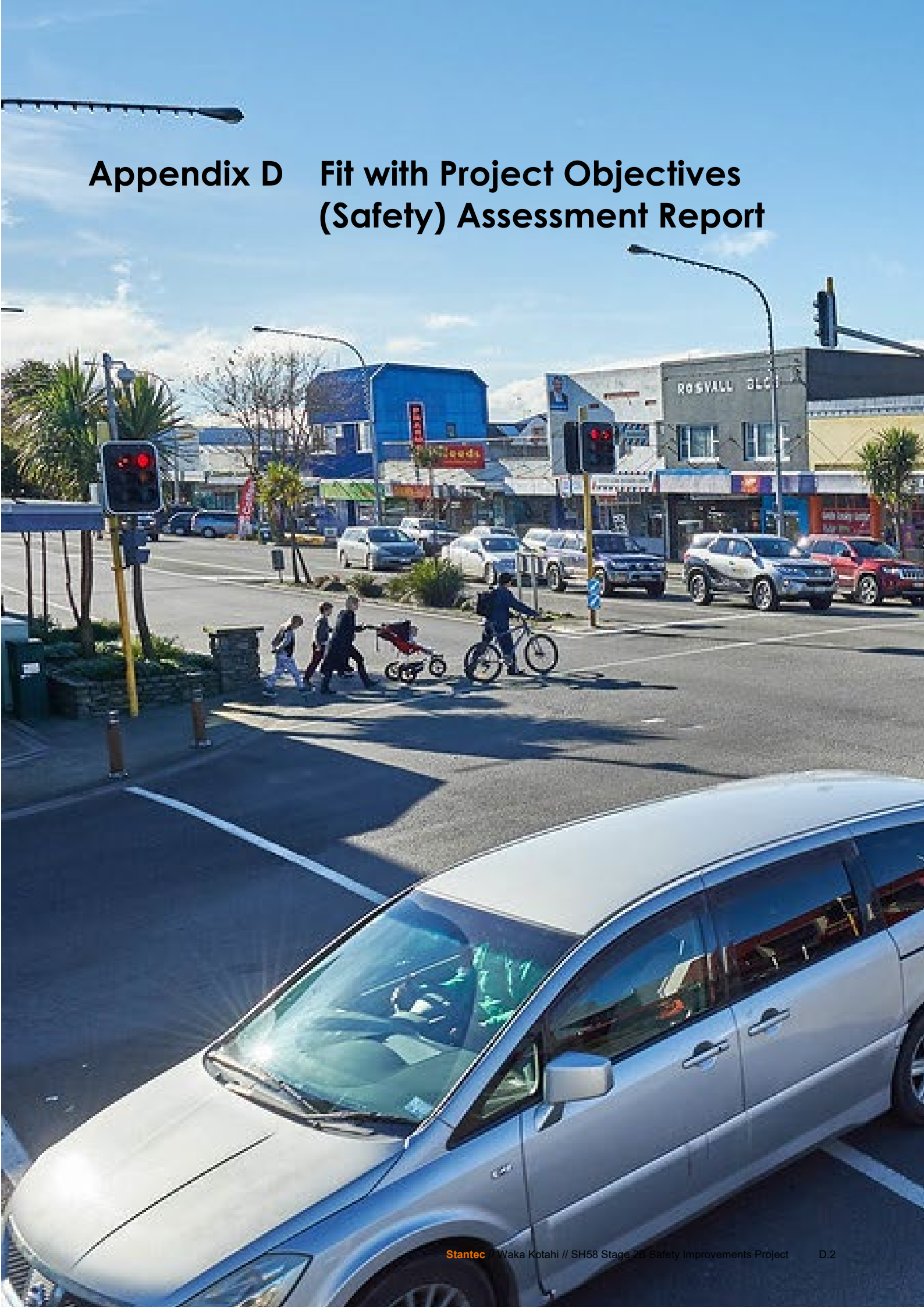
Bridget Burt

Steven Lamontagne

Raewyn Pudsey

William Peet

Appendix D Fit with Project Objectives (Safety) Assessment Report



ŌTAKI TO NORTH OF LEVIN
East of Levin Project Objectives MCA Report

Rev. no	Date	Description	Prepared by	Checked by	Reviewed by	Approved by
1.0	2/11/21	Draft for Client Comment	SR	DR	PP	PP
2.0	8/11/21	Final	SR	DR	PP	PP

1 Introduction

This Fit with Project Objectives report has been prepared to support the development of the Ō2NL Detailed Business Case, and in particular Waka Kotahi's East of Levin Multi Criteria Analysis (MCA) process.

In September 2021, Waka Kotahi decided to undertake a MCA process to help further inform its decision-making on the grade and connectivity for the new Ō2NL highway at Queen Street and Tararua Road. In addition, Waka Kotahi requested an MCA evaluation of the road grade level between Tararua Road and Queen Street be also undertaken. Collectively, these MCA processes are referred to as the "East of Levin MCA".

1.1 Purpose

This document summarises the methodology, scores and justification of scores for the Fit to Project Objectives criterion for the East of Levin MCA processes.

The Fit to Project Objectives criterion includes the assessment of the options against the project objectives, which can be summarised as:

- Safety
- Resilience
- Appropriate Connections
- Enable Mode Choice
- Enhanced Movement

It is noted that although the project objective themes have been consistent, there have been changes to the detail of these objectives between the end of the Indicative Business Case, through the NZ Upgrade Programme establishment and into the Detailed Business Case. Appendix B outlines these changes and why the assessment areas above are robust even when considering these changes.

The new Project Objective, not considered independently in the previous MCA (but considered under appropriate connections), relates to enabling mode choice. The full Project objective is:

> "Enable mode choice for journeys between local communities by providing a walking and cycling facility".

This was separated out for this assessment because of the high numbers of active mode users likely to be present in this location due to the proximity of Levin and the proposed Tara-Ika development.

1.2 Scoring Systems

The contribution to project objectives were scored based on performance. The scoring system ranges from 1 to 5, as well as an F rating, which are detailed in Table 1-1.

Table 1-1: Alignment and interchange score details

Score	Description
1	The option presents few difficulties on the basis of the criterion being evaluated and may provide significant benefits in terms of the attribute
2	The option presents only minor aspects of difficulty on the basis of the criterion being evaluated, and may provide some benefits in terms of the criterion
3	The option presents some aspects of reasonable difficulty in terms of the criterion being evaluated and problems cannot be completely avoided. There are few apparent benefits in terms of the criterion
4	The option includes clear aspects of difficulty in terms of the criterion being evaluated, and very limited perceived benefits
5	The option includes significant difficulties or problems in terms of the criterion being evaluated and no apparent benefits
F	The option will result in completely unacceptable adverse effects that cannot be appropriately avoided, remedied or mitigated (including offsetting)

1.3 Supporting Information

The assessment has relied on the following information:

- Specialist briefing notes, presentations and option drawings, Stantec
- SATURN and SIDRA transportation modelling outputs, Stantec

- Previous Ō2NL Fit with Project Objectives Assessments, Stantec
    - Interchanges MCA - May/June 2020
    - Alignment MCA – May/June 2020
    - Local Roads MCA – May/June 2020
    - Additional MCAs (Taylors Road, Kimberley/Tararua Connection, Tararua Road) – May 2021
- The notified Plan Change for the Tara-Ika Subdivision, HDC
- Draft Network Operating Framework, HDC
- One Network Customer Levels of Service, Waka Kotahi

1.3.1 Transport Modelling

SATURN

A range of scenarios were developed to understand the performance of the East of Levin options using the Ō2NL Saturn (wider network) model and help inform the project objectives assessment.

Specific models were developed for the following scenarios:

- Queen St Overpass plus Tararua Interchange (Q0/T0)
- Queen St and Tararua at-grade roundabouts (Q3/T3)
- Queen St closed but with the Liverpool Extension, Tararua Interchange (Q4/T0)
- Queen St Diverted, Tararua Interchange (Q5/T0)
- 5-arm Roundabout north of Queen St, Tararua Interchange (Q8/T0)

Key assumptions included:

- All options included a central spine connection from Tara-Ika, connecting to SH57 via a roundabout.
- Only option Q4 included the Liverpool extension link for the purposes of this MCA. However, none of the East of Levin options preclude such a link being provided in the future.
- All option combinations have not been modelled; however, the range of modelled options allow for an understanding of key impacts. For example, the Q0/T0 model run used as a proxy for other options (i.e. options that had level / grade differences but no change in connectivity)
- Queen St option variants, with the exception of Q3/T3, all include an interchange at Tararua Road (T0) as that was the previously preferred interchange form and the connectivity of this option is the same as most other Tararua Road options.

SIDRA

In addition to the SATURN modelling, further detailed SIDRA intersection analysis was undertaken on:

- Option Q3 to better understand the operational performance of closely spaced roundabouts in terms of queuing and delays
- Option T3, for the same reasons as Q3.
- Option Q8 to better understand the future option performance of the large 5-arm multi-lane roundabout in terms of queuing and delays.

Refer Appendix A for a summary of the SATURN and SIDRA modelling outputs.

1.4 Area of Consideration

The assessments considered the impact that different East of Levin option combinations would have on the wider Ō2NL and SH57 corridors based on SATURN modelling.

Figure 1-1 below presents the area of influence of East of Levin options, highlighting that Q8, compared to the DBC option of Q0/T0, resulted in increased volumes on Ō2NL between Tararua and the proposed 5-arm roundabout, but reduced volumes north of the new roundabout (and correspondingly higher volumes on the existing SH57).

As a result, the study area consists of Ō2NL, SH57 and the key east-west links between Tararua Road and the northern SH1-SH57 Connection, and the impacts are considered within the scope of this area rather than the entire project.

Figure 1-1: East of Levin Area of Consideration

2 Safety

As per previous assessments for both the alignment and interchanges, safety was assessed in a qualitative manner but relied on the SATURN modelling results to understand the impact on flows and any traffic re-assignment effects, for example Ō2NL taking traffic off the existing state highways.

SATURN modelling was supplemented by more detailed modelling using SIDRA to understand the intersection performance in terms of queueing and delays where intersections were closely spaced.

Consideration was also given to the new highway in the context of the Wellington Northern Corridor. While each interchange option was considered from a standalone perspective, considerations to the wider interchange layout was given. For example, an at grade roundabout should not be located between two grade separated interchanges.

Crash models from the crash estimation compendium were considered as a method of assessment, however as the traffic volumes for which the models are valid and the expected flows on the new highway did not overlap for all options, they were deemed to not be suitable for this assessment.

Where there is a known slope on an overpass structure, stopping sight distance has been assessed to ensure suitable visibility based on the current drawings.

2.1 Queen Street Options

For this assessment it has been assumed that SH57 and Queen Street in this area will operate with either a 50 km/h or 60 km/h speed limit following the development of Tara-Ika.

For grade separated options where there was no significant change from the previous options[1], this resulted in a score of 1, in line with previous assessments. Options with only minor concerns, and also scoring 1, are outlined below.

Table 2-1: Safety - Queen St – Options that score 1

Option	Score	Special Notes
Q0	1	No conflict between Ō2NL and Queen Street due to overpass. No sight distance issues. Scored previously.
Q1	1	The introduced grade is minor and there is sufficient visibility for this to not be expected to lead to additional crashes.
Q2	1	The introduced grade will help stopping on approaches to the roundabout. During detailed design, sight distance for northbound traffic on SH57 to Queen Street East is to be maintained. This is not expected to be an issue.
Q4	1	Queen St closed, but an alternate grade separated east-west link is provided via the Liverpool Extension. No conflict between Ō2NL and local traffic (Liverpool Street). The introduced grade is moderate, however there is sufficient visibility for this to not be expected to lead to additional crashes.
Q5	1	The introduced grade is minor and there is sufficient visibility, unlikely to lead to additional crashes. The re-routing of traffic will have a minor impact on the local network.
Q6	1	As per Q0. Effectively a different elevation of Q0.

This leaves options Q3, Q7 and Q8 which scored worse than a 1. The reasons for these are outlined below.

2.1.1 Q3 Assessment

Option Q3 creates two roundabouts approximately 100m apart. The eastern roundabout being between Ō2NL and Queen Street while the western roundabout connects SH57 to Queen Street.

A roundabout at this location was initially considered to score a 2. Compared to a roundabout at the Tararua location previously assessed, there will be an increased urban feel and drivers particularly those from south will have seen a reasonable amount of urban development. For southbound drivers, they are likely to have passed through a roundabout at North of Levin and the Ō2NL-SH57 Split, so a roundabout at this location is less surprising for southbound drivers. It was considered a 'high' 2 due to the intersection creating more conflict than grade separated options, forcing local and state highway traffic to mix.

SATURN network modelling highlighted that the Q3 roundabout improves the local connectivity of Ō2NL, as trips using the expressway to access Levin become easier, resulting in an increase of 6,000 vpd on Ō2NL between Tararua Road interchange and Queen St. The improved connectivity also results in an increase of approximately 4,000 vpd north of Queen St. Traffic volume increases on the high standard Ō2NL corridor improves overall safety, as there is generally a

[1] Assessed as part of the Interchanges MCA in May/June 2020, contained in the Project Objectives MCA Report.

corresponding reduction in flows on the existing SH57. However, as speeds on SH57 south of Queen Street are likely to be reduced to 60km/h, the impacts of these flow reductions are unlikely to improve the safety score from a 2.

SIDRA modelling showed that by 2049, traffic growth within the area would result in queuing greater than the distance between the roundabouts. While this could be mitigated by additional lanes, the additional lanes would create further weaving manoeuvres which carry their own safety risk. Furthermore, it was considered that in time with future growth beyond the 2049 modelled year, this situation could become worse, with queuing on Ō2NL causing unexpected stops at a roundabout on what is an expressway style highway. This caused the score to increase by one point to 3.

It is noted that should the Tararua interchange be a roundabout instead, a roundabout at Queen Street would no longer be an out of context intersection form for northbound motorists, and the score would correspondingly improve by one point, however it would remain one of the 'worst' options with a score of 2.

2.1.2 Q7 Assessment

Option Q7 results in Queen St crossing Ō2NL by means of a local road overbridge; this results in relatively steep grade leading into the SH57/Queen St roundabout.

Whilst having no direct connection between Ō2NL and the Queen Street would normally be considered a 1, the steep grades (approximately 8% 40 m away from the roundabout limit lines) could result in braking and sight distance issues for traffic approaching SH57 from Tara-Ika. This has caused the score to be assessed as a 2.

2.1.3 Q8 Assessment

Option Q8 is a large ~100m diameter roundabout with 5 approach legs. In addition to connecting two state highways, it also includes Queen Street East which has been diverted into the new large roundabout. This option also removes the need for the interchange planned further north at the Ō2NL and SH57 bifurcation.

Option Q8 was initially given a base score of 1 in line with the roundabouts north of Levin. As detailed in the previous Fit with Project Objectives report, this score differs to the Tararua roundabouts due to the passage through an urban area and its ability to signal a change to the road environment for users moving to SH57 (which a grade separated interchange does not do as effectively).

As a large five arm roundabout with high flows, this was judged to then be scored down one point for a combination of factors relating to the roundabout operation:

- This option forces all local traffic travelling to and from Tara-Ika to cross high speed highway traffic via a large multi lane roundabout.
- SIDRA modelling showed delays for several minutes for two approaches by 2049. At this point, risky gap taking is an issue as drivers become frustrated.
- The capacity issue can be resolved by making sections of the roundabout 3 lanes, which would increase the amount of lane changing within the roundabout, further increasing crash risk.

The above factors combined to increase the base score to 2.

Finally, when considering the wider network impacts it was then judged that due to the transfer of approximately 7,300 additional vehicles onto the existing SH57 for a much longer distance created a significant enough safety issue on that road to warrant a further increase in score. This resulted in a final score for this option of 3.

2.2 Tararua Road Options

The proposed options at Tararua Road were either previously assessed or only differ by the levels or gradients on the approaches to the roundabouts. For the options with different gradients and final levels, the visibility and impact to braking were assessed.

The review of braking and sight distances did not raise any issues. Scoring for grade separated options remained a 1, with the roundabout scoring a 3 in line with the previous assessment[2][3].

2.3 Mid-block Options

The level of the highway between Tararua Road and Queen Street has no impact on the safety of the new highway.

[2] Assessed as part of the Interchanges MCA in May/June 2020, contained in the Project Objectives MCA Report.

[3] Out of context interchange form for the location (first at-grade roundabout on the Wellington Northern Corridor for northbound journeys, small diameter, roundabout in largely rural area).

3 Resilience

This criterion included the following elements:

- The ability of the intersection/interchange to facilitate travel on the alternative route (the current SH1 and the new highway).
- The impacts to the network if there is a crash at the intersection/interchange
- The potential of a natural hazard causing the new highway to close

Note that the assessment did not factor in the engineering difficulty to prevent the closure, as this would be covered under the separate engineering degree of difficulty criteria.

There was no notable difference between the connectivity offered by a grade separated interchange or a roundabout for the East of Levin area. However, the consequence of a crash at a roundabout is more severe than a grade separated interchange, as traffic exiting or entering the roundabout could impact an entire direction of travel or both directions of travel. This is mitigated with a grade separated interchange which have a lower crash risk and separated movements.

3.1 Queen Street Options

For the Queen Street options, the key differentiators relate to the presence of grade separation and whether Ō2NL was above the estimated maximum ground water level.

The scores are summarised in Table 3-1 below and highlight that:

- All grade separated options, with the exception of Q0, score a 1 as they are fully above or only partially below estimated maximum groundwater
- Option Q0 scores a 2 as due to the high groundwater levels, larger than 1:100 year events may result in a short closure of the highway (as outlined above, the engineering difficulty of this option is assessed separately).
- Roundabout options (Q3 and Q8) score a 2 due to higher crash risk coupled with a significantly higher probability of any event impacting both directions of traffic (e.g. crash or breakdowns)

Table 3-1: Resilience - Queen St

Option	Score	Comments
Q0	2	Is designed to perform in a 1:100 AEP with climate change. Larger events may result in short 2-4h closure of highway, which is still an improvement over the Do-Minimum
Q1	1	Similar to above, but with a much lower probability of a full closure.
Q2	1	Highway is above groundwater. Grade separation minimises impact of crashes/other events.
Q3	2	Highway at-grade. Roundabouts as per previous MCA have higher crash likelihood compared to an interchange or overpass and if an event were to occur this is likely to block multiple lanes / both directions of traffic. The proximity of the roundabouts under Q3 means that an event on the existing SH57 may also impact Ō2NL.
Q4	1	As per Q2
Q5	1	As per Q2
Q6	1	As per Q2
Q7	1	As per Q2
Q8	2	Comments as per other roundabouts, noting the high volumes and 5-arm nature of the roundabout further increase the probability of crashes and impact of any event.

3.2 Tararua Road Options

The key differentiators for the Tararua Road options are similar to the Queen Street options outlined above.

Overall, the grade separated options score a 1 with the at-grade roundabout scoring a 2. The scores and commentary for each option are presented in Table 3-2 below.

Table 3-2: Resilience - Tararua Rd

Option	Score	Comments
T0	1	Possible interface with groundwater, but only clipping compared to Q0, score for a grade separated interchange unchanged from previous MCA.
T1	1	As per T0, but improved as maximum depth of cut limited to maintain a few metres above max GW level.
T2	1	No issues with groundwater based on new information, score for a grade separated interchange unchanged from last MCA.
T3	**2**	Highway at-grade, score for a roundabout interchange unchanged from last MCA (increased crash risk, events impacting both directions).
T6	1	As per T2
T7	1	As per T2

3.3 Mid-block Options

The level of the highway between Tararua Road and Queen Street has no impact to the likelihood of a crash on the new highway.

Similarly, there are no changes to liquefaction or proximity to faults and if slopes are properly engineered, no changes to slope stability considerations.

With respect to flooding, Option 1 (ground level) is easier to design for, but both options are viable. Noting that any transitions from below to above ground will need considered during detail design to ensure any ‘sump’ arrangement is accounted for.

As a result, both the ground level and below ground level options score a 1 for resilience, with at grade being slightly better performing.

4 Appropriate Connectivity

This assessment followed the previously established interchanges and intersection MCA processes. The assessment focusses on the appropriateness of the interchange/intersection form in relation to the current road environment, the potential future road environment and the wider One Network Road Classification system (and corresponding Customer Levels of Service[4] document).

Currently, SH1 is classified as a National High-Volume Road from the southernmost point of the project area to the SH1-SH57 intersection. From here, both SH1 and SH57 are considered National Roads. For the new highway, the same junction points have been assumed (i.e. the northern split between O2NL and SH57) and therefore the new highway at this location would be a National High-Volume Road.

The Customer Level of Service for a National High-Volume Road when evaluating access points is described as follows:

> *Landuse access for road users rare and highly engineered, usually only to highway service centres. Strategic network connectivity for road users due to infrequent connections, generally only to National high volume roads. High volume traffic will be unimpeded by other traffic at junctions.*

The Customer Level of Service for a National Road when evaluating access points is described as follows:

> *Landuse access for road users infrequent and highly restricted in rural areas, and often restricted in urban areas. Mainly strategic network connectivity for road users due to infrequent connections, generally only to other equal and higher category roads. Easy navigation at intersections, with National road traffic given priority, unless joining with equal or higher category roads.*

The One Network Framework was not used as the metrics used for the ONRC assessment (customer levels of service) have not yet been sufficiently developed to enable a detailed comparison between options. Consideration was given to the draft Network Operating Framework, and where this would change the scores is detailed below. It is noted that no connection is in many cases considered the most appropriate connection.

This assessment area links directly to the integration between State Highway and local road project objective, as well as supporting intra and inter-regional economic growth when reviewed in conjunction with enhanced movement. It facilitates the project outcome of facilitating safe, efficient growth in Horowhenua and aiding the improvement of Levin's main retail area attractiveness. While this project objective includes the connections to the local road and impact on the community, these criteria are also being evaluated separately as part of the MCA process, so care was given not to overemphasis this element.

4.1 Queen Street Options

The Queen Street options were grouped into three areas based on connectivity; grade separated with direct or minor detours, grade separated with road closures or at-grade roundabouts.

Discussion of the grade separated options with minor differences are outlined in Table 4-1 below.

Table 4-1: Appropriate Connections - Queen St

Option	Score	Special Notes
Q0	1	No conflict between local and highway traffic. No interchange here is an appropriate form
Q1	1	Grade variant of Q0, therefore the same logic applies.
Q2	1	Grade variant of Q0, therefore the same logic applies.
Q5	1	The diversion of Queen Street promotes traffic using Liverpool Street which is consistent with the draft NOF. The diverted distance is not sufficient to warrant a 2 as separation of traffic is maintained and full connectivity is provided. Special provisions for active modes are provided via a direct overbridge. Considered the least preferred option which scored a 1 in the current environment. If public transport movements are better provided for in a future iteration, this would be considered a better 1 when considering the draft NOF.
Q6	1	Grade variant of Q0, therefore the same logic applies.
Q7	1	Grade variant of Q0, therefore the same logic applies.

The remaining options, which scored worse than a 1, are discussed further below.

[4] https://www.nzta.govt.nz/assets/Road-Efficiency-Group-2/docs/customer-levels-of-service.pdf

4.1.1 Q3 Assessment

The base assessment for this option is in line with previous roundabout assessments at Tararua Road, which had a roundabout between a National High Volume road and an Arterial or lower classification under the ONRC scoring a 3. The score accounts for the fact that this location could the logical end of the classification as a National High Volume Road due to the change in volumes and function (i.e. better than a roundabout at Kuku/Manakau which scored a 4 previously).

It is also noted that if the Tararua interchange became a roundabout, driver expectations of an interchange at Queen would change, and the roundabout would be considered more appropriate, but still a 3 overall due to the conflict between ONRC classes as per the customer levels of service.

4.1.2 Q4 Assessment

Option Q4 results in the permanent closure of Queen Street to traffic, requiring east-west traffic to use the Tara-Ika Central Spine Connector and Liverpool Extension instead.

This assessment considered conflicting aspects:

- Having no interchange here is an appropriate form of connection;
- However, this option also severs an existing connection.

On balance, this has been judged to be a score of 2, noting that the severance likely precludes a future Queen Street connection being put in place. This option effectively detunes Queen Street, which is in line with the draft NOF, but also precludes a direct future public transport connection.

4.1.3 Q8 Assessment

Option Q8 was judged to not be as appropriate as the previously assessed roundabout at the Ō2NL-SH57 split. This was due to the introduction of the Queen Street connection which then means that it is no longer a highway to highway connection, nor is it the conversion of a National High Volume Road into two National Roads.

While a large dual lane roundabout was deemed very appropriate for a Ō2NL-SH57 intersection, it was judged that the introduction of the Queen Street approach into the roundabout had significant impacts to the appropriateness of the intersection form.

These aspects are outlined below:

- Northbound traffic on Ō2NL would be giving way to Queen Street East traffic, representing a significant give-way disparity between ONRC classes at an intersection (i.e. National or National High Volume giving way to an Arterial or lower).
- It forces purely local traffic into a 100m diameter dual lane roundabout with an anticipated 100 km/h speed limit

The impact of the priority being in favour of Queen Street East over northbound Ō2NL traffic is considered significant due to the traffic volumes expected to be on Queen Street East due to the Tara-Ika development. These two factors have lowered the roundabouts appropriateness score to a 3.

4.2 Tararua Road Options

The difference of elevation does not impact the scoring previously undertaken, nor has the roundabout design changed from previous assessments to warrant a change in score.

All grade separated options scored 1 while the roundabout scored 3 in line with previous assessments[5].

4.3 Mid-block Options

As per the previous assessment, the Appropriate Connectivity criterion was not assessed for an alignment option. As a result, both options score a 1 for consistency.

[5] A roundabout at this location is not an appropriate form as under the ONRC CLoS, the national highway should have priority this is not possible at a roundabout. This is also the first at-grade intersection for northbound traffic on the Wellington Northern Corridor.

5 Mode Choice

This is a relatively new project objective for the Ō2NL which was added as part of the projects inclusion in the New Zealand Upgrade Programme (NZUP). While the specific wording of the project objective discusses a providing a shared use path, such a facility will be included under all options. Accordingly, this assessment has focused on the east-west connectivity enabled by the project.

Key areas for the assessment included whether or not a specific east-west active modes facility was provided, any issues with gradient and any difficulties expected from users navigating the area by means of the road form or volumes.

It has been assumed that at this stage of the design, modifications such as widening of shared path or alterations to proposed structures can be accommodated if it would provide a significant benefit to the mode. It has also been assumed that where these facilities connect into an existing road that suitable crossing facilities by means of a signalised crossing point or pedestrian crossings will be provided.

In determining the score, consideration was given to the priority assigned to both pedestrians and cyclists in the draft NOF.

In all cases, it was judged that the new facilities will significantly improve the mode choice within the area and therefore scores above 3 were unlikely.

5.1 Queen Street Options

All Queen Street options provide separated active mode facilities which remove conflict with Ō2NL through traffic. Most options also had limited gradients which would not impact on attractiveness. All options which scored 1 for this criterion, along with any notes on the score, are presented in Table 5-1 below.

Table 5-1: Mode Choice - Queen St

Option	Score	Special Notes
Q0	1	The introduced slope is minor and for a short distance. Avoids conflict with Ō2NL. Assumes an appropriate crossing facility is provided on SH57.
Q1	1	The introduced slope is minor and for a short distance. Avoids conflict with Ō2NL. Assumes an appropriate crossing facility is provided on SH57.
Q2	1	The introduced slope is minor and for a short distance. Avoids conflict with Ō2NL. Assumes an appropriate crossing facility is provided on SH57.
Q3	1	An active modes overbridge is provided. It is assumed that this will have suitable grades and will also either cross SH57 or provide for a suitable crossing facility. Anticipated to be on the southern side.
Q5	1	An active modes overbridge is provided. It is assumed that this will have suitable grades and will also either cross SH57 or provide for a suitable crossing facility.
Q6	1	Active modes retained at surface level. Assume an appropriate crossing facility is provided, likely to the south of Queen Street.
Q8	1	An active modes overbridge is provided at Queen Street to enable east-west movements

Options which did not score 1 are discussed further below.

5.1.1 Q4 Assessment

While not shown in the drawings, as Queen Street is a priority route for active modes it is assumed that an active modes facility is provided here. However, the option shown has grades in excess of 7% along the Tara-Ika Central Connector leading into a roundabout with SH57, which is accommodating the diverted Queen Street traffic. This will reduce the attractiveness of this link for active modes resulting in a score of 2.

Should there not be an active modes facility at Queen Street, this option would be scored a high 3 due to a combination of the gradient and additional traffic active modes could be conflicting with.

5.1.2 Q7 Assessment

As Queen Street is a priority route for active modes, the gradient of over 8% heading into the Queen St/SH57 roundabout (as a result of the local road going over Ō2NL), creates both safety concerns for cyclists and reduced attractiveness for all active modes. As a result, Q7 has a score of 2 due to reduced attractiveness.

5.2 Tararua Options

For the Tararua options presented, the intersection form provided the largest barriers to active mode attractiveness.

All grade separated options at Tararua Road consist of a dumbbell roundabout arrangement for connectivity. As a result, east-west active mode movements from Tara-Ika will be required to traverse up to 3 roundabouts, including the 2 roundabouts from the proposed interchange and the proposed roundabout at SH57/Tararua Road.

Only Option T3 provides a specific overbridge facility for active modes to avoid the Ō2NL/Tararua Road roundabout. As a result, this option scores a 1 and Tararua Interchange options score a 2.

Table 5-2: Mode Choice - Tararua Road

Option	Score	Comments
T0	2	Trips to/from Tara-Ika traverse up to 3 roundabouts
T1	2	As per T0
T2	2	As per T0
T3	1	Overbridge provided for active modes avoids 2x interchange roundabouts
T6	2	As per T0
T7	2	As per T0

5.3 Mid-block Options

A north-south shared use path is provided under all options and east-west connectivity is considered as part of the Queen and Tararua assessments outlined above.

However, the below ground midblock option does provide an opportunity to reduce the gradient of the Tara-Ika Central Spine connection onto SH57 (based on Q4 design which has 7%+ grade). Ō2NL being below grade could reduce the overbridge gradient to less than 5% for a near 300m climb, improving attractiveness for active modes.

On this basis, the above ground options scored a 2 as a result of the knock on impacts to the active mode overbridge gradients, while the below ground option scored a 1.

6 Enhanced Movement

The enhanced movement objective has been assessed at a high level by looking at the travel time on key routes through the study area.

The assessment relied on a combination of SATURN and SIDRA modelling. For the interchange assessment, traffic modelling was used to inform travel times on key routes.

These routes were kept the same as the DBC and previous MCA assessments:

- Otaki to SH1 North of Levin;
- Otaki to Levin; and
- Otaki to SH57 North of Levin.

Refer Appendix A for a summary of the SATURN and SIDRA modelling outputs.

Local road connections were not assessed as part of this assessment, as the objective focuses on state highway movements. Specific intersections were modelled in SIDRA to understand any localised issues. It was noted that performing well on two routes at the cost of the third route was not considered an optimum outcome.

When assessing enhanced movement, the approach to focus on travel times was done in part to avoid double counting benefits in the MCA process. Whilst travel times are a good supporter of growth, other elements are important too. However, as Horowhenua District Development was its own MCA criterion scored separately, counting the benefits from growth in Horowhenua in this project objective would result in those benefits being double counted in the MCA process and are therefore not included in this assessment. This does not preclude them being reported on in a project objective capacity in other reports. Inter-regional economic growth is governed by the travel time assessed above, as well as the reliability which is noted in the resilience objective.

6.1 Queen Street Options

For the Queen Street Options it was assumed that there would be an interchange at Tararua and a roundabout at the Ō2NL-SH57 split in all cases except for option Q8. In Option Q8, the large new roundabout replaced the proposed roundabout at the Ō2NL-SH57 Split.

All grade separated options here scored 1 as there was no new delays to the routes compared to previous assessments, with Ō2NL providing approximately 10 minute travel time savings for journeys from Otaki to North of Levin (via SH1 or SH57) and 5 minute travel time savings for trips from Otaki to Levin.

Scores for the non-grade separated options are discussed below.

6.1.1 Q3 Assessment

Option Q3 has a mixture of benefits and disbenefits. As a base position, it was scored a 2 in line with all online roundabouts due to the geometric delay introduced for all vehicles which use the roundabout.

From here its position within the network was assessed, noting that it's close proximity to the Levin Town Centre did improve travel time to and from the town centre by about a minute. These benefits did come at the cost of journey times increasing slightly on Ō2NL for inter-regional trips heading north of Levin onto either SH1 or SH57, these were considered minor delays at less than half a minute (but would impact more traffic).

On balance, Q3 was assessed to remain a 2, but was considered the worst 2.

6.1.2 Q8 Assessment

The Q8 option was the only option which introduced significant disbenefits. As a roundabout it was assigned a base score of 2 due to the introduced geometric delay for all vehicles.

However, the score was reduced further as the roundabout was forecast to result in delays of several minutes on the two SH57 approaches in the PM peak in the 2049 future year. It also adds journey time for local trips from Tara-Ika to central Levin compared to other options. The forecast delays of several minutes could be mitigated with additional approach and circulating lanes, however doing this would have wider safety concerns.

It is also noted that growth will continue following 2049 which will add further delays to these approaches. Compared to the 4 leg roundabout proposed further north under other options, there is more conflicting traffic introduced from the fifth approach that severely impacts the roundabout performance.

The combined impact of the SH57 delays and local road impact have been judged of a sufficient scale to warrant a further drop in score compared to the other roundabouts. Q8 is therefore scored a 3.

6.2 Tararua Road Options

The Tararua Road options only differed from previous assessments by grade. This has no impact on travel times within the area.

Therefore, all grade separated options scored 1 while the roundabout scored 2 in line with the previous assessment, due to the additional geometric delay introduced.

6.3 Mid-block Options

The elevation of the highway has no impact on the scoring of this criterion, so both options scored 1.

7 Overall Scores

A summary of the overall scores across each objective for the Queen, Tararua and Midblock assessments is presented in the tables below.

Queen Street Options

Option		Safety	Resilience	Connections	Mode Choice	Enhanced Movement
Ō2NL below grade	**Q0**	1	2	1	1	1
Ō2NL part below	**Q1**	1	1	1	1	1
Local part below	**Q2**	1	1	1	1	1
Roundabout	**Q3**	3	2	3	1	2
Close Queen, Liverpool Ext	**Q4**	1	1	2	2	1
Divert Queen	**Q5**	1	1	1	1	1
Ō2NL over	**Q6**	1	1	1	1	1
Local over	**Q7**	2	1	1	2	1
5-arm Roundabout	**Q8**	3	2	3	1	3

Tararua Road Options

Option		Safety	Resilience	Connections	Mode Choice	Enhanced Movement
Ō2NL below grade	**T0**	1	1	1	2	1
Ō2NL part below	**T1**	1	1	1	2	1
Local part below	**T2**	1	1	1	2	1
Roundabout	**T3**	3	2	3	1	2
Ō2NL over	**T4**	1	1	1	2	1
Local over	**T5**	1	1	1	2	1

Midblock Options

Option	Safety	Resilience	Connections	Mode Choice	Enhanced Movement
Option 1: At-Grade	1	1*	1	2	1
Option 2: Below grade	1	1	1	1	1

Appendix A: Ōtaki to North of Levin East of Levin MCA Project Objectives Modelling Information

Initial SATURN Modelling Outputs

- **Queen St Overpass, Tararua I/C**
  - DBC, but proxy for other partially submerged and bridge options (level differences but no connectivity difference)
  - MCA Q0, Q1, Q2, Q6, Q7; T0, T1, T2, T6, T7
- **Queen and Tararua at-grade roundabouts**
  - MCA Q3 and T3
- **Queen St Closed but with Liverpool extension, Tararua I/C**
  - MCA Q4
- **Queen St Diverted, Tararua I/C**
  - MCA: Q5
- **New 5-arm roundabout, Tararua I/C**
  - MCA: Q8

- **Further modelling outputs available**
  - Google earth KMZ for network flows
  - Delay plots
  - Travel times for key routes
  - Further SIDRA to be undertaken – 5 arm roundabout (Q8) and Queen roundabout (Q3)

2039 Do-Min / No Ō2NL

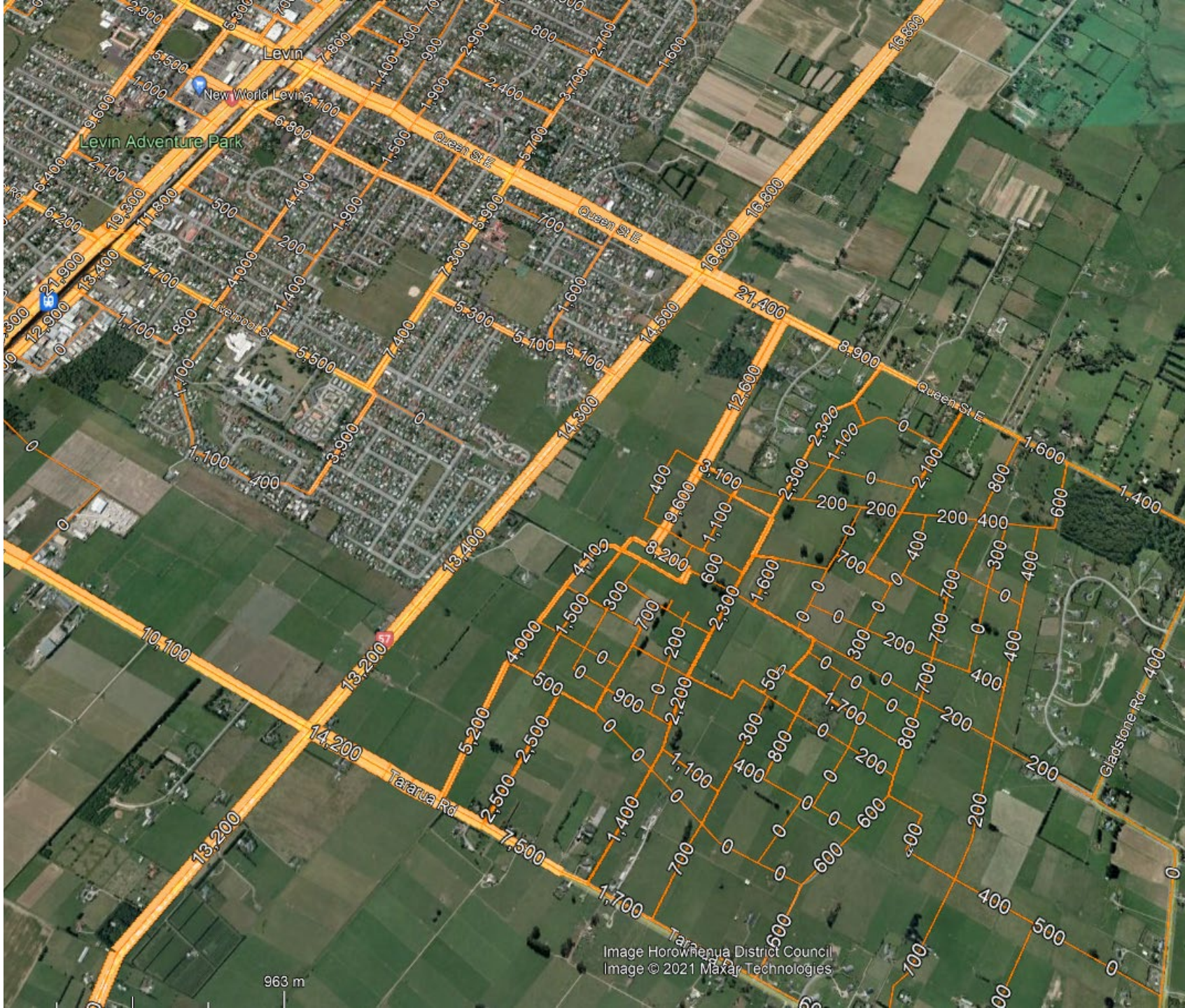
- 2039 daily traffic, includes Tara-Ika
- Thickness of bands indicates two-way daily flow

- **SH57** – 13-17,000 vpd
- **Queen St** – 21,400 vpd
- **Tararua Road** – 10-14,200 vpd

- Travel times on key routes +5mins compared to 2018 (+20-30%)

- Several intersections operating at or over capacity on SH1

- Assumes:
  - No SH57 /Tara-Ika central spine connection
  - Dual lane roundabouts at Tararua/Queen St for MCA modelling



Queen overpass, Tararua I/C
(DBC, Q0/T0)

Compared to Do Min:

- **SH57** – large reductions due to Ō2NL
- **Queen St** – large reductions east of SH57 due to Ō2NL and Tara-Ika connection to SH57
- **Tararua Road** – increase due to Ō2NL I/C
- **Expressway** – 16,600vpd north of Tararua

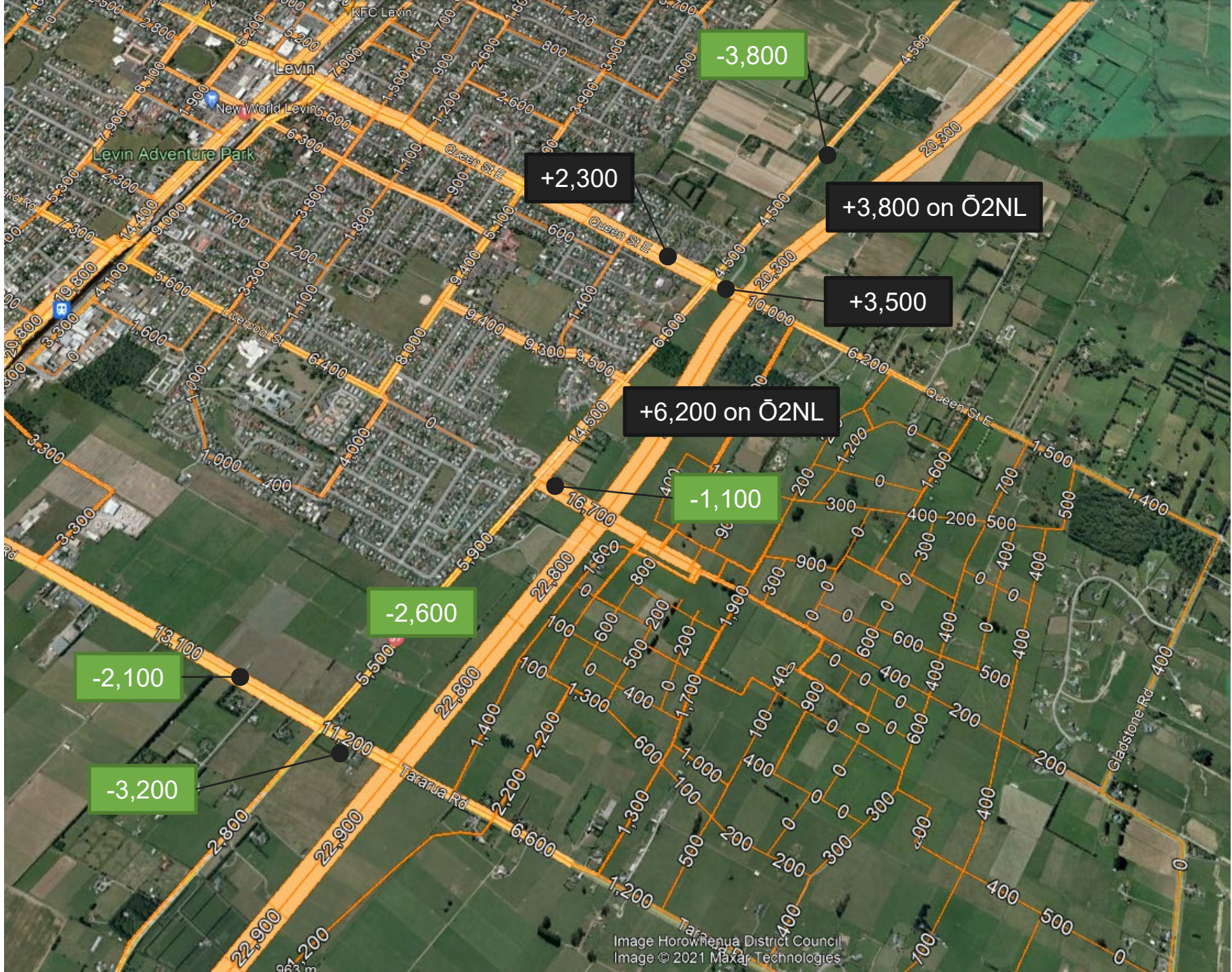
- Travel Time /Delays:
  - ~10min saved Ōtaki to north of Levin (SH1 & SH57)
  - ~5min saved Ōtaki to Levin
  - Intersections in Levin + SH1 side roads reduced delays

Queen and Tararua Roundabouts (Q3/T3)

- Differences compared to current DBC option with an overpass at Queen:

- Roundabouts:
  - Improve connectivity/ attractiveness of Ō2NL north of Tararua
  - Increase flows at Queen
  - Reduce flows at Tararua

- Travel Time /Delays:
  - +25s from Ōtaki to North of Levin due to RABs (but still saving 10mins to DM)
  - Up to 1 min quicker for journeys to Central Levin
  - Similar network travel time benefits to DBC (+1%)
  - SIDRA to confirm delays due to roundabout proximity

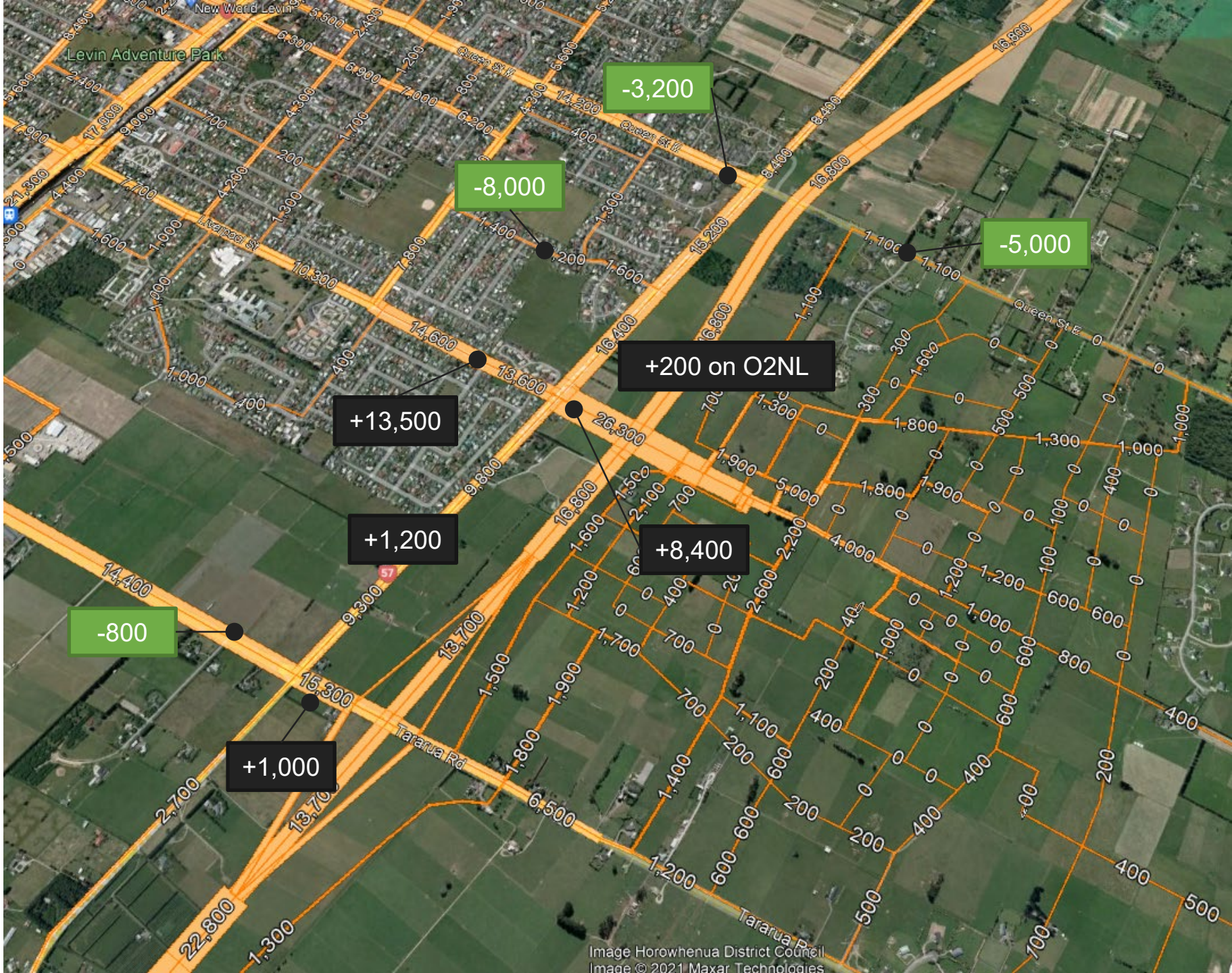


Queen St Closed, with Liverpool extension (Q4)

- Differences compared to current DBC option with an overpass at Queen

- Minimal impact on Ō2NL flows
- Liverpool extension reduces impacts on Queen and Meadowvale
- Flows balanced between Liverpool, Tararua and Queen into Levin

- Travel Time /Delays:
  - No change to regional journeys
  - Slightly lower network travel time benefits to DBC (-2%)

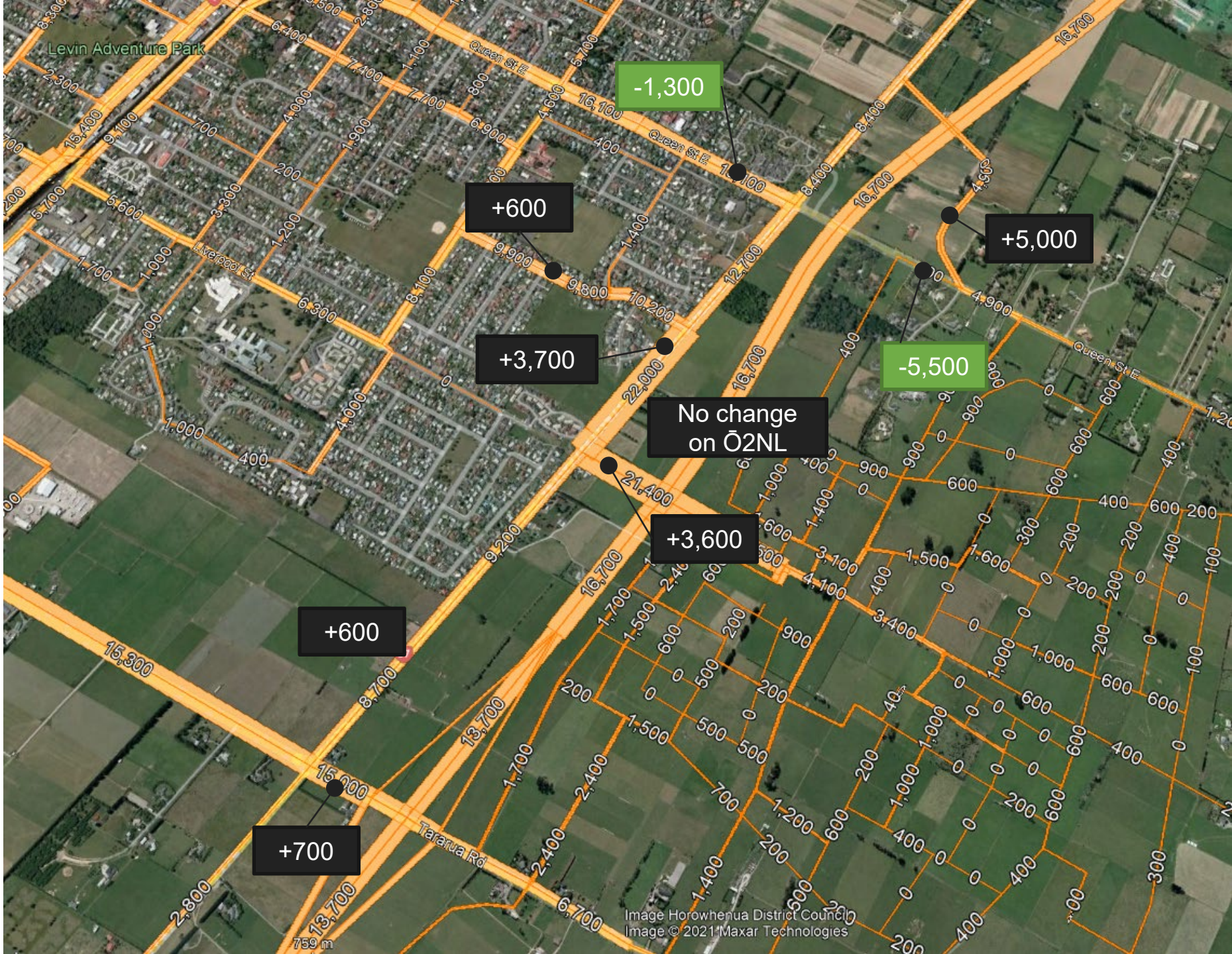


Queen St Diverted, Tararua I/C (Q5)

- Differences compared to current DBC option with an overpass at Queen

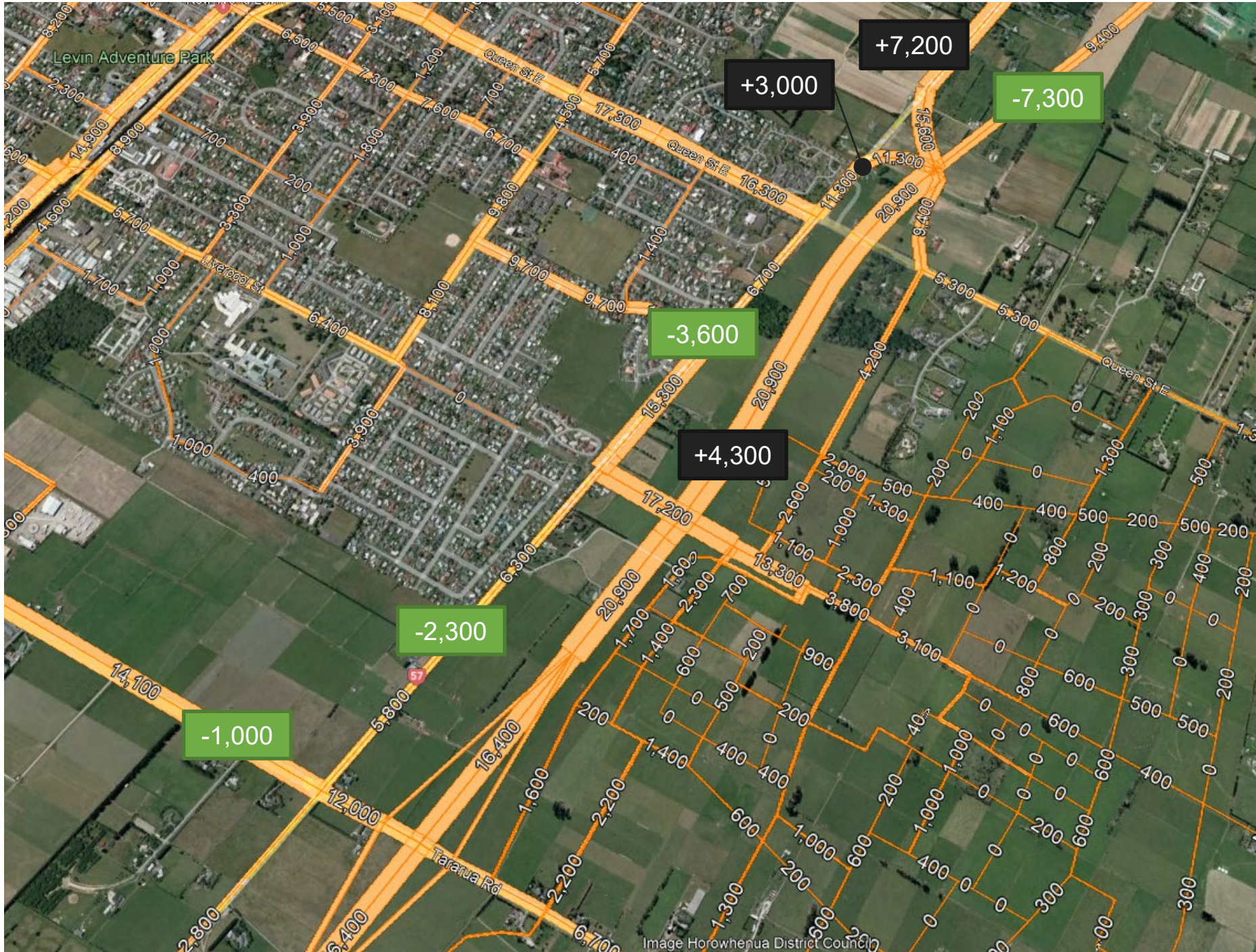
- No impact on Ō2NL flows
- Queen St diversion reduces traffic by about half compared to the overpass
- The diversion increases traffic using the Tara-Ika SH57 connection with smaller increases at Tararua Rd.

- Travel Time /Delays:
  - No change to regional journeys
  - Lower travel network time benefits to DBC (-5%)



New 5-arm roundabout (Q8)

- Differences compared to current DBC option with an overpass at Queen
- Roundabout increases attractiveness of Ō2NL south of Queen, reducing flows on SH57 and Tararua
- Travel Time /Delays:
  - SIDRA to confirm likely roundabout performance



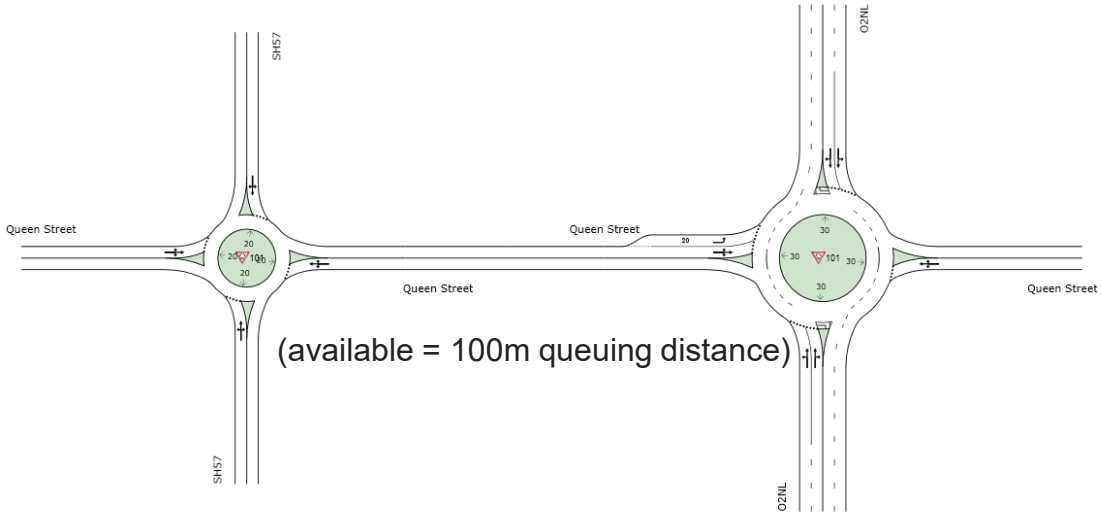
Further SIDRA Analysis

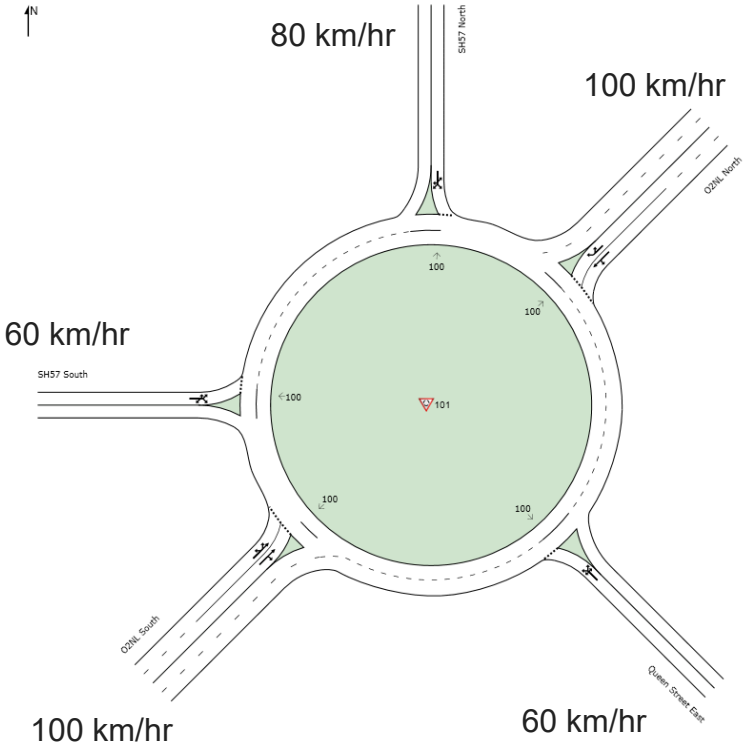
- **Purpose of SIDRA Traffic Modelling**
  - Confirm likely roundabout performance, given closely spaced roundabouts (Q3 / T3)
  - Confirm likely roundabout performance (Q8)

- **Q3 –** Roundabouts for the SH57 and Ō2NL Expressway intersections along Queen Street East (SIDRA network) – 100m apart

- **T3 –** Roundabouts for the SH57 and Ō2NL Expressway intersections along Tararua Road (SIDRA network) – 250m apart

- **Q8** – A new five-arm roundabout north of Levin, connecting SH57, the Ō2NL Expressway and a realigned Queen Street East (SIDRA isolated site).





Assumptions

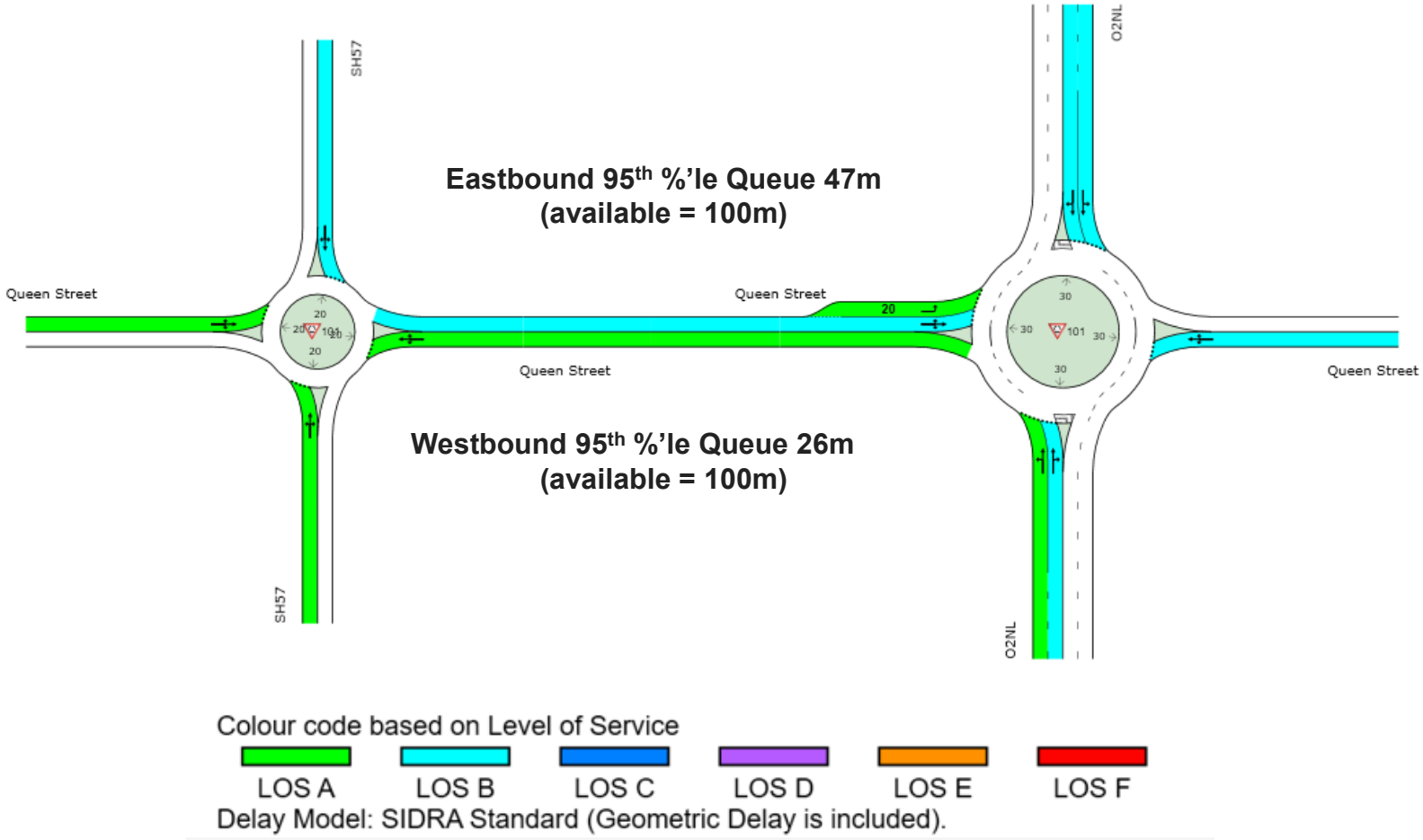
- PM peak assessment using 2039 forecasted pcu's/hr from SATURN (model runs 2RRf_M1 and 25If_M1)
- Speeds along Ō2NL 100km/hr, SH57 80km/hr (dropped to 60km/hr between Queen Street East and Tararua Road), east-west local roads 50km/hr, and 60km/hr for the realigned Queen St East for Scenario Q8
- As 2049 forecasted volumes were modelled in SATURN for the MCA options, this has been derived by using a 2% pa growth applied to the 2039 forecasted volumes
- Results are provided for the critical PM Peak. However, the AM peak will likely have queuing/delays at other approaches (tidal nature of the peaks), but due to the lower volumes compared to the PM peak, these are expected to be of less significance.
- Site/network peak flow period of 30 minutes
- All other factors left as default

Q3: Queen Street 2039 PM Peak

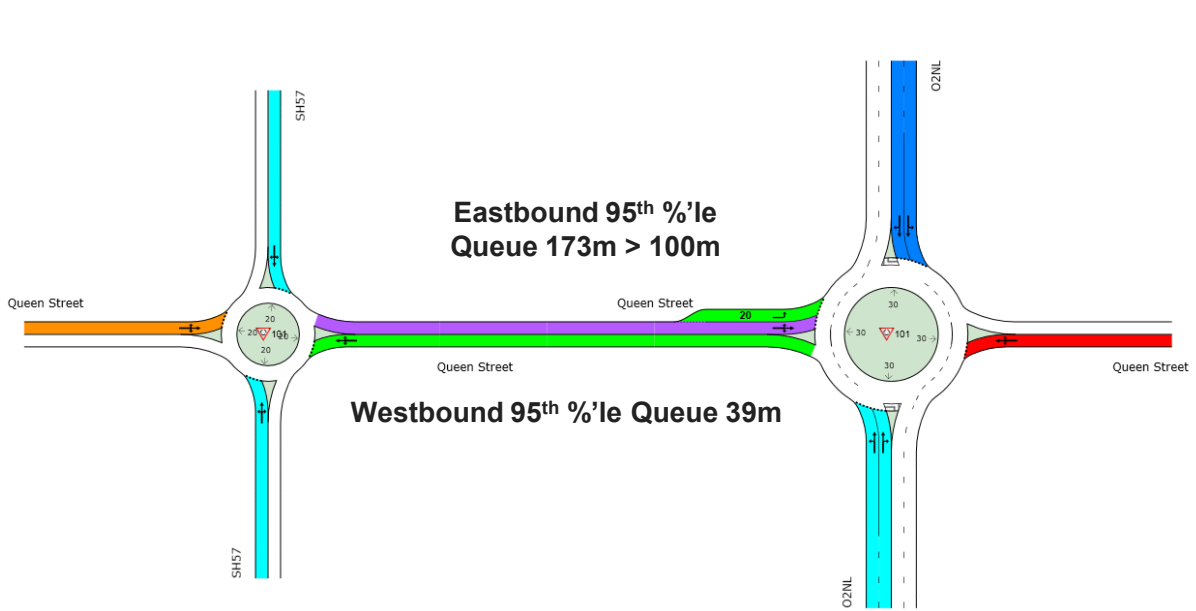
- The purpose of SIDRA analysis for the Q3 option was to determine whether the closely spaced roundabouts would perform adequately.

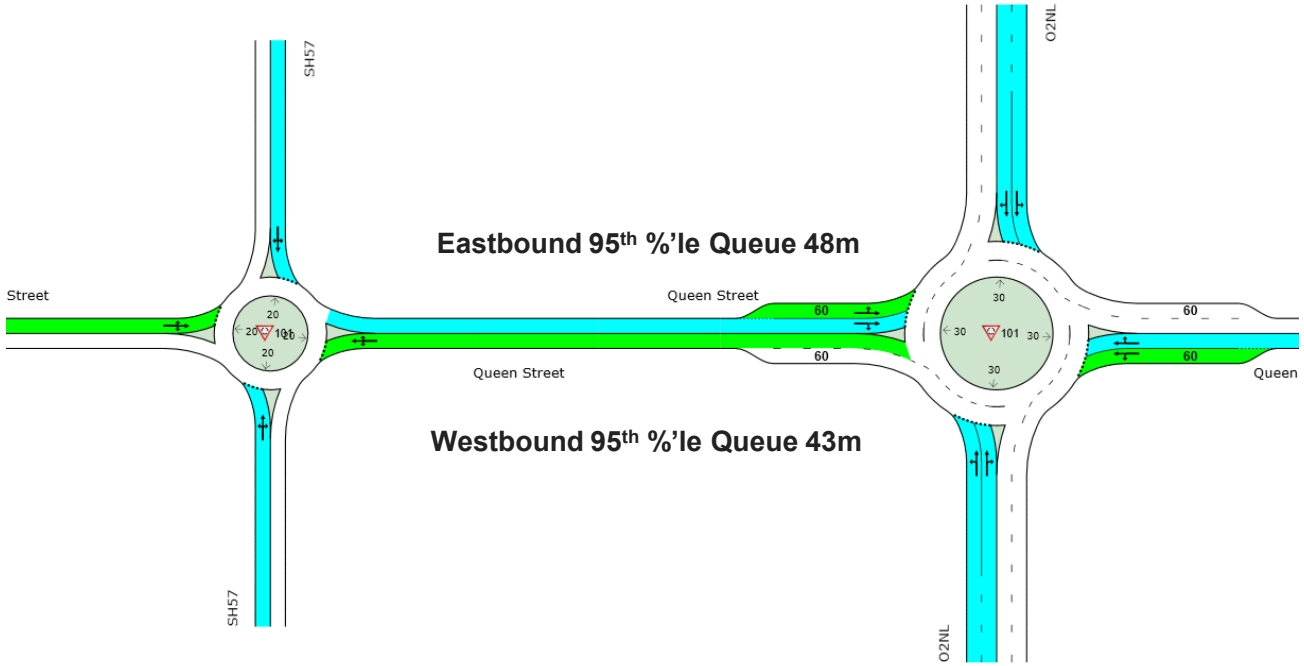
- SIDRA suggests no significant issues with a single-lane roundabout at SH57/Queen St East and dual lane roundabout at Ō2NL/Queen St East for a forecasted 2039 PM peak period, with a network LOS C.

- Average network delay = 10s
- Avg delay for O2NL approaches = 10-14s
- 95th Queue = 50m Eastbound, 50% of available stacking distance.



Q3: Queen Street 2049 PM Peak





Colour code based on Level of Service

LOS A | LOS B | LOS C | LOS D | LOS E | LOS F

Delay Model: SIDRA Standard (Geometric Delay is included).

- However, with 2049 forecasted volumes, SIDRA indicates that the eastbound queue from the Ō2NL/Queen St East intersection is around 175m, spilling through to the SH57/Queen St East roundabout and resulting in a network LOS D.
- This highlights a potential queue stacking issue as the proposed design provides for around 100m of lane length between the two roundabouts.

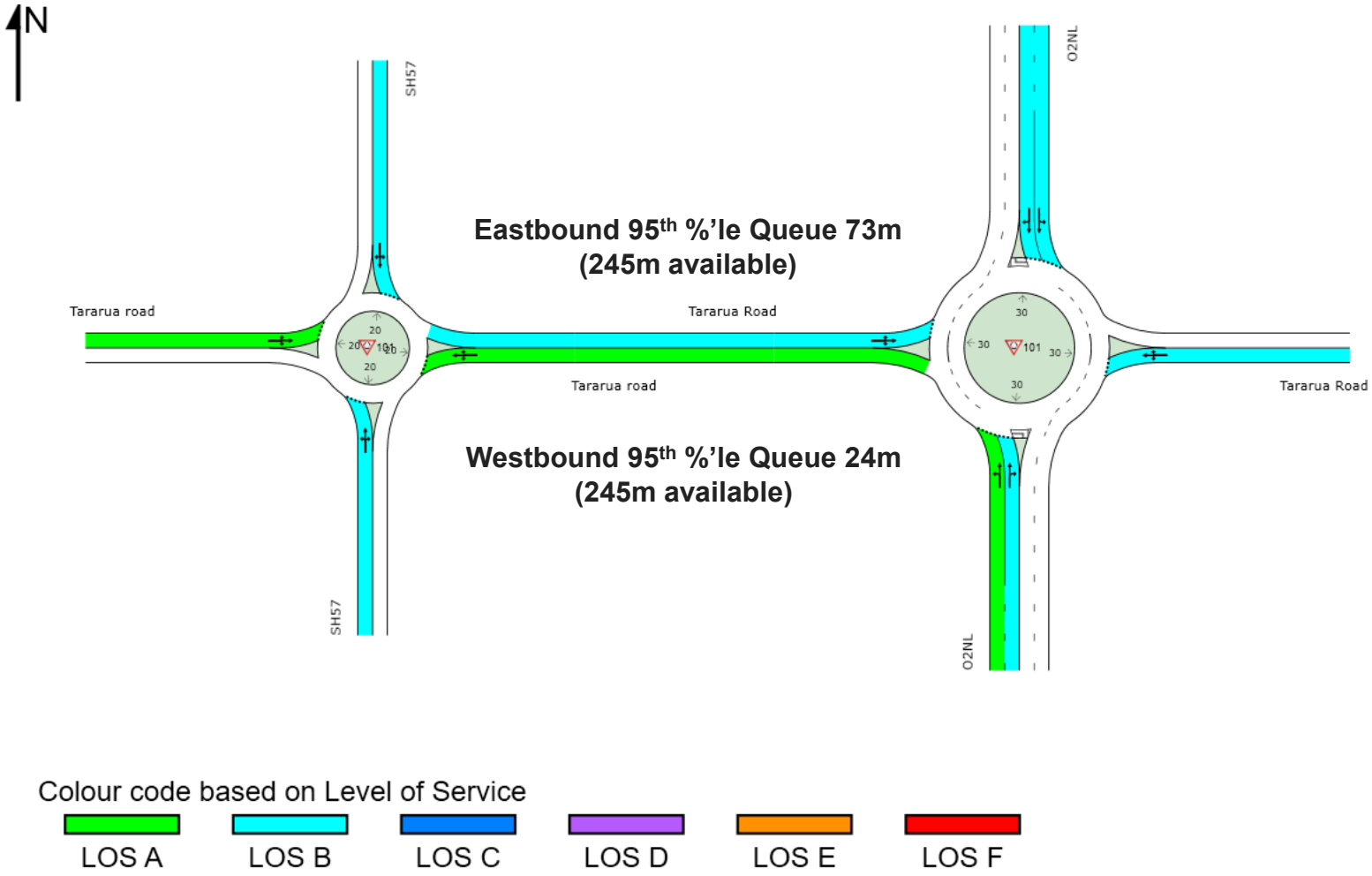
- Flared approach lanes on the O2NL roundabout increases capacity and avoids queues spilling through both roundabouts:
  - Network LOS C
  - Average network delay = 12s
  - Average delay for O2NL approaches= 12-16s

T3: Tararua Road 2039 PM Peak

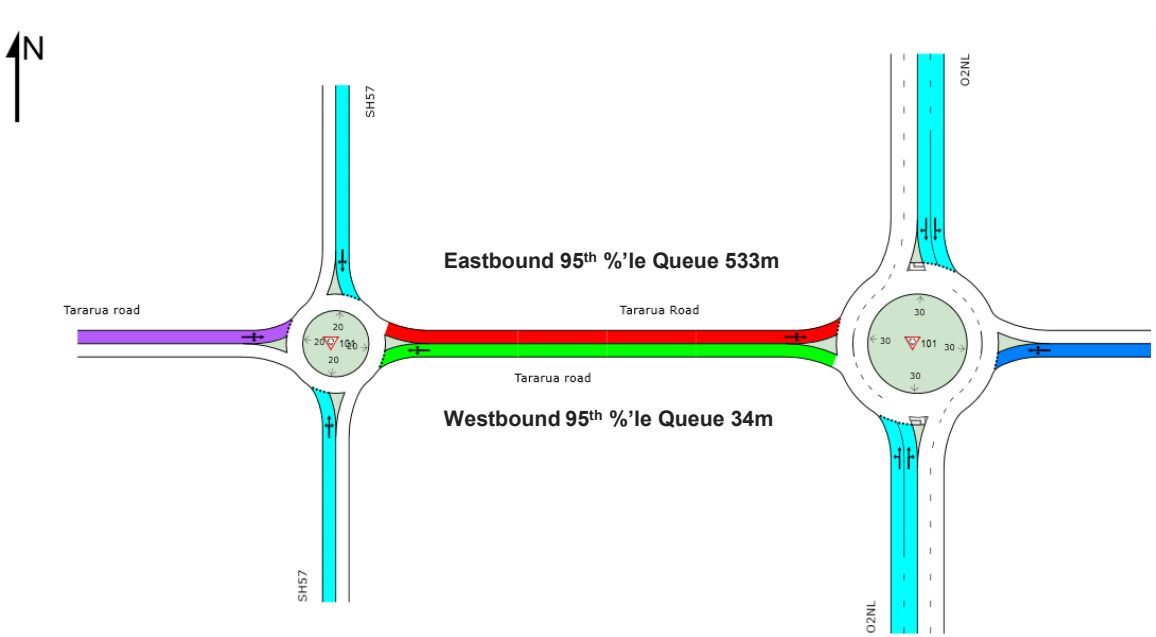
- The purpose of SIDRA analysis for the T3 option was to determine whether the closely spaced roundabouts would perform adequately.

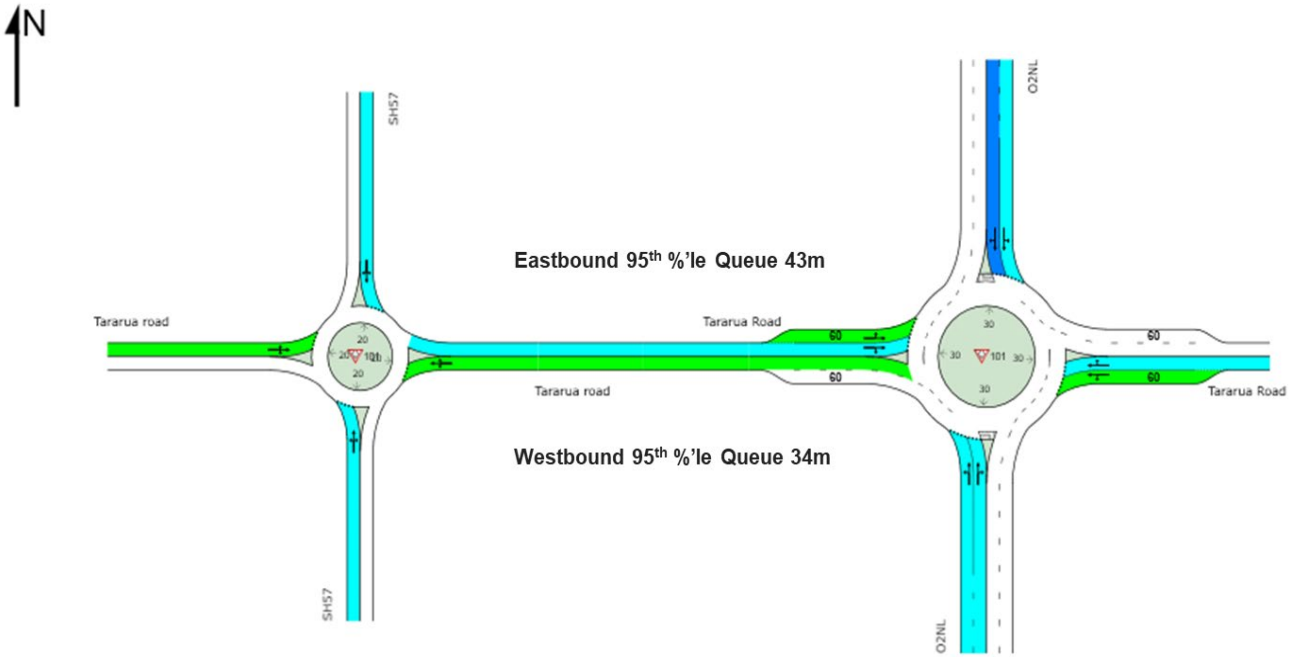
- SIDRA suggests no significant issues with a single-lane roundabout at the SH57/Tararua and Ō2NL/Tararua intersections, for a forecasted 2039 PM peak period, with a network LOS C.

- Average network delay = 11s
- Average delay for O2NL approaches = 11-14s
- 95th Queue = 73m Eastbound, 30% of available stacking distance.



T3: Tararua Road 2049 PM Peak





Colour code based on Level of Service

LOS A | LOS B | LOS C | LOS D | LOS E | LOS F

Delay Model: SIDRA Standard (Geometric Delay is included).

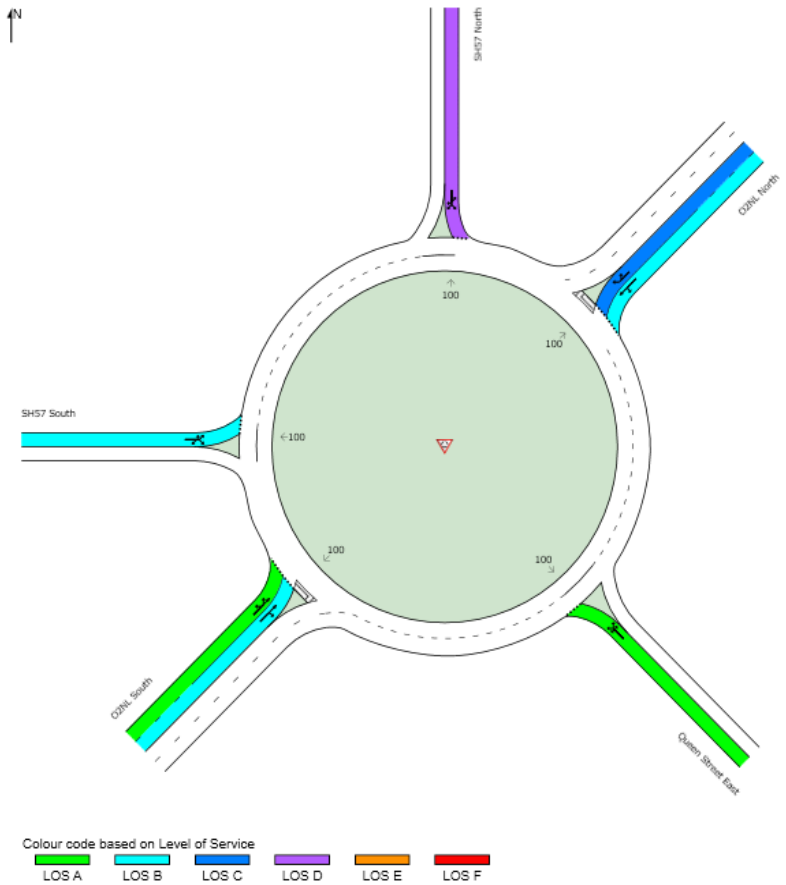
- However, with 2049 forecasted volumes, SIDRA indicates that the eastbound queue from the Ō2NL/Tararua East intersection is greater than 500m, spilling through to the SH57/Tararua roundabout and resulting in a network LOS D.
- This highlights a potential queue stacking issue as the proposed design provides for around 250m of lane length between the two roundabouts.

- Dual-lane approach and exit lanes mitigate this issue, reducing queue lengths to within the midblock and avoiding spilling through both roundabouts
- Network LOS C
- Average network delay = 12s
- Average delay for O2NL approaches= 13-21s

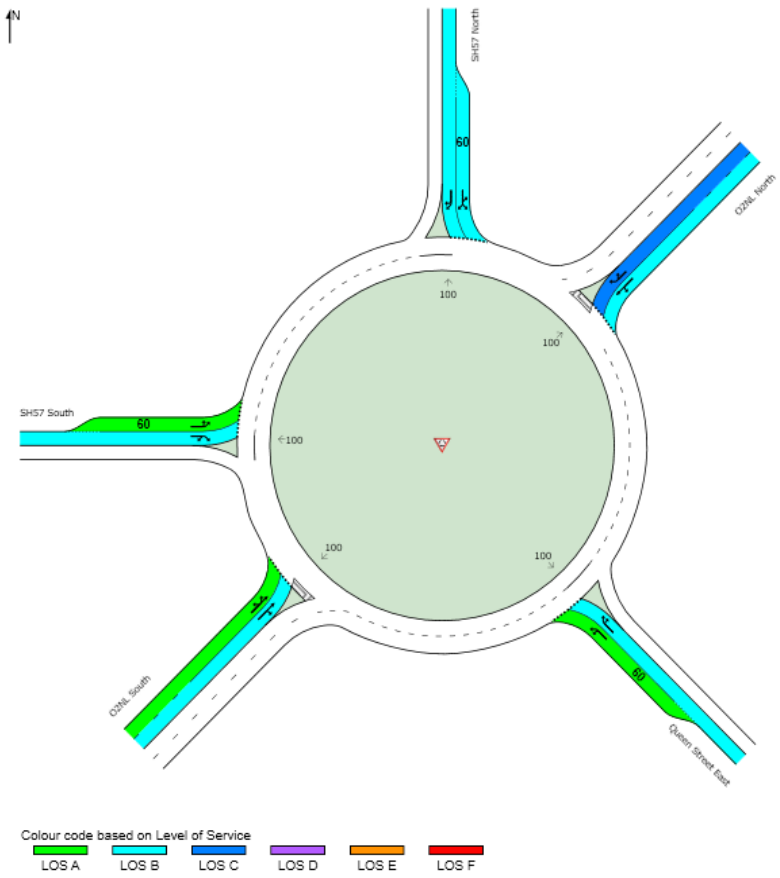
Q8: 5-arm Roundabout 2039 PM Peak

- SIDRA suggests that the 5-arm roundabout will perform at an overall LOS B, for a forecasted 2039 PM peak period.
- Avg intersection delay(s) = 20s
- Avg delay for O2NL approaches = 9-18s
- However, the roundabout is above practical capacity with a v/c of 0.9, reflected by an approximately 175m queue along SH57 approaching from the north.
- As this option removes the SH57/O2NL roundabout to the north, there are higher volumes on the SH57 leg than the O2NL north leg (as travel demand to/from PN is higher).
- This is mitigated by providing dual-lane approaches on all arms, reducing the v/c to <0.5 and SH57 queue to around 40m.

	Approaches					Intersection
	Southeast	Northeast	North	West	Southwest	
LOS	A	B	D	B	A	B



	Approaches					Intersection
	Southeast	Northeast	North	West	Southwest	
LOS	A	B	B	A	A	B

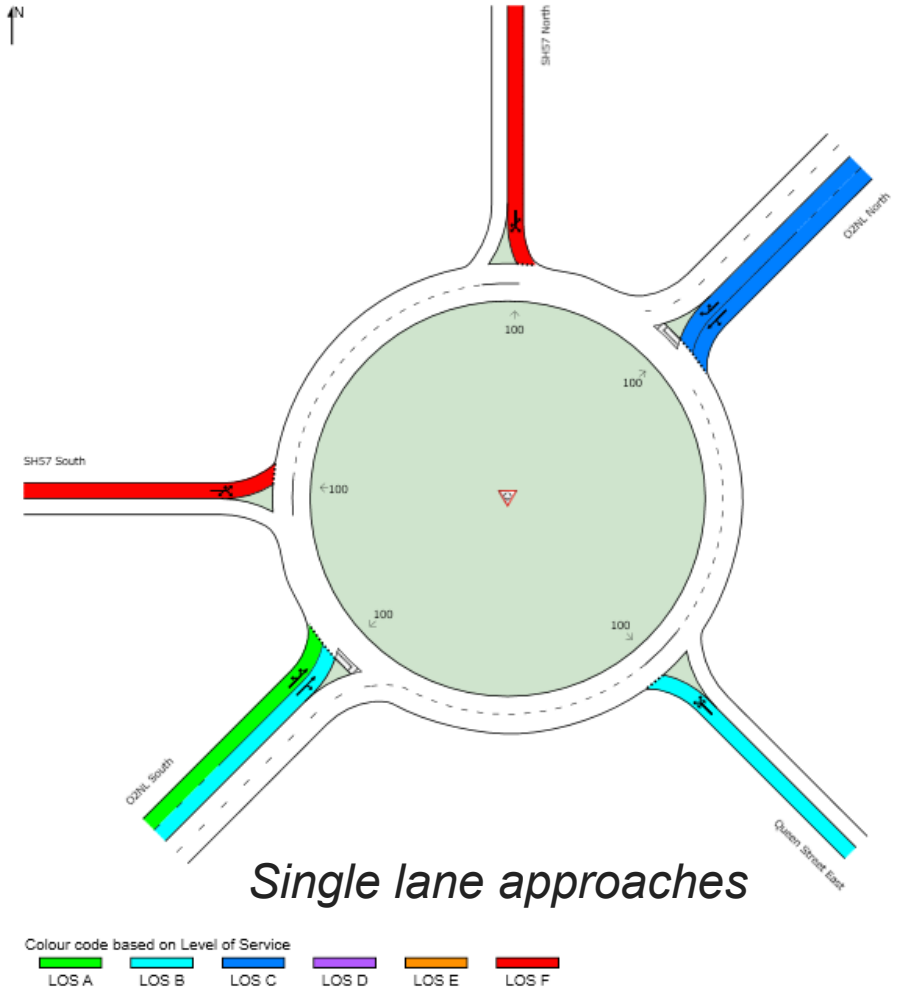


Q8: 5-arm Roundabout 2049 PM Peak

- For the 2049 PM peak period, predicted performance deteriorates to an LOS F with high delays and long queues on the SH57 approaches.
- Dual-lane approaches on all arms provide mitigation, when implemented with an additional short exit lane on SH57 northbound and three circulating lanes between the SH57 approaches.
- This results in an overall LOS B, with the average delay on Ō2NL approaches 9-13s and 95th Queue within 40m for all approaches.

	Approaches					Intersection
	Southeast	Northeast	North	West	Southwest	
LOS	B	C	F[11]	F[11]	A	F[11]

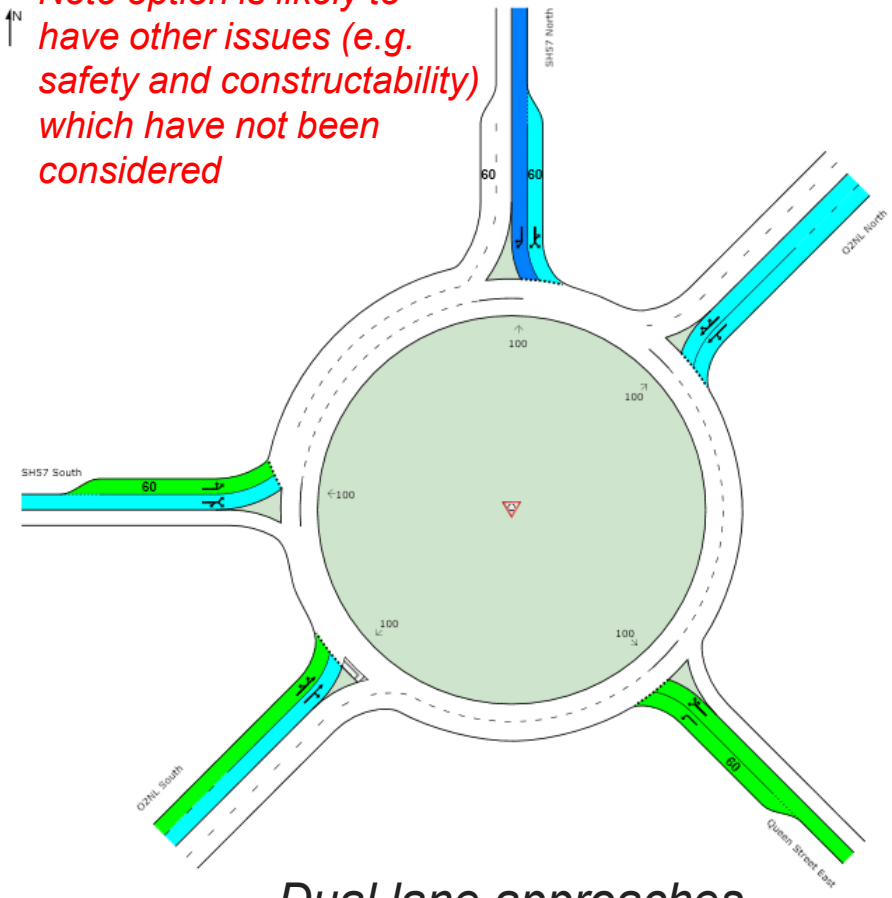
11 Level of Service is worse than the Level of Service Target specified in the Parameter Settings dialog.



Single lane approaches

	Approaches					Intersection
	Southeast	Northeast	North	West	Southwest	
LOS	A	B	B	A	A	B

Note option is likely to have other issues (e.g. safety and constructability) which have not been considered



Dual lane approaches

Colour code based on Level of Service

LOS A | LOS B | LOS C | LOS D | LOS E | LOS F

Appendix B: Changes to the Project Objectives

B.1 Project Objective Changes

The following table outlines the objectives as they have changed since the production of the IBC. How this impacts each of the assessment themes is discussed in the following section.

2018 IBC Project Objectives (draft RMA objectives)	NZUP Project Development Plan (PDP)	NZUP Establishment Report (ER)	Adopted Project Objectives May 2021	Theme for MCA Assessment
Enhance safety of travel on the state highway network	Enhance the safety of the State highway network by delivering a four lane State highway between Ōtaki and North of Levin. Deaths and serious injuries are expected to reduce by about 135 over 30 years	Enhance the safety and resilience of the state highway network. Deaths and serious injuries are expected to reduce by about 135 over 30 years	Enhance safety of travel on the state highway network.	Safety
Enhance the resilience of the state highway network	Improve the resilience of the State highway network		Enhance the resilience of the state highway network.	Resilience
Provide appropriate connections that integrate the state highway and local road network to serve urban areas.	Provide integration between the State highway network and the local road network including supporting access to multi-modal connections and Levin	Provide integration between the state highway and local road networks, including supporting access to multi-modal connections	Provide appropriate connections that integrate the state highway and local road network to serve urban areas.	Appropriate Connections
			Enables mode choice for journeys between local communities by providing a north-south cycling and walking facility.	Mode Choice
Contribute to enhanced movement of people and freight on the state highway network	Support intra and inter-regional economic growth and productivity through improved movement of people and freight Enhance efficiency and journey time reliability along the State highway network	Support inter and intra-regional growth and productivity through improved movement of people and freight Prioritise freight, public transport and vehicles carrying multiple people	Support inter and intra-regional growth and productivity through improved movement of people and freight on the state highway network.	Enhanced Movement

B.2 Impacts on Project Objective Themes

B.2.1 Safety

The safety objective has changed the least over time. This project has always had a strong focus on safety and the assessment has a focus on reducing deaths and serious injuries which is consistent with all iterations of the project objectives

B.2.2 Resilience

Resilience has also been consistent with no significant changes to how this is worded.

B.2.3 Appropriate Connections

The MCA analyses that were undertaken during the IBC phase were based on the same wording of the project objectives that are being used in the DBC now.

The NZ Upgrade Programme added elements in terms of multi-modal connectivity and walking and cycling. These aspects are very important but are not affected by the options considered in this report. Multi-modal priority and or facilities are able to be added to any of the options identified here and the walking and cycling facility is being provided regardless.

B.2.4 Mode Choice

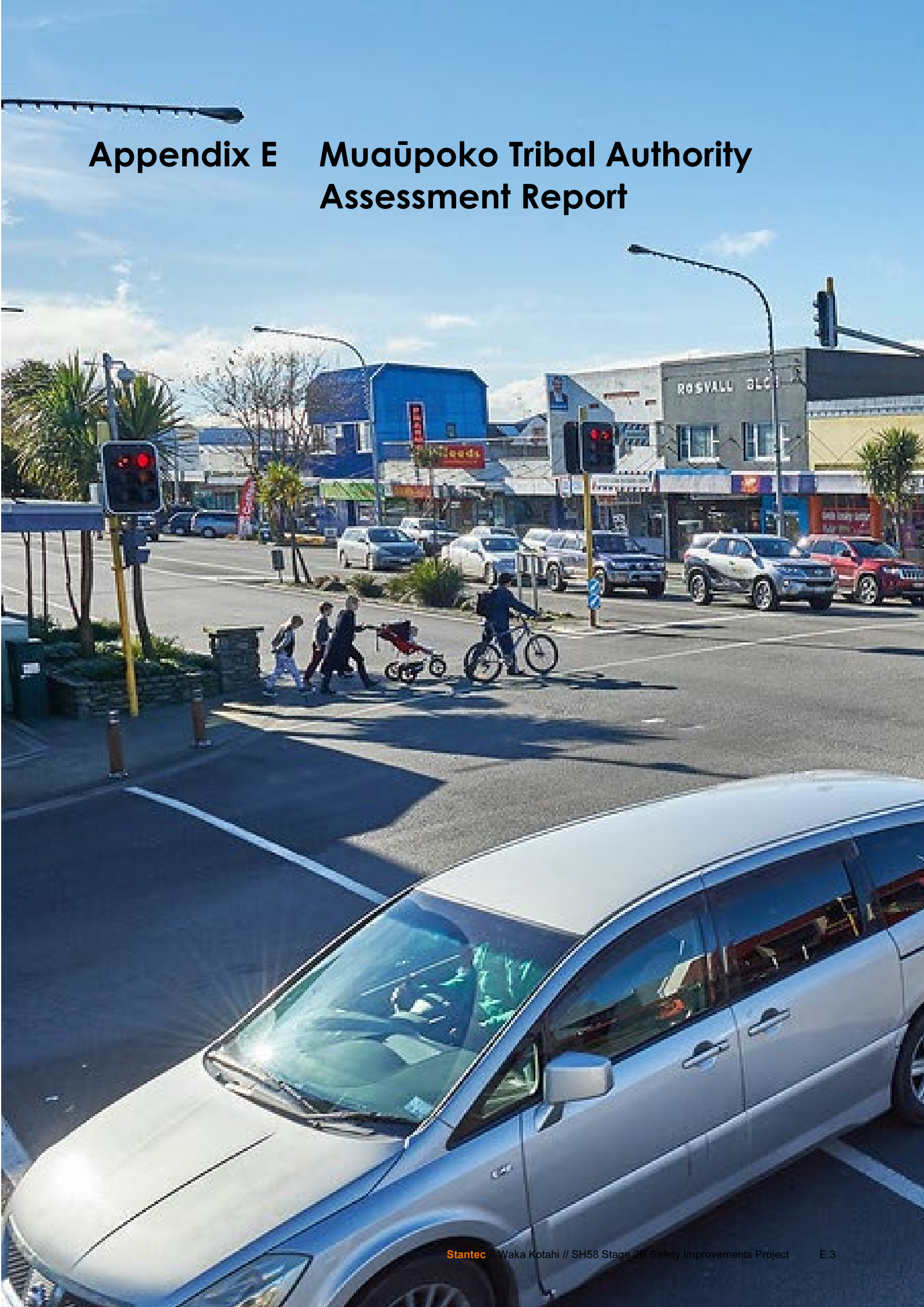
This is a relatively new objective. In the previous analysis, Mode Choice was considered under Appropriate Connections but for this assessment it was separated out to acknowledge the increased active mode presence East of Levin.

B.2.5 Enhanced Connections

The common theme with the changes in the wording is the element of “improved [or enhanced] movement of people and freight”. This is the foundation of the other element of the DBC objectives which is “support inter and intra-regional growth and productivity”. As the latter is influenced by a wide range of factors, it is considered appropriate to continue to measure the common theme which is movement of people and freight on the state highway network.

Advice from Waka Kotahi is that the additional element of “prioritise freight, public transport and vehicles carrying multiple people” was added in mistake. The intent was to ensure the project “investigate” these elements but it was not meant to be a project objective. The investigation of those elements is being reported in the DBC.

Appendix E Muaūpoko Tribal Authority Assessment Report



East of Levin Multi Criteria Analysis

ŌTAKI TO NORTH OF LEVIN HIGHWAY PROJECT

FOR WAKA KOTAHI NZ TRANSPORT AGENCY

OCTOBER 28, 2021

Lake Horowhenua and Tararua Ranges, 1875 painted by John Barr Clarke Hoyte (1835-1913)[1]

Muaūpoko Tribal Authority Inc.
ceo@muaupoko.iwi.nz
306 Oxford Street, Taitoko 5510

[1] From Auckland Art Gallery collection at:
http://collection.aucklandartgallery.govt.nz/collection/results.do%3Bjsessionid=E7F66D0CB428C46D5927E2A268E818AC?view=detail&db=object&id=7923

Summary

In September 2021, Waka Kotahi decided to undertake a multi criteria analysis (MCA) process to help further inform decision-making on the intersection designs for the new Ō2NL highway at Queen Street and Tararua Road. In addition, Waka Kotahi requested an MCA evaluation of the road grade level between Tararua Road and Queen Street is also undertaken to inform the design decision-making processes. Collectively these MCA processes are referred to as the "East of Levin MCA".

This report has been prepared to support the development of the Ō2NL Detailed Business Case, and in particular Waka Kotahi's East of Levin Intersection and Midblock Multi Criteria Analysis process.

Recommendations

- The East of Levin design selection does not include any cutting options.
- Waka Kotahi continue to work with Muaūpoko Tribal Authority to ensure effects on Muaūpoko cultural values, as a result of the East of Levin design package, are appropriately remedied and mitigated.

Contents

1 Background

Muaūpoko Tribal Authority (MTA) is the mandated iwi organisation for Muaūpoko iwi. MTA is responsible for:

- promoting and supporting Tino Rangatiratanga for Muaūpoko whānau, hapū and iwi;
- strengthening and retaining the traditional, cultural and spiritual values of Muaūpoko whānau, hapū and Iwi;
- protecting, preserving and enhancing Muaūpokotanga, assets and taonga;
- representing Muaūpoko interests and support stronger economic, educational, health, social and cultural base for Muaūpoko people.

MTA has partnered with Waka Kotahi on the Ō2NL project to ensure the project does not adversely affect Muaūpoko people, values and assets. MTA have participated in the East of Levin MCA to ensure Muaūpoko cultural values are considered in the design decision making process.

1.1 Tangata Whenua; Muaūpoko

Muaūpoko rohe (tribal area) once stretched from the northern South Island to the Rangitikei River, however most of the people are now concentrated within the Horowhenua region. The area between Punahau, Lake Horowhenua and the Tararua Ranges, within which the East of Levin MCA is focused, has never been occupied by any tribe other than Muaūpoko and the ancient people who preceded them.

The 52,000-acre Horowhenua block was created through Native Land Court processes in 1873, its included Punahau, Lake Horowhenua and the setting for Taitoko (Levin) township. This block was and still is today, Muaūpoko heartland. The proposed highway crosses what was known as block 2, 3, 6 and 10. The Muaūpoko owners of the Horowhenua blocks attempted to protect the land from alienation through the Native Land Court, but the restrictions put in place were removed and (according to the Waitangi Tribunal) proved to be ‘a worthless form of protection’. By 1900 only 4,246 acres remained in Muaūpoko ownership, and this balance was further eroded over the next few decades. Irrespective of legal ownership, Muaūpoko have maintained strong cultural, traditional and spiritual associations with all of their Horowhenua lands.

The concept of tangata whenua is key to understanding the environmental management philosophies of Māori. Tangata whenua is defined by the Resource Management Act as the customary authority exercised by an iwi or hapū in an identified area. It is the authority to control and manage a traditional area or resource in relation to prescribed customary, cultural and spiritual practices. The authority is obtained through the relationship of the people and their ancestral connection to the land. Muaūpoko have maintained their position as tangata whenua

within the Horowhenua block for over 1000 years and within blocks 2, 3,6 and 10 there are no overlapping interests from any other iwi or hapū.[23]

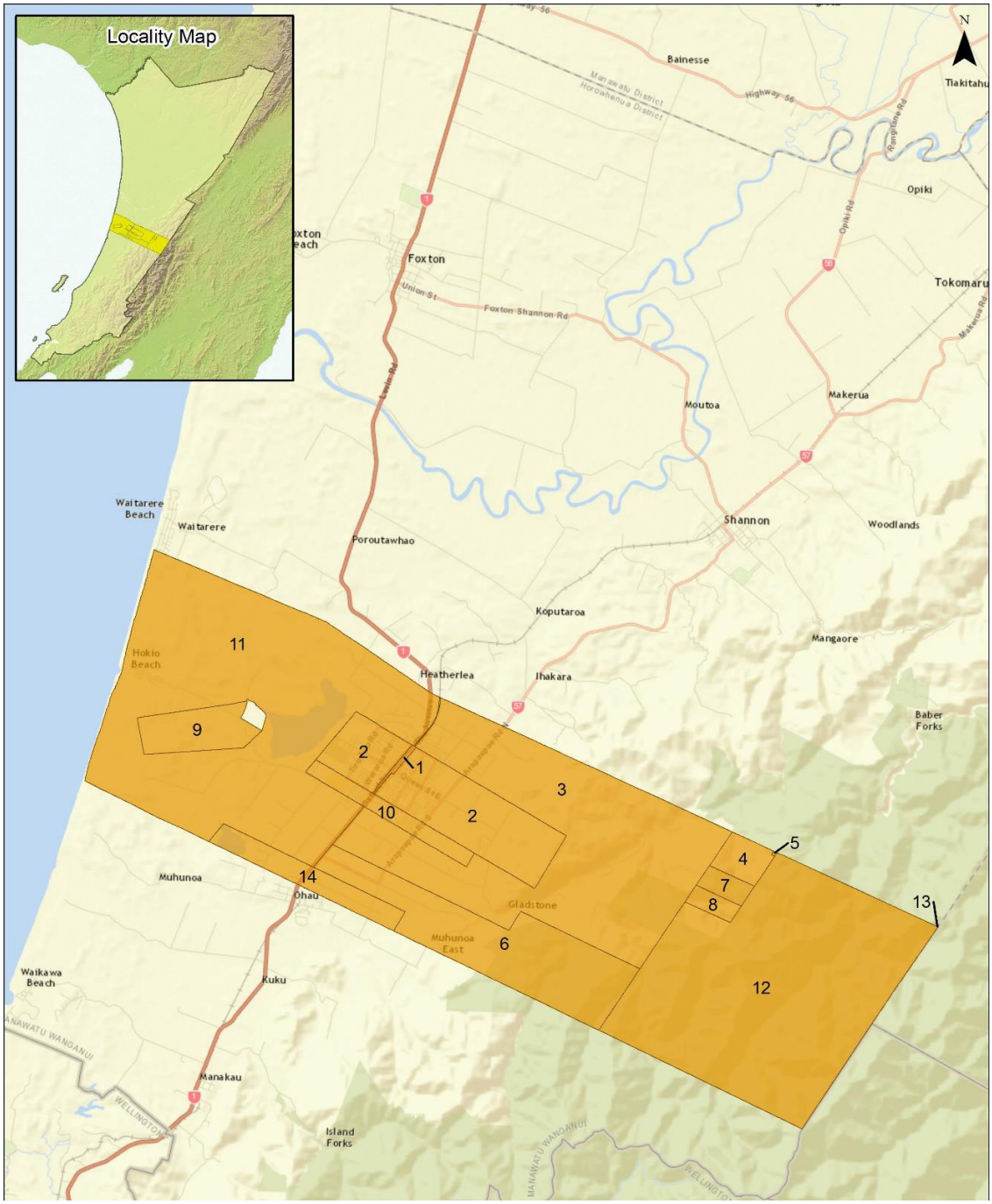


Figure 1: Subdivision of the Horowhenua Block in 1873

[2] Louis Chase (2015). *Muaūpoko Oral Evidnece and Traditional History Report.* WAI 2200 Porirua ki Manawatū District Inquiry. Commissioned by the Waitangi Tribunal: New Zealand.

[3] D.A., Armstrong (2021). *Muaūpoko Origins, Rohe, Customary Interests and Sites of Significance*. History Works: New Zealand.

1.2 Punahau, Lake Horowhenua

Lake Horowhenua was traditionally known to Muaūpoko as Punahau (or Waipunahau), loosely translated as 'the spring of vitality". The name highlights the abundant life supporting capacity of the lake. Punahau was shrouded with dense forest of pukatea, kahikatea, and rata on the lake margin; huge wetland areas with a plentiful supply of kākahi (freshwater mussels), īnanga (whitebait), pātiki (flounder) and tuna (eels). Native birds such as the kererū were found in their thousands[4]. These species were main components of Muaūpoko diets. From the lake inland to the Tararua Range stood rangatira (chiefs of the forest) of nikau, tōtara, karaka, mātai, and rimu, among other taonga, which provided food, shelter and other necessities for survival.

Drawing on historical records and interviewees' living memories, Forbes describes the past 150 years of changes to the lake and wider environment as 'rapid and overwhelming'. Those of the latter recounted vibrant stories of teeming fish stocks and stunning natural scenery now tinged with pain, sadness and loss because of these rapid changes. Many of those Muaūpoko spoke of their roles as kaitiaki of the land, rivers and streams, lakes and the coastline[5]. Adkin provided some useful commentaries, much of which is recounted from McDonald, noting how the heavily forested hinterland was replaced by railway and roads, as was the forested inner plain and foothills with farms. The destruction of the forest cover altered river courses and wetland functions, which were once able to control heavy rainfall discharges from the mountains. Floodwaters became swift and destructive, eroding the rich alluvial flatlands.[6]

Horowhenua means landslide in te reo Māori and is now the name used for Punahau. "Horowhenua" traditionally being used by Māori to describe the gravel fan that starts in the Tararua Ranges and culminates at the lake. Muaūpoko understand through their mātauranga that Horowhenua linked the Tararua ranges with Punahau, that the gravels contain the headwaters or lifeblood of Punahau, and the land upon which the highway project traverses is extremely interconnected with the lake.

The gravel fan is referred to as Q2a gravels and is depicted in Figure 3. The gravels are highly porous and absorb the majority of rainwater within the landscape. It is only in particularly heavy rainfall events that surface-runoff channels form. As a result, groundwater levels are highly dynamic across the landscape and freshwater springs, known as puna, are common.

[4] O'Donnell, E, with McDonald J, Te Hekenga, p.25.

[5] Forbes, S. (1996). *Te Waipunahau – Archaeological Survey*, (Prepared for the Horowhenua Lake Trustees).

[6] Adkin, Horowhenua, pp.5-6.

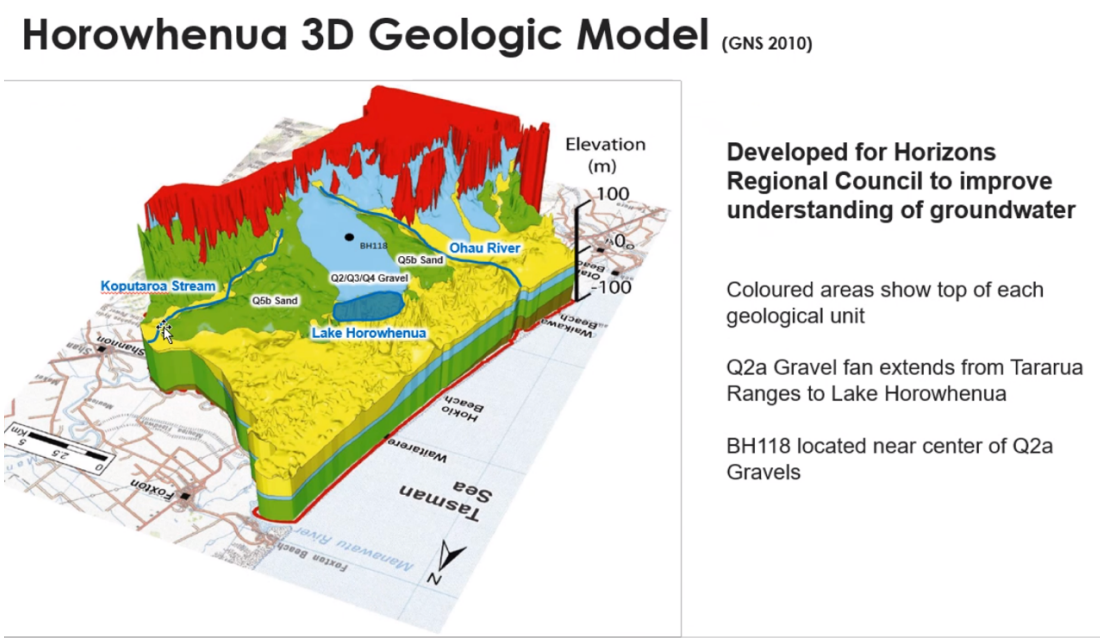


Figure 1: Punahau, Lake Horowhenua is fed by an aquifer connecting the Tararua Ranges to the lake[7]

Although direct sewage discharge to Punahau ceased in 1987, today large amounts of nutrients, sediment from farming and horticulture, industrial and urban stormwater contamination from the Taitoko township and industry continues. The lake in the summer period is regularly closed due to the presence of cyanobacteria, caused by introduced contaminants adding to accumulated discharge elements already present.

Pollution and destruction of forest cover has not only affected the landscape and wai (water) but also the people. When reminiscing about traditional mahinga kai from the land, lakes and streams, Muaūpoko are clear that the current degradation is a culmination of Crown failures to protect Muaūpoko assets and interests. Many Muaūpoko speak about how their spiritual connection and their ability to sustain themselves physically from the whenua, lakes and streams has suffered immensely since European colonisation.

2 Methodology

MTA have undertaken three MCA's including:

1) Queen Street intersection;

2) Tararua Road intersection; and

[7] Lake Horowhenua and Hokio Stream Catchment Management Strategy, Manawatu-Wanganui Regional Council, 1998.p.9.

3) The grade/level of the road between Queen Street and Tararua Road intersections.

Sources of information relied on to describe the options include:

a) Drawings 310203848-01-001-SK1000 through to 310203848-01-001-SK1015 (revision A);

b) Option presentations delivered by Waka Kotahi.

The following people were involved in the three MCA assessments:

- Di Rump (Muaūpoko)– MTA CEO
- Rob Warrington (Muaūpoko) – MTA independent advisor
- Professor Jon Proctor (Muaūpoko) – MTA independent advisor
- Dean Wilson (Muaūpoko) – MTA kaitiaki
- Siobhan Karaitiana – MTA Kaupapa Taiao Specialist
- Tom Bennion – MTA legal advisor
- Fraser Fleming – MTA Facilitator

2.1 Objective and Principles

The objective of MTA throughout the MCA process is:

- **Whāia te tika me te pono o Muaūpoko**…*To follow Muaūpoko lore*

This means MTA must:

- **Tiakina te mana o te wai**…*Protect the spiritual and cultural qualities of water*
- **Tiakina ngā tohu whenua me te wairuatanga**…*Protect the spiritual and cultural features within the landscape*

The following project principles found within the draft CEDF[8] were also considered throughout the MCA, particularly within the conclusions and recommendations:

Tread Lightly, with the whenua

- **Me Tangata te whenua***…treat the land as a person*
- **Kia Māori te whenua**…l*et it be its natural self*

[8] Ōtaki to North of Levin Cultural and Environmental Design Framework ('CEDF') Preliminary draft, 17th September 2021.

- **Kia Māori te Whakaaro**…*normalise Māori values*
- **Me noho Tangata whenua ngā mātāpono**…*embed the principles in all things*
- **Tū ai te Tangata, Tū ai te whenua, Tū ai te Wai…***elevate the status of the people, land and water*

Figure 2: The project principles focus the East of Levin design on a solution that preserves, restores, enhances and creates.

2.2 Muaūpoko Criteria

MTA designed the following assessment criteria against the objectives and principles described in section 2.1:

1) **Papatūānuku me tōna toto…** ***earthworks and groundwater dynamics***

Muaūpoko worldview is based on the holistic principle that all elements are interrelated. Every part of the environment understood to have a common genealogy, descending from a common ancestor. The principal ancestors being Io matua te kore (Io the Parentless), Ranginui and Papatūānuku (Sky Father and Earth Mother) and their atua tamariki (Including Tāne Mahuta of the Forest, Tangaroa of the Moana, Haumia-tiketike of Cultivated Foods, and Rongomātāne of wild foods). Papatūānuku is Earth mother and wife of Ranginui, from whom all living things originate and are sustained. Toto in this context is referred to as the lifeblood of Papatūānuku and is associated with the presence and movement of water through the Horowhenua (groundwater).

Options that minimise effects on Papatūānuku me tōna toto are favoured, while options that involve significant cutting into the earth and disruption of natural groundwater dynamics are unacceptable.

2) **Te mana o ngā awa…** ***the mauri (lifeforce) of surface waters***

Te Mana o te Wai is a concept that has emerged in the National Policy Statement for Freshwater. Te Mana o te Wai encompasses 6 key principles relating to the role of tangata whenua that include:

(a) Mana Whakahaere: the power, authority, and obligations of tangata whenua to make decisions that maintain, protect, and sustain the health and well-being of, and their relationship with, freshwater

(b) Kaitiakitanga: the obligation of tangata whenua to preserve, restore, enhance, and sustainably use freshwater for the benefit of present and future generations

(c) Manaakitanga: the process by which tangata whenua show respect, generosity, and care for freshwater and for others

(d) Governance: the responsibility of those with authority for making decisions about freshwater to do so in a way that prioritises the health and well-being of freshwater now and into the future

(e) Stewardship: the obligation of all New Zealanders to manage freshwater in a way that ensures it sustains present and future generations, and

(f) Care and respect: the responsibility of all New Zealanders to care for freshwater in providing for the health of the nation.

Te Mana o te Wai also has a hierarchy of obligations that prioritises:

(a) First, the health and well-being of water bodies and freshwater ecosystems

(b) Second, the health needs of people (such as drinking water)

(c) Third, the ability of people and communities to provide for their social, economic, and cultural well-being, now and in the future.

Surface water run-off from the wider Horowhenua landscape occurs roughly in a 1 in 10year event. These events are culturally significant and are traditionally a celebration of renewal. Incoming winter floods wash away any build-up of paru, create habitat for taonga to regenerate and connect the mauri of different aspects of the environment.

The health and wellbeing of this water must be protected as it travels through the East of Levin corridor. Options that gently guide the life-giving floodwaters through the 02NL corridor and minimise disruption of natural pathways are favoured, while options that require extensive engineering and divert floodwaters away from their natural pathways are unacceptable.

3) Taonga…*The role of taonga species as kaitiaki in the landscape*

Taonga are tangible and intangible components of Muaūpoko identity. Taonga are anything that is of value or treasured including places, people, language, objects, flora and fauna that must be cherished, protected and enhanced. The East of Levin design has the potential to impact taonga species, in particular the Ornate Skink (*ligosoma ornatum*, At Risk – Declining) found within the two bush remnants adjacent to Queen St East and Arapaepae Road. Mokomoko (lizards/skinks) are seen by Muaūpoko as an omen or as kaitiaki (guardians). In this location they watch over Muaūpoko spiritual pathway (described further in criteria 4).

The ngata (native carnivorous landsnail) *powelliphanta traversii traversii* is also associated with this spiritual pathway and can be found in high abundance within the Waiopehu Reserve, east of the 02NL corridor. It is a nationally endangered species, an absolute taonga for Muaūpoko. Muaūpoko have records of several different ngata species within the Queen St/Arapaepaea Bush remnants and wider landscape. They have not been recorded by ecologists through the 02NL project, however are recognised as potentially present in low numbers.

4) Ngā ara wairua…interactions with spiritual pathways and connections

Arapaepae (which can be interpreted as “the track across”) was a trail that crossed the Arapaepae Ridge within the Tararua Ranges. This trail lead from Lake Horowhenua, up through Queen St East and out to the Tararua Ranges was used by Muaupoko bird-snaring parties and those gathering mahinga kai (food and resources) and rongoa (medicines). This trail is said to have been first marked out by the Muaūpoko ancestor Haere-Tu-Te-Rangi.[9] It is a highly valued spiritual pathway, a pathway that Muaūpoko spirits traverse to depart into the afterlife. An intermittent stream known to Muaūpoko as Wai Marie (‘the waters of peace’) was also connected to this pathway, it begun at Maunu Wahine (a wāhi tapu/place for women and children spiritual respite and wānanga located just west of Waiopehu Reserve) and flowed along what is now Queen Street East.[10]

2.3 Scoring

MTA have used the scoring descriptions found in Table 1 to score the four cultural criteria described in section 2.2. Where options include an attribute score of an F, we have not continued to score these options and the final score is simply an F. In all other situations, the final score is a weighted average of each of the four cultural criteria scores.

[9] G. Adkin. *Horowhenua: its Maori Place-names and their Topographic and Historical Background*. 1948. 139: J. Proctor. *Summary to Accompany Sites of Significance Map Book.* November, 2015. Wai 2200 #A183a.

[10] G. Adkin. *Horowhenua: its Maori Place-names and their Topographic and Historical Background*. 1948. 395.

Table 1: Approach to MCA scoring provided by Waka Kotahi.

Score	Description
1	The option presents few difficulties on the basis of the criterion being evaluated and may provide significant benefits in terms of the attribute
2	The option presents only minor aspects of difficulty on the basis of the criterion being evaluated, and may provide some benefits in terms of the criterion
3	The option presents some aspects of reasonable difficulty in terms of the criterion being evaluated and problems cannot be completely avoided. There are few apparent benefits in terms of the criterion
4	The option includes clear aspects of difficulty in terms of the criterion being evaluated, and very limited perceived benefits
5	The option includes significant difficulties or problems in terms of the criterion being evaluated and no apparent benefits
F	The option will result in completely unacceptable adverse effects that cannot be appropriately avoided, remedied or mitigated (including offsetting)

3 Results

Muaūpoko have participated in early highway alignment selection exercises. The final alignment chosen in partnership with Muaūpoko avoids a wide range of cultural sites, features and landscapes. Muaūpoko understand as a result of this process that there is a functional need for the highway to exist in the East of Levin location, however do not accept there is a functional need for a cutting. While cultural effects (cutting into the earth and perturbation of local water soakage) exist as a result of at grade road construction and operation, these effects are seen to be reasonable, with the ability to be remedied and mitigated. Thus, any at grade options are scored a 1 for the criteria “Papatūānuku me tōna toto” on the basis that the options presents few difficulties for Muaūpoko in this context. Above grade options score more poorly due to the need for extensive piling, while cutting options score an F.

3.1 Queen Street East Intersection

Options Q0, Q1 and Q2 were scored an F because they will result in effects that are completely unacceptable to Muaūpoko. Cutting into the Horowhenua gravels will introduce an adverse effect on the Horowhenua landscape/Papatūānuku me tōna toto that cannot be appropriately avoided, remedied or mitigated because:

1) The cultural value of the Horowhenua landscape/Papatūānuku me tōna toto is extremely high;

2) There will be a very major alteration to the Horowhenua/Papatūānuku due to interactions between the purpose, size, depth, and position of the cutting in the landscape such that the post-development character will be detrimentally and fundamentally changed;

3) The nature and extent of disruption to natural groundwater dynamics (both local and wider landscape scale), landscape drying and the impact on Lake Horowhenua is unquantified, yet expected to be high and therefore inappropriate;

4) The risk associated with the cutting, both working below maximum groundwater level and the unquantified nature of effects, is unreasonably high.

Option Q3: Construction works in close proximity have potential to impact the role of Mokomoko and ngata as kaitiaki, mitigations expected include ecological protection, enhancement and monitoring. A walking/cycling bridge with a lookout and development of mahi toi (Māori artworks) is considered a good opportunity to connect with ngā ara wairua.

Options Q4 and Q5: Muaūpoko must be able to physically connect with their ara wairua, if Queen St East is closed then a walking/cycling bridge must be provided. The closure of Queen Street East and cul-de-sac design is considered a good opportunity for connections with ara wairua and development of mahi toi. The options have a greater opportunity to protect and enhance the role of kaitiaki in the landscape by drawing roadways and traffic away from the area.

Options Q6 and Q7: Q7 is preferred to minimise impacts on ngā ara wairua. Noise and vibration will significantly impact the role of kaitiaki during construction for both options- mitigations expected include ecological protection, enhancement and monitoring.

Option Q8: Option has greater opportunity to enhance the role of kaitiaki. Walking/cycle way provides opportunity to connect with ngā ara wairua. This option has a marginally greater impact on surface water quality as a result of building new local roads.

Table 2: Queen Street East Intersection MCA scores.

		Criteria				
Option	**Description**	**1- Papa**	**2- Awa**	**3- Taonga**	**4- Ara wairua**	**Overall**
Q0	New highway goes beneath - Queen Street remains close to existing grade	F	-	-	-	**F**
Q1	New highway partially submerged at Queen Street - Queen Street reconnected via overbridge - 'half and half' option with highway partially submerged and local road partially raised	F	-	-	-	**F**
Q2	New highway partially raised at Queen Street - Queen Street reconnected via underpass - 'half and half' option with Queen Street partially submerged and new highway partially raised	F	-	-	-	**F**
Q3	New highway at or close to grade - New roundabout provided - new walking and cycling bridge required	1	1	4	2	**2**
Q4	New highway at or close to grade - new connection at Liverpool Street - Liverpool Street on bridge over new highway - new roundabout on Arapaepae Road	1	1	1	5	**2**
Q5	New highway at or close to grade - Queen Street closed in current location, but walking and cycling bridge provided - Queen Street realigned further north via overbridge - new roundabout onto Arapaepae Road	1	1	1	1	**1**

Q6	Queen Street remains at grade - new highway on bridge over Queen Street	1	1	5	5	**3**
Q7	New highway at or close to grade - Queen Street on bridge over new highway	1	1	4	4	**2.5**
Q8	New highway at or close to grade at Queen Street - Queen Street closed to traffic and relocated northwards - new 5 arm at grade roundabout linking SH1 and SH57	1	2	1	2	**1.75**

3.2 Tararua Road Intersection

Options T0, T1 and T2 were scored an F because they will result in effects that are completely unacceptable to Muaūpoko. Cutting into the Horowhenua gravels will introduce an adverse effect on the Horowhenua landscape/Papatūānuku me tōna toto that cannot be appropriately avoided, remedied or mitigated because:

1) The cultural value of the Horowhenua landscape/Papatūānuku me tōna toto is extremely high;

2) There will be a very major alteration to the Horowhenua/Papatūānuku due to interactions between the purpose, size, depth, and position of the cutting in the landscape such that the post-development character will be detrimentally and fundamentally changed;

3) The nature and extent of disruption to natural groundwater dynamics (both local and wider landscape scale), landscape drying and the impact on Lake Horowhenua is unquantified, yet expected to be very high and therefore inappropriate;

4) The risk associated with the cutting, including the unquantified nature of effects, is unreasonably high.

Option T3: This option does not impact kaitiaki within the landscape. The route interacts with Waiporoporo track and connections between Tararua Ranges and Te Moana o Raukawakawa. Mitigation expected include mahi toi and lookout development.

Options T6 and T7: Options impact connections between Tararua Ranges and Te Moana o Raukawakawa to a greater degree than T3. Muaūpoko prefer the elevation of Tararua Road over the highway allowing Muaūpoko better access to mountain and moana views. Scores reflect the invasiveness of piling on Papatūānuku me tōna toto.

Table 3: Tararua Road MCA scores.

		Criteria				
Option	**Description**	**1- Papa**	**2- Awa**	**3- Taonga**	**4- Ara wairua**	**Overall**
T0	New highway goes beneath Tararua Road - Tararua Road and new roundabouts remain close to existing grade	F	-	-	-	**F**
T1	New highway partially submerged at Tararua Road - 'half and half' option with highway partially submerged and local road partially raised - maximum depth of excavation limited to a few metres to avoid maximum GW level	F	-	-	-	**F**
T2	New highway travels over the top of the local road - 'half and half' option with local road partially submerged and highway partially raised - maximum depth of excavation limited to a few metres to avoid maximum GW level	F	-	-	-	**F**
T3	New highway at or close to grade - new roundabout provided - new walking and cycling bridge required	1	1	1	2	**1.25**
T6	Tararua Road remains at grade - new roundabouts also at grade - new highway on bridge over Tararua Road (7-8m above ground level)	4	1	1	5	**2.75**
T7	New highway is at grade - interchange ramps and local road / new roundabouts all raised - new local road bridge over highway 7-8m above ground level	4	1	1	4	**2.5**

3.3 Mid-block

Mid-block below ground cutting scored an F because it will result in effects that are completely unacceptable to Muaūpoko. While cultural effects (cutting into the earth and perturbation of local water soakage) exist as a result of at grade road construction and operation, these effects are seen to be reasonable, with the ability to be remedied and mitigated. Thus, at grade options are scored a 1 for the criteria "Papatūānuku me tōna toto" on the basis that the options presents few difficulties for Muaūpoko in this context, water can be managed in a way that supports mauri. There are no effects on Muaūpoko ara wairua and taonga.

	Criteria				
Description	**1- Papa**	**Awa**	**Taonga**	**Ara wairua**	**Overall**
Ground Level	1	1	1	1	1
Below Ground	F	-	-	-	F

4 Conclusions

- The Horowhenua landscape and groundwater dynamics (Papatūānuku me tōna toto) are connected to the mana of Punahau and Muaūpoko. Cutting Papatūānuku will have effects on this connectivity that are unacceptable to Muaūpoko.
- Options that close Queen St while maintaining active transport modes are more favored. These options maintain Muaūpoko cultural and spiritual connections with their ancient pathways and taonga species, including their ancestors who have stood on and in the landscape for centuries.
- Elevated options that run east-west (rather than north-south) are more in harmony with the visual and spiritual connections and pathways of critical importance to Muaūpoko. Options which cut across north to south amplify cultural disconnection.

Disclaimer

We have used various sources of information to write this report. Where possible, we tried to make sure that all third-party information was accurate. However, it's not possible to audit all external reports, websites, people, or organisations. If the information we used turns out to be wrong, we can't accept any responsibility or liability for that. If further information becomes available after we wrote our report that would have altered its conclusions, we may update our report. However, we are not required to do so.

Prepared by:

Siobhan Karaitiana
Kaupapa Taiao Specialist

BSc (Honours) Ecology

VERSION	DATE	AUTHOR	REVIEWER	COMMENTS
1	26/10/21	SK	Di Rump	Approved
2	27/10/21	SK	Jon Procter	Approved
3				
4				

Appendix F Ecology Assessment Report

17 November 2021
By E-mail

Forbes Ecology
Dr. Adam Forbes
PO Box 8740
Havelock North (4157)
Hastings
New Zealand

Stantec
Stantec Building
Level 15, 10
Brandon Street
Wellington
New Zealand 6011

Attn: Selwyn Blackmore

Dear Selwyn,

Re: O2NL October 2021 MCA – Queen Street and Tararua Road

This Ecology report has been prepared to support the development of the Ō2NL Detailed Business Case, and in particular Waka Kotahi's *East of Levin Intersection and Midblock Multi Criteria Analysis* process.

In September 2021, Waka Kotahi decided to undertake a multi criteria analysis (MCA) process to help further inform its decision-making on the intersection designs for the new Ō2NL highway at Queen Street and Tararua Road. In addition, Waka Kotahi requested an MCA evaluation of the road grade level between Tararua Road and Queen Street be also undertaken to inform its design decision-making processes. Collectively these MCA processes are referred to as the "East of Levin MCA".

MCA Scoring Method

Constraint score descriptions were aligned using professional judgement with EIANZ (2018)[1] Tables 4, 5 & 6 descriptors of ecosystem and species value and with One Plan freshwater and terrestrial ecosystem/habitat descriptors (One Plan Schedules B & F). This approach integrates the project's MCA constraints system with national best practice impact assessment methods and regional statutory benchmarks for identification of significant ecological features.

The aligned criteria were used to rank terrestrial and freshwater/wetlands constraints and from this the MCA scores were derived.

[1] See the EIANZ (2018) guidelines here: https://www.eianz.org/document/item/4447

Table 1. Ecological constraint categories and thresholds adopted for the assessment.

Constraint score	Constraint score description	Ecological attributes		One Plan Schedule B	One Plan Schedule F
		Ecosystems	Species	• Site of Significance – Aquatic (SOS–A) • SOS – Riparian (SOS–R) • Natural State (NS)	• Threatened or At-Risk habitat type (Threatened or At-Risk)
Fatal flaw	Option not supportable	Values present are beyond the limits of biodiversity offsetting meaning that the option should not proceed on ecological ground alone			
5	The option includes significant difficulties or problems in terms of the criterion being evaluated and no apparent benefits.	Area rates High for 3 or all of the four assessment matters listed in Table 4	Nationally Threatened species, found in ZOI either permanently or seasonally	SOS–A, R, or NS	Threatened or At-Risk
4	The option includes clear aspects of difficulty in terms of the criterion being evaluated, and very limited perceived benefits.	Area rates High for 2 of the assessment matters, Moderate and Low for the remainder, or area rates High for 1 of the assessment matters, Moderate for the remainder. Likely to be regionally important and recognised as such	Species listed as At Risk–Declining, found in the ZOI, either permanently or seasonally	SOS–A, R, or NS	Threatened or At-Risk
3	The option presents some aspects of reasonable difficulty in terms of the criterion being evaluated and problems cannot be completely avoided. There are few apparent benefits in terms of the criterion.	Area rates High for one matter, Moderate and Low for the remainder, or Area rates Moderate for 2 or more assessment matters Low or Very Low for the remainder Likely to be important at the level of the Ecological District	Species listed as any other category or At Risk, found in the ZOI either permanently or seasonally	SOS–A, R, or NS	Threatened or At-Risk
2	The option presents only minor aspects of difficulty on the basis of the criterion being evaluated, and may provide some benefits in terms of the criterion.	Area rates Low or Very Low for Majority of assessment matters and Moderate for one. Limited ecological value other than as local habitat for tolerant native species	Locally (ED) uncommon or distinctive species	Not Schedule B	Not Schedule F

1	The option presents few difficulties on the basis of the criterion being evaluated and may provide significant benefits in terms of the attribute.	Area rates Very Low for 3 matters and Moderated, Low of Very Low for remainder	Nationally and locally common indigenous species	Not Schedule B	Not Schedule F

MCA Recommentations

Comments on options are as follows.

- Q0 – Uncertainty over groundwater effects to bush blocks. Uncertainty over overland flow management. Uncertainty over stormwater management effects. Terrestrial score = F. Freshwater/wetland = 5.

- Q1 – Uncertainty over groundwater effects to bush blocks. Uncertainty over overland flow management. Uncertainty over stormwater management effects. Uncertainty over watertight structure. Terrestrial score = F. Freshwater/wetland = 5.

- Q2 – Uncertainty over groundwater effects to bush blocks. Uncertainty over overland flow management. Uncertainty over stormwater management effects. Uncertainty over watertight structure. Terrestrial score = F. Freshwater/wetland = 5.

- Q3 – Only minor aspects of difficulty to terrestrial and freshwater/wetland ecology. Terrestrial score = 2. Freshwater/wetland = 2.

- Q4 – No constraints. The option presents few difficulties to terrestrial and freshwater/wetland ecology. Terrestrial score = 1. Freshwater/wetland = 1.

- Q5 – No constraints. The option presents few difficulties to terrestrial and freshwater/wetland ecology. Terrestrial score = 1. Freshwater/wetland = 1.

- Q6 – Works in proximity to bush blocks. Only minor difficulty. Terrestrial score = 2. Freshwater/wetland = 2.

- Q7 – Works in proximity to bush blocks. Only minor difficulty. Terrestrial score = 2. Freshwater/wetland = 2.

- Q8 & Q8-1 – No constraints. The option presents few difficulties to terrestrial and freshwater/wetland ecology. Terrestrial score = 1. Freshwater/wetland = 1.

- Mid Block Above grade – No constraints. The option presents few difficulties to terrestrial and freshwater/wetland ecology. Terrestrial score = 1. Freshwater/wetland = 1.

- Mid block below grade – Uncertainty over groundwater effects to bush blocks. Uncertainty over overland flow management. Uncertainty over stormwater management effects. Terrestrial score = F. Freshwater/wetland = 5.

- Tararua options presented few difficulties due to the denuded, cultivated, and dry nature of the landscape at that location.

Numerical constraints scoring is as follows:

Option		MCA 1 Queen		MCA 2 Tararua	
		T	FW & W	T	FW & W
Fully submerged	Fully below grade (Q/T 0)	F	5	1	1
Partially submerged	Expressway partially below grade (Q/T 1)	F	5	1	1
	Local road partially below grade (Q/T 2)	F	5	1	1
At grade options	At grade: roundabout (Q/T 3)	2	2	1	1
	At grade: Close Queen, upgrade Liverpool (Q 4)	1	1		
	At grade: Queen diverted north (Q 5)	1	1		
	At grade: 5-arm, shift SH57 connection South (Q 8)	1	1		
	At grade: 5-arm round about (Q 8-1)	1	1		
Standard bridge options	Expressway over top (Q/T 6)	2	2	1	1
	Local road over top (Q/T 7)	2	2	1	1
Mid block AG		1	1		
Mid block BG		F	5		

Specific Comments on Recommended Fatal Flaws.

Fatal flaws are recommended in relation to fully submerged and partially submerged options for MCA1 in the location of Queen Street where two signficant bush remnants exist. Also for the below ground Mid Block option which is also in proximity to these bush remnants.

These options present potential for significant interuption of groundwater hydrology. The nature and extent of this potential interuption in hydrology is uncertain and remains unquantifyed. Even less certain is the effect that any change in hydrology would have on native forests in this area.

Given the likely ecological values, level of uncertainty and potential ecological consequence fatal flaws are recommended for four options as outlined above.

Closing

I trust this information is useful, please feel free to contact me for further advice.

Yours Sincerely,

Dr Adam Forbes
Principal Ecologist
Forbes Ecology Limited

Appendix G Landscape / Visual Assessment Report

Isthmus.

ŌTAKI TO NORTH OF LEVIN DETAIL BUSINESS CASE

MULTI CRITERIA ANALYSIS: EAST OF LEVIN OPTIONS

LANDSCAPE + VISUAL + URBAN DESIGN

Client:	Stantec on behalf of Waka Kotahi
Project:	Ōtaki to North of Levin (O2NL) Detailed Business Case (DBC)
Code:	2923
Report:	MCA East of Levin Options
	Landscape, Visual, Urban Design
Status:	Final
Date:	18 October 2021
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No.	Date	Details	Author	QA
1	18/10/2021	Final	Gavin Lister	Lisa Rimmer

1 EAST OF LEVIN OPTIONS

Introduction

1.1 This report has been prepared to support the development of the Ō2NL Detailed Business Case, specifically the East of Levin Multi Criteria Analysis (MCA) process.

1.2 The MCA process was undertaken to help further inform Waka Kotahi's decision-making on the intersection designs for the new Ō2NL highway at Queen Street and Tararua Road, including consideration of an alternative crossing on the Liverpool Street alignment. In addition, Waka Kotahi requested an MCA evaluation of the road grade level between Tararua Road and Queen Street

1.3 This report explains landscape, visual, and urban design input to the MCA process.

Background

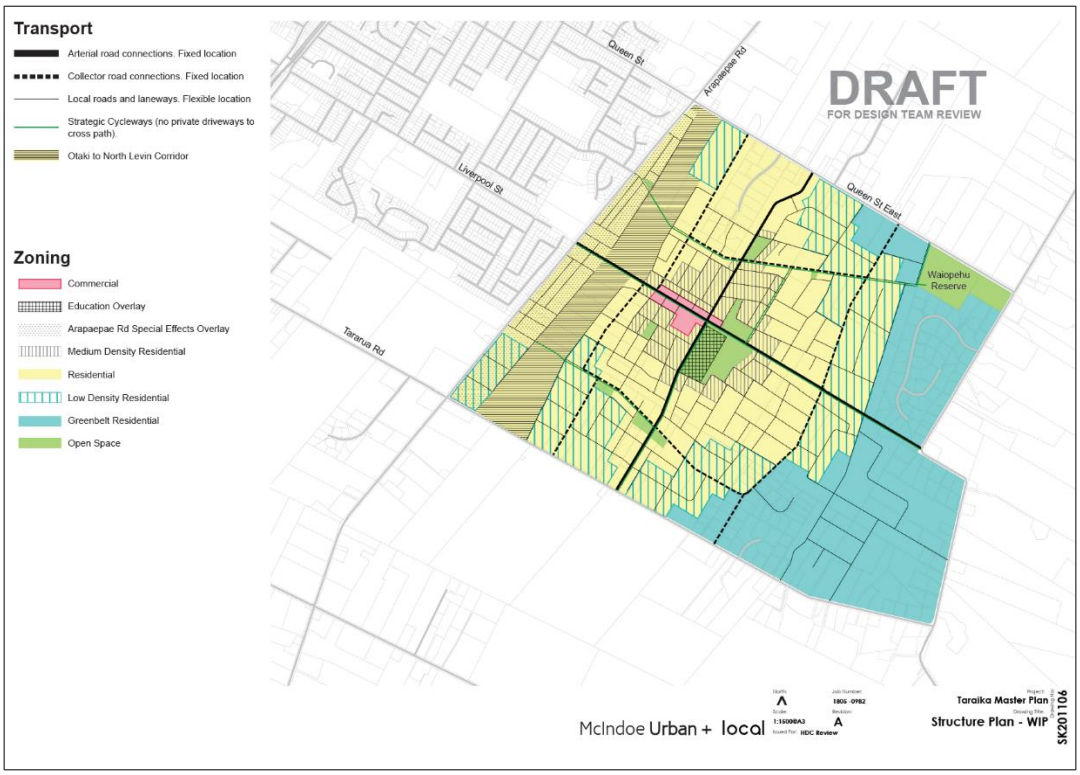
1.4 A preferred eastern route through Horowhenua, passing to the east of Levin, was identified through earlier MCA processes.

1.5 The broad eastern route was refined through subsequent MCA process to the preferred alignment parallel to Arapaepae Road. Consideration was given during these processes to both the existing environment and planned urban development options east of Levin which have become clearer during this time. The following landscape and urban design reports were prepared:

- *'Implications of Route Options on Eastern Growth Area Levin, Landscape + Urban Design", 1 March 2018, Gavin Lister, Isthmus'.* The report compared route options N4, N5, N8, and N9 in the area east of Levin. The comparison was made in the context of (a) the District Plan provisions and Structure Plan 13 at that time, and (b) the 'Horowhenua Growth Strategy 2040 Draft'. The former provided for future large lot residential development east of Levin (referred to as a 'Greenbelt Residential') while the latter proposed more intensive urbanisation for part of that area. That 2018 Landscape + Urban Design report favoured Option N9 in terms of the future urbanisation indicated in the Draft Growth Strategy because the alignment roughly coincided with an anticipated boundary between urban development and a 'Greenbelt Residential' area. Option N5 was considered slightly less favourable than N9 because it encroached into the area of future urbanisation. Option N4 was considered least favourable (with respect to urban development)[1] because it would sever the new urban area from Levin, hinder connectivity, and cause amenity effects for housing both sides of the highway. That report noted that such effects could be mitigated by highway design but at likely greater cost.
- *'Proposed Plan Change 4 (Taraika Growth Area)', Landscape + Visual + Urban Design, 14 July 2021, Gavin Lister, Isthmus.* The report reconsidered route options N4, N5, N8, and N9 with respect of proposed Plan Change 4 which provides for the planned Tara-Ika urban development. Plan Change 4 presents a different situation from that considered in the previous report. The area of proposed urban development for Tara-Ika is roughly twice that indicated in the earlier Horowhenua Growth Strategy. Whereas the N9 option

[1] N4 was preferred with respect to the operative provisions as it provided a boundary between urban Levin and the 'Greenbelt Residential' area

coincided more-or-less with the edge of the urban area depicted in the Horowhenua Growth Strategy, it would pass adjacent to the neighbourhood centre planned in the middle of Tara-Ika. The zoning maps and provisions provide for a neighbourhood centre in the middle of Tara-Ika (including supermarket, convenience retail, and service-based activities), and a large public open space, part of which has an 'education overlay' that enables a school. Medium density residential is provided for around the centre. Development of Taraika is to comply with Structure Plan 13[2] which depicts a circulation network with a high degree of connectivity between the neighbourhood centre and the rest of Taraika, and connections between Taraika and Levin. The Structure Plan depicts the Ō2NL alignment. Connections with Levin across Ō2NL are depicted as the existing connections along existing Queen Street and Tararua Road, and a new connection on the alignment of Liverpool Street. Two further 'Strategic Cycleways' are also depicted across O2NL.



Structure Plan 13, Proposed Plan Change 4: The Structure Plan depicts a neighbourhood centre comprising commercial node, public open space, and provision for school – surrounded by medium density housing. It also depicts connectivity between the neighbourhood centre and the rest of Tara-Ika, and between Tara-Ika and Levin.

2 METHODOLOGY

Landscape, visual, and urban design matters considered

2.1 The highway alignment, and therefore most broadscale landscape matters, are common to all options and have been considered in earlier MCA processes. This MCA assessment therefore focuses on the matters that differentiate the intersection and grade options. The main

[2] For example, Policy 6A.1.1

matters are visual effects, connectivity between Tara-Ika and Levin, and effects on the Kei te Whakahoro te Whenua landform. Considerations relating to these matters are summarised below.

Visual effects

2.2 Visual effects relate to the infrastructure itself and the moving traffic including night-time lights. The highway has greater potential for adverse visual effects than the local roads because of the highway's larger scale and faster moving traffic.

- The least prominent options in this regard are those where the highway is below-grade and local roads are at-grade.
- Conversely, the most prominent are those where the highway is elevated. It is assumed that elevated sections would have 1.1m high barriers adjacent to the carriageway, which would add to the buik of the highway, but not screen traffic.
- At grade options fall in a middle category. They have moderate visual effects assuming at-grade options would require 3m high noise walls (or a combination of bunds and noise wall). Such walls screen traffic (as well as reducing noise) but have their own adverse visual effect.

Connectivity

2.3 Connectivity relates to connections between Tara-Ika and Levin along the local roads. Factors influencing local connectivity include legibility (straight is best), grade (at-grade is best), amenity (underpasses generally less preferable), directness (short is best) and the nature of intersections (roundabouts are impediments to cyclists and pedestrians). It is also influenced by the relationship of the road to the street network ('space syntax'). Each of the three main local roads is different in this regard.

- Queen Street East is aligned with the northern edge of Tara-Ika and connects directly to the centre of Levin. It is also an historic path between Waipunahau and the Tararua Ranges.
- Liverpool Street extension is Tara-Ika's central spine and therefore has the best connectivity within the urban development area. However, it is not as centrally connected to Levin as Queen Street. There are also some detail issues to be resolved to extend Liverpool Street through to Arapaepae Road, and at the the NIMT/Oxford Street (the main street) intersection.
- Tararua Road is aligned with the southern edge of Tara-Ika and with the industrial area on the southern fringes of Levin. It is assumed the intersection will be reconfigured at the NIMT/existing SH1. Tararua Road will have a regional traffic role as well as a role for local connectivity. It is likely to be less amenable to pedestrians and cyclists.

Landform

2.4 All options would affect, to varying degrees, the landform Kei te Whakahoro te Whenua (the great landslide) from which Horowhenua takes its name. This is the landform that gently slopes between the Arapapepae foothills of the Tararua Ranges to Waipunahau (Lake Horowhenua). Potential effects include those of earthworks on the intrinsic values of the landform including its groundwater, and on the legibility of the landform surface. The intrinsic

values are addressed as a cultural effect by the Project's Iwi Partners. The landscape perspective in this MCA focuses on the legibility of the landform which in this instance relates mainly to the flat land surface. All the below-grade and above-grade options will have legibility effects because they will either excavate into the land surface and/or place fill on it. The at-grade options (roundabouts) would have least effects in this regard, although they would require noise walls which would have their own adverse effects on legibility.

Process

2.5 An overall MCA rating was given for each option based on an assessment of the nature and magnitude of each effect (adverse and positive) in context.

- The assessment is against the existing environment and the planned Tara-Ika urban development signalled in proposed Plan Change 4.
- The ratings are specific to this MCA process to decide between certain options. They are specific to this process and context.
- At the same time, the ratings are proportional to the nature and magnitude of effects rather than an attempt to artificially differentiate between options. Rather, distinctions between options with the same MCA ratings are made in the text.
- The ratings attempt to resolve both adverse and positive effects which are sometimes in opposition to each other. For example, an option may have adverse visual effects but positive connectivity effects. Reasons are given to explain how those matters are resolved. The weight given to different matters depends on context.
- The descriptions in the report should be referred to as the foundation. While the ratings are a useful and necessary tool for the MCA process, they do not replace the assessment of landscape, visual, and urban design matters themselves.

2.6 The MCA ratings were based on the following system included in the brief.

Table 2: 6-point scoring system to be used by the MCA assessors

Score	Description
1	The option presents few difficulties on the basis of the criterion being evaluated and may provide significant benefits in terms of the attribute
2	The option presents only minor aspects of difficulty on the basis of the criterion being evaluated, and may provide some benefits in terms of the criterion
3	The option presents some aspects of reasonable difficulty in terms of the criterion being evaluated and problems cannot be completely avoided. There are few apparent benefits in terms of the criterion
4	The option includes clear aspects of difficulty in terms of the criterion being evaluated, and very limited perceived benefits
5	The option includes significant difficulties or problems in terms of the criterion being evaluated and no apparent benefits
F	The option will result in completely unacceptable adverse effects that cannot be appropriately avoided, remedied or mitigated (including offsetting)

2.7 Given that the landscape, visual, and urban design matters entail weighing benefits and adverse effects, the following table helps further explain the application of the table above.

MCA rating	Description
1	The option presents significant benefits (positive effects) and only minor difficulties (adverse effects).
2	The option presents moderate benefits (positive effects) and minor difficulties (adverse effects). Or significant benefits and moderate difficulties.
3	The option presents moderate benefits (positive effects) and moderate difficulties (adverse effects). Or moderate-high benefits and moderate-high difficulties.
4	The option presents significant difficulties (adverse effects) and moderate benefits (positive effects). Or it presents moderate-high difficulties and only minor benefits.
5	The option presents significant difficulties (adverse effects) and only minor benefits (positive effects).
F	The option will be unacceptable because the significance of difficulties (adverse effects) completely outweighs any benefit.

3 COMPARISON OF OPTIONS

Queen Street East options

Context

3.1 Queen Street is a key local road. It is Levin's central east-west axis, intersecting the main street (existing SH1) at the heart of the town, and helping divide Levin into four quadrants. It is an historical path between Waipunahau (Lake Horowhenua) and the Tararua Ranges: it is significant to tangata whenua in that regard and is an important recreational route. It leads to the significant Waiopehu Bush. It is the context for the historic Ashleigh homestead. In summary, it is important to Levin's sense of place.

3.2 It is also the northern edge of the planned Tara-Ika development and would provide a deep connection into the centre of Levin.

Q0: Highway below grade, Queen Street at grade

3.3 The highway would be in a trench approximately 6m deep. Queen Street East would remain on its current alignment and pass over the highway on a bridge almost at grade (approximately 1.7m above existing ground level).

3.4 From landscape, visual, and urban design perspective the MCA rating is '2' because:

- There would be least visual effects. The highway and traffic would be screened except from close quarters. Noise walls would be avoided. Potential adverse visual effects of the Queen Street bridge would be avoided.
- Queen Street East would have the greatest legibility and connectivity. The option would maintain the existing straight alignment, flat grade, and amenity values. There would be

little impediment to movement. It would retain the historic path connection between Levin and the Tararuas.

- There would be some effects on the legibility of the Kei te Whakahoro te Whenua landform although the legibility of broad landform surface would be retained. (As discussed, effects on intrinsic values are to be addressed by the Project's iwi Partners for each of the option).

3.5 This option is preferable to Q1 because the Queen Street bridge would be straighter and closer to grade.

Q1: Highway partially below grade

3.6 The highway would be in a partial trench approximately 4m deep, within a vertical-sided structure. Queen Street East would divert from its current alignment and be raised on bridge approximately 3.9m high above ground level with earth-worked ramps.

3.7 From landscape, visual, and urban design perspective the MCA rating is '3' because:

- The highway would have low adverse visual effects. It would be below ground level and traffic would be largely screened. Noise walls would be avoided. The local road would have only moderate adverse effects because of the relatively low height of the bridge and ramps.
- Queen Street East would have moderately good legibility and connectivity. However, it would not be as good as Q0 because the diversion from the existing straight alignment would reduce legibility and the bridge elevation would act as a small impediment to pedestrians and cyclists.
- There would be some localised effects on the legibility of the Kei te Whakahoro te Whenua landform because of both cuts and fills, although the legibility of broad landform surface would be retained. The vertical sided walls would assist in this respect.

3.8 Q1 would rate more strongly if it were to be located on existing Queen Street East alignment.

Q2: Queen Street partially below grade

3.9 The highway would be on ramps and flyover approximately 2m above ground level. Queen Street East would divert from its current alignment and be in vertical sided structure approximately 4.5m below ground level.

3.10 From landscape, visual, and urban design perspective the MCA rating is '4' because.

- The highway would have moderate-high adverse visual effects. The highway would be reasonably low, but the 2m height would be enough to increase visibility. It is assumed the highway would have 1.1m high barriers which would add to the prominence of the infrastructure but not screen the traffic.
- Queen Street would have low-moderate connectivity. The underpass would have poor amenity. The deviation from the straight alignment would reduce legibility. The 4.5m grade change would be a disincentive for pedestrians and cyclists especially in conjunction with the poor amenity.
- There would be some localised effects on the legibility of the Kei te Whakahoro te Whenua landform because of both cuts and fills, although the legibility of broad landform surface would be retained.

Q3: At grade roundabout Queen Street

3.11 Both the highway and Queen Street East would be close to grade, although the roundabout would be on fill elevated approximately 1.7m. A separate pedestrian/cycle bridge approximately 7m high would be constructed over the highway on the north side of the roundabout.

3.12 From landscape, visual, and urban design perspective the MCA rating is '3' because:

- The highway and local road would have moderate adverse visual effects. The roads and traffic would be at grade, albeit slightly elevated. It is assumed that 3m noise walls would be required beyond the roundabout.
- Queen Street East would have moderate connectivity. Retaining the current straight alignment and flat grade would help retain legibility. However, the connection between Tara-Ika and Levin would be weakened by the need for local traffic to interact with SH1 traffic. The roundabout would be a barrier for pedestrians and cyclists. While the footbridge would mitigate this adverse effect, it would require a 7m climb with relatively steep ramps.
- There would be least effects on legibility of the legibility of the Kei te Whakahoro te Whenua landform surface because both the highway and local road would be close to grade, although the roundabout would be on fill 1.7m above the natural ground level.

Q4: At grade, close Queen Street, upgrade Liverpool Street[3]

3.13 This option is scored as an alternative to a connection with Queen Street East and assumes the latter would be closed (i.e. it is an either/or option). For rating purposes, the highway is assumed to be at grade although there are options for the highway to be fully or partially trenched at this location (this is discussed further under the mid-block options below). Liverpool Steet would be on a bridge elevated approximately 6.6m (to carriageway) over the highway with earthworked ramps. It would be connected with Arapaepae Road by a large (two lanes) roundabout.

3.14 From a landscape, visual, and urban design perspective, the MCA rating is '2' because:

- The highway would have moderate adverse visual effects because the road and traffic would be at grade. It is assumed noise walls would be required. The Liverpool Street overbridge would have moderate adverse effects for nearby properties.
- Liverpool Street would have moderate-high connectivity. The road is the central spine to Tara-Ika. The straight alignment would reinforce legibility. The grade separation would facilitate integration of Tara-Ika with Levin by avoiding the need for local traffic to interact with highway traffic. However, the elevation of the overbridge would detract from connectivity for pedestrians and cyclists compared to at-grade options. Liverpool Street is preferable to Queen Street East in terms of connectivity between Tara-Ika and Levin, acknowledging there are pros and cons for the alternative options.
    - Queen Street is one of Levin's primary axes. It intersects the main street at the heart of the town. It has the better connection to the centre of Levin compared to Liverpool

[3] In this context, Liverpool Street refers to the spine road indicated on the Tara-Ika Structure Plan that is an extension of the Liverpool Street alignment. Liverpool Street does not currently connect through to Arapaepae Road but it is assumed such a connection would be made.

Street which is located off-centre from Levin and has a dog leg intersection with the main street and NIMT railway. Queen Street is also an historic path between Waipunahau and the Tararua Ranges. On the other hand, Queen Street East is not central to Tara-Ika – it is aligned to the northern edge of the urban development area.

- Liverpool Street has a slightly weaker connection with the centre of Levin as discussed above. However, it is the central spine and provides the best connections into the centre of the new Tara-Ika urban development area. It is also in a central location for distributing local traffic along Arapaepae Road to both Queen Street East and Tararua Road. Liverpool Street therefore provides the best future options for connectivity between the planned Tara-Ika development and Levin.

- There would be some localised effects on the legibility of the Kei te Whakahoro te Whenua landform because of fill embankments placed on the surface, and also the presence of noise walls (potentially bunding) adjacent to the highway. On the other hand, the elevation provided by the bridge might best enable people to perceive the broad landform surface given that such legibility will be hindered by urbanisation of the area.

3.15 While Liverpool Street is the preferred choice compared with Queen Street East, it is recommended that a footbridge at least also be provided at Queen Street East to maintain that historic path and for active mode connectivity between Tara-Ika and Levin. This combination would rate '1'.

3.16 Setting the highway into a trench or partial trench would improve connectivity between Tara-Ika and Levin by placing the local Liverpool Street bridge at grade or closer to grade. It would slightly reduce adverse visual effects, and slightly reduce legibility of landform. This combination would also rate '1'.

3.17 Traffic lights at the intersection between Arapaepae Road and the Liverpool Road extension would provide a better connection for pedestrians and cyclists, and a better fit with urban form. Similar comments would apply for the intersection between Arapaepae Road and Queen Street East and, to a lesser extent, Tararua Road once Arapaepae Road is no longer needed as a state highway.

Q5: At grade, Queen Street diverted north

3.18 Queen Street East would be closed, except for a pedestrian overbridge. A new road would be built from opposite Redwood Close to a roundabout on Arapaepae Road approximately 600m north of its current intersection with Queen Street. The highway would be at grade, the new road on an overbridge.

3.19 From a landscape, visual, and urban design perspective the MCA rating is '4' because.

- Highway would have moderate adverse visual effects. The road and traffic would be visible at grade. It may not require noise walls given rural location. The overbridge would be prominent, but in rural setting away from Tara-Ika.
- Connectivity between Queen Street East and Levin would be relatively poor (low). It would require a significant deviation (roughly 900m) from the straight alignment and it would have poor legibility. The new road would not tie logically into the Tara-Ika development because the new roundabout would be opposite a no-exit rural residential enclave (Redwood Close). It would have poor space syntax.

- There would be some localised effects on the legibility of the Kei te Whakahoro te Whenua landform because of fills placed on the surface, although the legibility of broad landform surface would be retained.

Q6: Expressway bridge over Queen Street East

3.20 The highway would be on flyover approximately 6.5m above ground level with fill embankment ramps. Queen Street East would remain at grade and on its current alignment. It is understood the works would not encroach into the Ashleigh property.

3.21 From a landscape, visual, and urban design perspective the MCA rating is '3' because:

- The highway would have high adverse visual effects because it would be elevated on a flyover. It is assumed it would have 1.1m concrete barriers. (There are mitigation options, see below).
- Queen Street East would retain high connectivity and legibility given it would retain its current straight alignment and be at grade. For the same reasons (straight and at grade) there would be only a small loss of amenity for the underpass beneath the highway – especially given the width of the opening (shown at 70m) and the open 'spill-through' abutments.
- There would be some localised effects on the legibility of the Kei te Whakahoro te Whenua landform because of fills placed on the surface, although the legibility of broad landform surface would be retained.
- There would be localised effects on legibility of the Kei te Whakahoro te Whenua landform surface because of fills to construct ramps.

3.22 In this instance, Q6 is preferable to Q7. While a highway flyover might not normally be preferred because of visual effects, in this situation the connectivity benefits of Q6 should be given greater weight because of the importance of the link between Tara-Ika and Levin. There are also site-specific opportunities to mitigate the visual effects. These include expanding the adjacent stands of bush to soften the highway and visually anchor the overpass. There is potential for the bridge to be enclosed by a bespoke noise structure, the design of which could reference the path along Queen Street (the connection between Waipunahau and the Tararua Ranges). Q6 would also have less visual effects on Ashleigh. Both options entail bridges of similar height in similar locations. However, the bridge and ramps for Q6 are aligned parallel with Ashleigh's western side boundary, while those for Q7 are aligned across Ashleigh's front boundary. Q6 would better retain the relationship of the entrance to Ashleigh from Queen Street.

Q7: Queen Street East bridge over expressway

3.23 The highway would be at ground level. Queen Street East would be on an overbridge approximately 7m above ground level, with earth-worked ramps either side. The bridge would be offset approximately 30m to the north of the existing Queen Street alignment to avoid encroaching into Ashleigh. The ramp on the western side would be steep to tie in with the Arapaepae Road roundabout

3.24 From a landscape, visual, and urban design perspective the MCA rating is '3' because:

- The option would have moderate-high adverse visual effects. The highway would have moderate adverse effects. Noise walls would likely be required in the vicinity. The Queen Street East overbridge would have moderate-high adverse visual effects because of its prominence, exacerbated by its inconsistency with the existing landscape pattern. It would detract from the line of the historic path along Queen Street. It would have moderate-high adverse effects on Ashleigh because the eastern ramp would be aligned in front of the property (the relationship of Ashleigh with Queen Street East would be diminished).
- Queen Street East would retain moderate connectivity between Tara-Ika and Levin, and with the historic route between Levin and the Arapaepae hills. It would be less legible than a straight alignment and the 7m change in grade would be a little more of an impediment compared to an at-grade connection, especially for pedestrians and cyclists and having regard to the steep slope on the western ramp.
- There would be localised effects on legibility of the Kei te Whakahoro te Whenua landform surface because of fills to construct ramps.

3.25 Despite Q6 and Q7 being assigned the same MCA rating, Q7 is less preferred compared to Q6 as discussed above.

Q8: At grade, five-arm roundabout, intersection with SH57

3.26 Queen Street East would be closed, except for a footbridge over the highway. A new major roundabout would be built as the intersection of SH1 and SH57 approximately 450m north of Queen Street. The roundabout would have arms leading north to SH57, another leading south to Arapaepae Road towards Queen Street and Levin, and a further leading towards Tara-Ika. The latter arm would connect with a roundabout on Queen Street East opposite the central NE-SW spine road depicted in the Tara-Ika structure plan.

3.27 From landscape, visual, and urban design perspective the MCA rating is '4' because:

- The highway and roundabout would have low-moderate adverse visual effects. The at-grade road and traffic would have moderate prominence but would be in a rural setting separate from Tara-Ika. Noise walls may not be required given rural location. The visual effects of the roundabout would be partly offset by the removal of the proposed SH1/SH57 roundabout further north. This would have benefits by enabling Arapaepae Road to maintain its straight alignment in keeping with landscape patterns to the north – although the arrangement would remove a section of Arapaepae Road opposite the roundabout.
- Connectivity between Queen Street East and Levin would be relatively poor (low-moderate). It would require a significant deviation (roughly 700m) from Queen Street's straight alignment, the connection with Levin would have poor legibility (it would depend on signage or memory, although it would better connect with the Tara-Ika street network than Q5). The roundabout would further diminish connectivity between Tara-Ika and Levin because of the need for local traffic to interact with SH1 and SH57 traffic. The effects would be partly mitigated by the footprint on the Queen Street alignment, although the 7m change in elevation for the footbridge would be a disincentive.
- There would be low effects on legibility of the Kei te Whakahoro te Whenua landform surface because the roundabout would be at grade.

3.28 This option rates unfavourably because of the poor connectivity between Tara-Ika and Levin. However, it does have some benefits with respect to the intersection with SH57. It would rate higher if Q8 was done in conjunction with a connection at Liverpool Street (Q4) which would address the connectivity matters in large part.

Mid-block options

Context

3.29 At-grade and below-grade options are being considered for the 1.2km mid-block section between Queen Street East and Tararua Road. Both mid-block options could be combined with any of Queen Street and Tararua Road Options.

3.30 The section of highway is parallel with Arapaepae Road (existing SH57). While the current landscape is mostly open pasture, the proposed Tara-Ika development is planned to occupy both sides of the highway. This includes a relatively narrow area of urban development planned between the Ō2NL highway and the existing SH57, and the bulk of Tara-Ika to the east of the highway. Visual effects on the amenity of nearby future development is therefore a relevant matter.

3.31 The highway alignment is between the planned Tara-Ika development and Levin, so that connectivity between Tara-Ika and Levin is an important consideration. The Tara-Ika structure plan indicates a spine road on the alignment of Liverpool Street with a bridge over Ō2NL. It also indicates two further pedestrian/cycle bridges connecting opposite Meadowvale Drive (providing access to Waiopehu College) and to the planned industrial area south of Levin (south of Strathmore Avenue).

M1: At grade

3.32 The highway would be approximately at ground level but would require normal shallow cuts and fills in the order of plus or minus 1m to create the road formation.

3.33 From a landscape, visual, and urban design perspective the MCA rating is '3' because:

- The highway would have moderate adverse visual effects. Noise walls up to 3m high are likely to be required (or a combination of bund and noise wall). These would be softened by landscaping.
- Any local connections across the highway between Tara-Ika and Levin (such as the Liverpool Street extension and the two strategic cycleways indicated on the Tara-Ika Structure Plan) would be accommodated on overbridges. These would contribute to visual effects to some degree. The elevation of the bridges would detract from connectivity compared to M2 below.
- There would be low effects on legibility of the Kei te Whakahoro te Whenua landform because the highway would be at grade – although as discussed, the Project would still require shallow cuts and fills to create the formation, and there would be noise walls. Any overbridges required would have some localised effects on legibility by placing fill ramps on the land. On the other hand, the overbridges would provide elevated views of the landform.

M2: Below-grade

3.34 The highway would be in a trench the depth of which would be adjusted to remain above maximum groundwater level. It would therefore be shallower than the trench depicted in the design freeze. It is understood that a conservative approach has been taken to ensure the works remain above ground water. The following table indicates approximate depths below ground level:

CH	*approx. depth (m)*
16600	1.4
16800	2.2
17000	3.8
17200	3.9
17400	3.4
17600	4.1
17800	4.2

3.35 From a landscape, visual, and urban design perspective the MCA rating is '2' because:

- The highway would have low adverse visual effects. The carriageway would be screened below ground level and most traffic would be screened from most of the mid-block section. The shallower sections would likely be screened by relatively low noise walls or bunding. The local connections would also have reduced visual effects because of the lower elevation required for bridges and ramps.
- The below-grade option would improve connectivity for any local connections by reducing the ramp gradient across the highway. The reduction would in elevation required would be roughly 3.8m for an extension of Liverpool Street,[4] and 2m and 4m for the two strategic cycleways indicated on the Tara-Ika Structure Plan.
- There would be some effects on the legibility of the Kei te Whakahoro te Whenua landform through a long trench. The broad landform, though, would still be perceived as a surface either side of the highway. (As discussed, effects on intrinsic values are to be addressed by the Project's iwi Partners for each of the option).

Tararua Road options

Context

3.36 Tararua Road has a different role as the SH1 interchange compared to Queen Street and Liverpool Street. It is a regional connector as well as a local one. Visual and connectivity are therefore considered in a different context.

- Apart from the at-grade roundabout (T3), Tararua Road will have greater adverse visual effects compared to equivalent Queen Street/Liverpool Street options because of the ramps and larger footprint – although it is a less sensitivity location compared to the Queen Street (historic path, central to Levin, adjacent to Ashleigh) or Liverpool Street (central to Tara-Ika). Rather, Tararua Road is on the southern edge of Tara-Ika and connects to the industrial area on the southern side of Levin.

[4] The same benefit with respect to the Liverpool Street spine connection between Tara-Ika and Levin could be obtained by a short below-grade section as discussed above for option Q4.

- Tararua Road will have worse local connectivity (but obviously critical regional connectivity) compared with the equivalent Queen Street/Liverpool Street options. All options require local traffic to interact with either SH1 or the SH1 ramps. All options except the at-grade roundabout entail a pair of 'dumbbell' roundabouts that detract from local connectivity, especially for pedestrians and cyclists.

T0: Highway below grade, Tararua Road at grade

3.37 The highway would be in trench approximately 6m-7m below ground level. Tararua Road would be almost at grade (up to 1.9m above existing round level) on a bridge over the highway. The four interchange ramps would rise from the trench to connect with roundabouts in a dumbbell configuration either side of the Tararua Road bridge.

3.38 From a landscape, visual, and urban design perspective the MCA rating is '2' because:

- It would have the least adverse visual effects. The main highway and its traffic would be screened except from close quarters. The ramps would be partially screened, with traffic emerging above ground level near the roundabouts. The Tararua Road overbridge would be least prominent being at grade.
- It would have the best local connectivity of the Tararua interchange options. It would maintain the existing straight and at-grade alignment of the local road, and the greatest amenity (albeit pedestrians and cyclists would need to negotiate the dumb-bell roundabouts).
- There would be some effects on the legibility of the Kei te Whakahoro te Whenua landform through the cut into the surface although the legibility of broad landform surface would be retained.

3.39 While being assigned a similar MCA rating, Q0 would have better local connectivity and such connectivity would be more important given its context.

T1: Highway partially below grade, Tararua Road partially elevated

3.40 The highway would be in trench approximately 3.0m below ground level. Tararua Road would be elevated on bridge approximately 5m above ground level, with broad ramps on either side to accommodate the roundabouts either side of the Tararua Road bridge. The four interchange ramps would climb onto these broad areas of fill to connect with roundabouts.

3.41 From a landscape, visual, and urban design perspective the MCA rating is '3' because:

- It would have low-moderate adverse visual effects. The main highway and its traffic would be largely screened by the trench. The earthworks required on either side to accommodate the ramps would also screen the highway. On the other hand, the elevated roundabouts, highway ramps, and Tararua Road bridge would be more prominent and have moderate adverse visual effects.
- It would provide moderate connectivity between Tara-Ika and Levin. It would maintain the existing straight alignment of the local road, but the elevation would be some impediment in addition to the twin roundabouts - especially for pedestrians and cyclists.
- There would be adverse effects on the legibility of the Kei te Whakahoro te Whenua landform through the cut into the surface and the broad fill required to accommodate the ramps and roundabouts.

3.42 While T1 is assigned the same MCA rating of '3', it is preferred ahead of T3, T6, and T7 from a landscape, visual, and urban design perspective because it would have slightly lesser adverse visual effects and slightly better local connectivity compared to the other options.

T2: Highway partially above grade, Tararua Road partially below grade

3.43 The highway would be on a flyover approximately 3m above existing ground level. Tararua Road and the dumbbell roundabouts would be in cut approximately 3m below ground level. The four interchange ramps would descend in cuts to connect with roundabouts.

3.44 From landscape, visual, and urban design perspective the MCA rating is '4' because:

- It would have moderate-high adverse visual effects. The main highway and its traffic would be elevated and prominent. Conversely, the ramps and roundabouts would be partially screened by topography and would have low-moderate prominence.
- It would provide relatively poor (low-moderate) connectivity between Tara-Ika and Levin. It would maintain the existing straight alignment of the local road, but the 3m change in grade and the poorer amenity in the underpass would be a comparative impediment, along with the twin roundabouts. especially for pedestrians and cyclists.
- There would be adverse effects on the legibility of the Kei te Whakahoro te Whenua landform through the fill create the ramps and the broad cut into the surface to accommodate the roundabouts and underpass. The combination of cut and fill would have relatively greater adverse effects compared to simpler options, although the effects would be localised. The broad landform surface would be retained.

T3: At grade, roundabout Tararua Road

3.45 Both the highway and Tararua Road would be close to grade. The roundabout would have a compact footprint and be directly aligned with both roads. A separate 7m high footbridge would be constructed above the highway on the north side of the roundabout.

3.46 From landscape, visual, and urban design perspective the MCA rating is '3' because.

- Highway and Tararua Road would have moderate adverse visual effects. The road and traffic would be at grade. 3m noise walls would likely be required for the main highway (these could be mitigated with planting).
- Tararua Road would have moderate connectivity. The local road would remain at grade and have a legible straight alignment. However, the roundabout would be a perceived hurdle given the need to interact with SH1 traffic, and it would discourage active modes. The latter would be partly mitigated by a proposed footbridge – although the 7m grade difference and ramps would also impede connectivity.
- There would least effect on legibility of the landform surface because the highway and local road would be at grade.

T6: Expressway bridge over Tararua Road

3.47 The highway would be on a flyover approximately 7m high. Tararua Road would pass beneath in an underpass. Tararua Road would remain at grade and on its current alignment, with a 'dumbbell' pair of roundabouts either side of the underpass.

3.48 From a landscape, visual, and urban design perspective the MCA rating is '3' because:

- The highway would have high adverse visual effects because it would be elevated on flyover. It is anticipated 1.1m barriers would be used, which means traffic would be prominent.
- Tararua Road would retain moderate connectivity and legibility given it would retain its current straight alignment and be at grade. For similar reasons (straight, at grade) there would be reasonable amenity in the underpass although the combination of double-roundabouts and underpass would be a disincentive to pedestrians and cyclists.
- There would be some effects on the legibility of the Kei te Whakahoro te Whenua landform through fill be placed on the surface, although the legibility of broad landform surface would be retained.

3.49 While given a similar MCA rating to Q6, this option would have fewer connectivity benefits given the greater importance of Queen Street to local connectivity and the values associated with the historic path.

T7: Tararua Road bridge over expressway

3.50 The highway would be at grade. Tararua Road would be on a bridge approximately 8m (carriageway) above the highway. The roundabouts would be elevated approximately 4m-6m above existing ground level. Consequently, there would be extensive fill on each of the four sides of the diamond.

3.51 From a landscape, visual, and urban design perspective the MCA rating is '3' because:

- The interchange would have moderate-high adverse visual effects. While the highway itself will be at grade the ramps, roundabouts, and local bridge will all be elevated and have a large footprint.
- Tararua Road would retain moderate-low connectivity. It would retain legibility given it would retain its current straight alignment. The double roundabouts and elevation, though, would provide a barrier to connections between Tara-Ika and Levin, especially for pedestrians and cyclists.
- There would be adverse effects on the legibility of the Kei te Whakahoro te Whenua landform through the fill required to construct the broad ramps. The broad landform surface would be retained.

Summary of MCA ratings

3.52 The ratings are tabulated below:

Q0	Highway below grade, Queen Street at grade	2
Q1	Highway partially below grade	3
Q2	Queen Street partially below grade	4
Q3	At grade roundabout Queen Street	3
Q4	At grade, close Queen Street, upgrade Liverpool Street	2
Q5	At grade, Queen Street diverted north	4
Q6	Expressway bridge over Queen Street East	3
Q7	Queen Street East bridge over expressway	3
Q8	At grade, five-arm roundabout, intersection with SH57	4
M1	Mid-block at-grade	3
M2	Mid-block below-grad	2

T0	Highway below grade, Tararua Road at grade	2
T1	Highway partially below grade, Tararua Road partially elevated	3
T2	Highway partially above grade, Tararua Road partially below grade	4
T3	At grade, roundabout Tararua Road	3
T6	Expressway bridge over Tararua Road	3
T7	Tararua Road bridge over expressway	3

Summary

3.53 Options with a below-grade highway and at-grade local roads (Q0, T0) would have the least adverse visual effects and the most favourable connectivity. Those options with a partially below-grade highway (Q1, T1) would be similar, but the visual and connectivity benefits would be slightly muted in comparison.

3.54 At-grade options with roundabouts (Q3, T3) would have moderate adverse visual effects and moderate connectivity. The roundabouts will provide connectivity for vehicular traffic, although local traffic would need to interact with SH1 traffic. Highway roundabouts are a significant barrier to pedestrians and cyclists that would be only partially mitigated by overbridges. Q3 and T3 would minimise adverse effects on the legibility of the Kei te Whakahoro te Whenua landform, although the benefits in that regard would be muted by the need for noise walls (or bunds) and the urban development of the land surface.

3.55 Options with highway at grade and local road on an overbridge (Q7, T7) would have moderate-high adverse visual effects and moderate or moderate-low connectivity. Options with the local road at grade and highway on an overbridge (Q6, Q7) would have greater adverse visual effects but better connectivity. Q6 would be preferable to Q7 because of the weight given to the connections along Queen Street and the potential to mitigate the visual effects of that option. Q6 would also have less adverse visual effects on Ashleigh.

3.56 The Liverpool Street alternative (Q4) is given a high MCA rating because it would provide the strongest local connectivity between Tara-Ika and Levin due to its role as a spine road for the planned urban development. It would rate even more favourably if the highway was in a partial trench at that location which would result in a lower bridge. If Q4 was preferred, it is recommended that a footbridge at least be provided at Queen Street to maintain the historic landscape connection along that road.

3.57 The options with roundabouts north of Queen Street (Q5, Q8) are rated poorly because they would have moderate adverse visual effects and poor (low) connectivity between Tara-Ika and Levin. However, Q8 has some landscape advantages as an alternative to the proposed SH57/SH1 roundabout further north and its significant disadvantages could be ameliorated if constructed in conjunction with a Liverpool Street connection (Q4).

Gavin Lister
Isthmus
18 October 2021

Appendix H Heritage Assessment Report

Ōtaki to North of Levin Expressway

East of Levin MCA Assessment – Built Heritage

October 2021

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Ōtaki to North of Levin

MCA Assessment East of Levin - Built Heritage

Prepared by Ian Bowman, architect and conservator

Date: 30 October 2021

Version: 1st draft

Contents

1.0 Introduction

1.1 Background

This report has been prepared to support the development of the Ō2NL Detailed Business Case, and in particular Waka Kotahi's East of Levin Intersection and Midblock Multi Criteria Analysis process.

In September 2021, Waka Kotahi decided to undertake a multi criteria analysis (MCA) process to help further inform its decision-making on the intersection designs for the new Ō2NL highway at Queen Street and Tararua Road. In addition, Waka Kotahi requested an MCA evaluation of the road grade level between Tararua Road and Queen Street be also undertaken to inform its design decision-making processes. Collectively these MCA processes are referred to as the "East of Levin MCA".

This report assesses any impacts on built heritage of the East of Levin options.

1.2 Limitations and assumptions

As described in an email from Selwyn Blackmore, Transport Planner, Practice Leader, Stantec New Zealand, dated 4 October, 2021, the MCA evaluation processes / assumptions comprise:

- *Assessors are to use the 6-point scoring scale for all option evaluations (1 to 5 plus fatal flaw)* [see table 1 below]
- *All scoring is to be absolute (that is, no artificial distinctions are to be made between the options)*
- *Q0 and T0 are the base case options (both options still need to be scored)*
- *For below grade options, cross drainage maintaining existing flow paths may require siphons for large events such as >1:25yr stormwater events*
- *Therefore, all evaluations need to be clear what their mitigation measure assumptions are when assessing the options*
- *All technical evaluation assumptions (including key assessment uncertainties) should be documented in all final MCA assessor reports.*

Table 1 Scoring system

Score	Description
1	The option presents few difficulties on the basis of the criterion being evaluated and may provide significant benefits in terms of the attribute
2	The option presents only minor aspects of difficulty on the basis of the criterion being evaluated, and may provide some benefits in terms of the criterion
3	The option presents some aspects of reasonable difficulty in terms of the criterion being evaluated and problems cannot be completely avoided. There are few apparent benefits in terms of the criterion
4	The option includes clear aspects of difficulty in terms of the criterion being evaluated, and very limited perceived benefits
5	The option includes significant difficulties or problems in terms of the criterion being evaluated and no apparent benefits
F	The option will result in completely unacceptable adverse effects that cannot be appropriately avoided, remedied or mitigated (including offsetting)

It is assumed that reasonable noise mitigation will be provided and that, given the distance of the house from Queen Street and the proposed highway, there will be no vibration effects from construction or operation.

This assessment is based on:

Stantec drawings, Option Q0-8, 310203848-01-001-SK1000-0008, rev A, dated 21.09.21;

Stantec drawings, Option T1-3, 310203848-01-001-SK1010-1011 , rev A, dated 21.09.21;

Stantec drawings, Option T6-7, 310203848-01-001-SK1014-1015 , rev A, dated 21.09.21;

Smith, Michael, Altissimo Consulting, Otaki to North Levin Project, East of Levin Intersection and Midblock, Multi-Criteria Analysis – Noise and Vibration, 20 October 2021

Lister, Gavin, Isthmus Consulting, Otaki to North Levin Business Case, Multi-Criteria Analysis, East of Levin Options, Landscape +Visual +Urban Design, 18 October 2021

1.3 Impacted built heritage

The only heritage building potentially impacted by the East of Levin options is the Prouse property, 'Ashleigh', described below. Its value grading[1] is ranked as medium, meaning it is of high or medium importance, regional scale, category 1 or 2 Heritage New Zealand Pouhere Taonga (HNZPT) listing. It is not listed by HNZPT or on the Horowhenua District Plan schedule 2: Historic Heritage – Buildings, Structures and Sites.

Table 2 Ashleigh description

Address	Name	Date	Description	O2NL zone	Heritage grading
1024 Queen Street East, Levin	'Ashleigh'	Ca 1891	James Prouse's homestead, 2 story villa with outbuildings including barn, creamery, wash house, stable etc. Prouse born 1854 Chair County Council, saw miller, farmer, influential in dairy industry.	G/H	Medium

1.4 Methodology

Waka Kotahi guide

The general methodology used is the "Guide to assessing cultural heritage effects for state highway projects" March 2015, Guideline 2 Transport Agency built heritage assessment report template[2] (Waka Kotahi Guide).

Range of impacts

The Waka Kotahi Guides discusses a range of potential negative impacts from road construction, operation and environmental mitigation. The effects can be direct and indirect; cumulative, temporary and permanent, reversible or irreversible, visual, physical, social and cultural, even economic. Specific impacts can include:

[1] Refer Waka Kotahi Guide
[2] http://www.Waka Kotahi.govt.nz/assets/resources/guide-to-assessing-cultural-heritage-effects/docs/historic-heritage-impact-assessment-guide-2015.pdf

- shadows created that alter the appearance of a heritage attribute or change the viability of a natural feature or plantings, such as a garden ;
- isolation of a heritage attribute from its surrounding environment, context or a significant relationship;
- direct or indirect obstruction of significant views or vistas within, from, or of built and natural features;
- introduction of physical, visual, audible or atmospheric elements that are not in keeping with the character and setting of the built heritage resource;
- vibration from construction causing physical damage;
- disruption;
- displacement;
- isolation;
- encroachment[3].

None of the options physically impacts the house nor does any option impinge on the property boundaries[4]. Therefore any impacts on the building and property are indirect only and comprise visual, noise, vibration and heritage aspects of amenity. This assessment relies on advice from specialists in the areas of visual[5], noise and vibration impacts[6]. It has been confirmed that there will be no vibration impacts on 'Ashleigh'.

Ranking of significance of impacts

The Waka Kotahi guide compares the heritage grading of built heritage with the magnitude of impact of a project to determine impacts of the project (see appendix 1). The following table equates the Waka Kotahi guide significance of impact with the 6 point scoring table in table 1.

Table 3 Comparison of significance of impact and 6 point scoring table

6 point score	Waka Kotahi guide
F	Very large
5	Very large/large
4	Moderate/Large
3	Moderate
2	Slight
1	Neutral/slight

[3] Ontario Ministry of transportation, 2007
[4] Email, Jamie Povall, Director Major Projects, Stantec New Zealand, 14 October 2021
[5] Gavin Lister/Lisa Rimmer, Isthmus, Otaki to North of Levin Detailed Business Case, Multi-Criteria Analysis: East of Levin Options, Landscape+Visual+Urban Design, 18 October 2021
[6] Michael Smith, Altissimo Consulting, Otaki to North Levin Queen St and Tararua Rd, MCA Assessment – Noise (October 2021), powerpoint

1.5 Options to be assessed

The following table outlines the options assessed with respect to Prouse property.

Table 4 Options descriptions

Option	Description
Q0	Highway below grade, Queen St at grade, bridge over highway near north west corner of Prouse property
Q1	Highway partially below grade, Queen St moves north from the north of the Prouse property boundary and a bridge over the highway
Q2	Queen St partially below grade, moves north from the Prouse property, highway bridge over Queen St
Q3	At grade roundabout with joining Queen St and highway to the north west corner of the Prouse property
Q4	Highway at grade, Queen St closed
Q5	At grade, Queen Street diverted north
Q6	Highway bridge over Queen St at north west corner of Prouse property
Q7	Queen St moves north with bridge over highway
Q8	Highway at grade, Queen Street closed, five-arm roundabout, intersection with SH57
T0	Highway below grade, Tararua Road at grade
T1	Highway partially below grade, Tararua Road partially elevated
T2	Highway partially above grade, Tararua Road partially below grade
T3	At grade, roundabout Tararua Road
T6	Expressway bridge over Tararua Road
T7	Tararua Road bridge over expressway
M1	Mid-block at-grade
M2	Mid-block below-grade

2.0 Assessment of options

2.1 Queen Street options

The following table summarises impacts on 'Ashleigh' and its environs.

Table 5 Assessment of Q options

Options	Noise	Visual	Amenity	Magnitude of impact	Significance of impact/score
Q0	The highway will not generate additional noise such that there will be no change in the acoustic environment of the place. Queen St noise will remain the same or increase with increased traffic over time.	No impact on Ashleigh or from the north, east and south boundaries of the property given the dense mature planting. Possible visual impact from isolated areas on the west boundary but if this is the case, it is assumed trees will be planted to continue to obscure the property from the west.	The historic access to the property will not change, however the view from the entry gates will be slightly modified by a bridge over the highway.	Negligible	1
Q1	It is assumed that there will be concrete barriers on the Queen St bridge that will mitigate any noise impacts. The impact of noise from the highway is not considered to be material.	No impact on Ashleigh or from the north, east and south boundaries of the property given the dense mature planting. Possible visual impact from isolated areas on the west boundary but if this is the case, it is assumed trees will be planted to continue to obscure the property from the	The historic access to the property will change as Queen St moves to the north and will be raised with ramps to a bridge. The view from the entry gates will be modified bridge over Queen Street.	Minor	2

Options	Noise	Visual	Amenity	Magnitude of impact	Significance of impact/score
		west.			
Q2	It is assumed that there will be concrete barriers on the highway bridge that will mitigate any noise impacts. Queen St is further away than currently, slightly reducing noise impacts from the road. From an acoustic perspective, the impact on Ashleigh is slightly worse than Q1.	No impact on Ashleigh or from the north, east and south boundaries of the property given the dense mature planting. Possible visual impact from isolated areas on the west boundary but if this is the case, it is assumed trees will be planted to continue to obscure the property from the west.	The historic access to the property will change as Queen St moves to the north and will be below grade. The bridge to the highway will be visible from the entry gates.	Minor	2
Q3	The noise from both Queen St and the highway will increase which will introduce audible elements that are not in keeping with the in the acoustic environment of the place.	No impact on Ashleigh or from the north, east and south boundaries of the property given the dense mature planting. Possible visual impact from isolated areas on the west boundary but if this is the case, it is assumed trees will be planted to continue to obscure the property from the west.	The historic access to the property will not change, however the view from the entry gates will be slightly modified with the roundabout to the north west.	Moderate	3
Q4	It is assumed that there will be noise barriers or	No impact on Ashleigh or from the north, east	The historic access to the property will	Minor	2

Options	Noise	Visual	Amenity	Magnitude of impact	Significance of impact/score
	bunds on the highway embankment that will mitigate any noise impacts. The will be no noise from Queen St as it is closed either side of the highway.	and south boundaries of the property given the dense mature planting. Possible visual impact from isolated areas on the west boundary but if this is the case, it is assumed trees will be planted to continue to obscure the property from the west.	change as Queen St is closed either side of the highway, resulting in partial isolation. The view from the entry gates will be modified with the embankment for the highway.		
Q5	It is assumed that there will be noise barriers or bunds on the highway embankment that will mitigate any noise impacts. The will be no noise from Queen St as it is closed either side of the highway with a new connection north.	No impact on Ashleigh or from the north, east and south boundaries of the property given the dense mature planting. Possible visual impact from isolated areas on the west boundary but if this is the case, it is assumed trees will be planted to continue to obscure the property from the west.	The historic access to the property will change as Queen St is blocked off either side of the highway resulting in partial isolation. The view from the entry gates will be modified with the embankment for the highway.	Minor	2
Q6	It is assumed that there will be noise barriers or bunds on the highway embankment that will mitigate any noise impacts. However the	Depending on the height of the bridge, it is possible, but unlikely that the bridge will be visible from Ashleigh. Otherwise there	The historic access to the property will not change, however the view from the entry gates will be slightly modified by a	Moderate	3

Options	Noise	Visual	Amenity	Magnitude of impact	Significance of impact/score
	noise will be greater than for Q1, which will introduce audible elements that are not in keeping with the in the acoustic environment of the place. Queen St noise will remain the same or increase with increased traffic over time.	will be no impact from the north, east and south boundaries of the property given the dense mature planting. Possible visual impact from isolated areas on the west boundary but if this is the case, it is assumed trees will be planted to continue to obscure the property from the west.	bridge over Queen St.		
Q7	It is assumed that there will be noise barriers or bunds on the highway embankment that will mitigate any noise impacts. As Queen St is pushed further north, there is the potential for noise reduction from the local road.	Depending on the height of the bridge, it is possible, but unlikely that the bridge will be visible from Ashleigh. Otherwise there will be no impact from the north, east and south boundaries of the property given the dense mature planting. Possible visual impact from isolated areas on the west boundary but if this is the case, it is assumed trees will be planted to continue to obscure the property from the	The historic access to the property will change as Queen St moves to the north and will be raised with ramps to a bridge. The view from the entry gates will be modified by the bridge over Queen Street.	Minor	2

Options	Noise	Visual	Amenity	Magnitude of impact	Significance of impact/score
		west.			
Q8	It is assumed that there will be noise barriers or bunds on the highway embankment that will mitigate any noise impacts. The will be no noise from Queen St as it is closed either side of the highway with a new connection north.	No impact on Ashleigh or from the north, east and south boundaries of the property given the dense mature planting. Possible visual impact from isolated areas on the west boundary but if this is the case, it is assumed trees will be planted to continue to obscure the property from the west.	The historic access to the property will change as Queen St is closed either side of the highway resulting in partial isolation of the property. The view from the entry gates will be modified with the embankment for the highway.	Minor	2
Q8 – 1	It is assumed that there will be noise barriers or bunds on the highway embankment that will mitigate any noise impacts. The will be no noise from Queen St as it is closed either side of the highway with a new connection north.	No impact on Ashleigh or from the north, east and south boundaries of the property given the dense mature planting. Possible visual impact from isolated areas on the west boundary but if this is the case, it is assumed trees will be planted to continue to obscure the property from the west.	The historic access to the property will change as Queen St is closed either side of the highway resulting in partial isolation of the property. The view from the entry gates will be modified with the embankment for the highway.	Minor	2

2.2 Tararua Road Options

There are no built heritage places impacted by these options.

Table 6 Assessment of T options

Options	Noise	Visual	Amenity	Score
T0	No	No	No	1
T1	No	No	No	1
T2	No	No	No	1
T3	No	No	No	1
T6	No	No	No	1
T7	No	No	No	1

2.3 Mid block options

There are no built heritage places impacted by these options.

Table 7 Assessment of M options

Options	Noise	Visual	Amenity	Score
1 Midblock Highway at grade	No	No	No	1
2 Midblock Highway below grade	No	No	No	1
3 Midblock Highway combined	No	No	No	1

References

Bowman, I., *Built Heritage Assessment Template*, July, 2013

English Highways' Agency, *Design Manual for Roads and Bridges*, Volume 11 Section 3, part 2 HA 208/07, Cultural heritage 2007

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Waka Kotahi, *Guide to assessing historic heritage effects for state highway projects*, March 2015, Waka Kotahi

Stantec drawings, Option Q0-8, 310203848-01-001-SK1000-0008, rev A, dated 21.09.21;

Stantec drawings, Option T1-3, 310203848-01-001-SK1010-1011 , rev A, dated 21.09.21;

Stantec drawings, Option T6-7, 310203848-01-001-SK1014-1015 , rev A, dated 21.09.21;

Smith, Michael, Altissimo Consulting, Otaki to North Levin Project, East of Levin Intersection and Midblock, Multi-Criteria Analysis – Noise and Vibration, 20 October 2021

Lister, Gavin, Isthmus Consulting, Otaki to North Levin Business Case, Multi-Criteria Analysis, East of Levin Options, Landscape +Visual +Urban Design, 18 October 2021

Appendix 1

Ranking of magnitude of impact

The following table gives best practice rankings to assess magnitude of impacts.

Table 8 Waka Kotahi/ICOMOS guide magnitude of impact

Impact	Factors in the Assessment of Magnitude of Impacts
Major	Change to key historic building elements, such that the resource is totally altered. Comprehensive changes to the setting.
Moderate	Change to many key historic elements, such that the resource is significantly modified. Changes to the setting of an historic building, such that it is significantly modified.
Minor	Change to key historic elements, such that the resource is slightly modified. Change to the setting of an historic building, such that it is noticeably changed.
Negligible	Slight changes to historic building elements or setting that hardly affect it.
No change	No change to fabric or setting.

Ranking of significance of impacts

The following table gives best practice rankings to assess significance of impacts.

Table 9 Waka Kotahi/ICOMOS guide significance of value

VALUE	**Very high**	Neutral	Slight	Moderate /large	Large/very large	Very large
	High	Neutral	Slight	Moderate /Slight	Moderate /large	Large/ very large
	Medium	Neutral	Neutral/ slight	Slight	Moderate	Moderate/ large
	Low	Neutral	Neutral/ slight	Neutral/ slight	Slight	Moderate/ slight
	Negligible	Neutral	Neutral	Neutral /slight	Neutral/ slight	Slight
		No change	**Negligible**	**Minor**	**Moderate**	**Major**

	MAGNITUDE OF IMPACT

Appendix I Archaeology Assessment Report

Introduction

This archaeological report has been prepared to support the development of the Ō2NL Detailed Business Case, and in particular Waka Kotahi's *East of Levin Intersection and Midblock Multi Criteria Analysis* process.

In September 2021, Waka Kotahi decided to undertake a multi criteria analysis (MCA) process to help further inform its decision-making on the intersection designs for the new Ō2NL expressway at Queen Street and Tararua Road. In addition, Waka Kotahi requested an MCA evaluation of the road grade level between Tararua Road and Queen Street be also undertaken to inform its design decision-making processes. Collectively these MCA processes are referred to as the "East of Levin MCA".

The East of Levin MCA options have been assessed and scored as previously described in the research methodology section of the *Analysis of Archaeological Potential Relating to Alignments, Interchanges and Local Roads Within the S6 and N4 Route Options for the North of Otaki to North of Levin Expressway* assessment report. The intersection and midblock options assessed in this report fall within the zones F, G, H and K that were assessed in the report above. No new archaeological sites were identified in the course of this work, but some previously identified potential archaeological sites have been excluded after further research indicated they are not, or are highly unlikely to be, archaeological sites. Additionally, refinement (reduction) of the Options Corridor to a proposed Designation Extent means only a subset of 15 previously identified archaeological sites is assessed within these zones for the East of Levin MCA. There is one verified[1] archaeological site in this subset and 14 potential archaeological sites which are listed in Table 1 and their locations are shown in Figure 1.

Site Name	Site Type	Description

[1] A verified archaeological site is a location, building or object that fulfils the statutory requirements to be considered an archaeological site under the Heritage New Zealand Pouhere Taonga Act 2014 and where the location and extent of the site are known to a high precision.

Waiore	Geology and fauna	Unknown, possibly an old well. Kawana Hunia te Hakeke described a similarly named place, Waihau, as being a place "where we obtained hinau berries and caught birds. We lived at these places… To Waihau I went to receive the tapu". Paki te Hunga described Waihau as "an artificial well for steeping hinau".
[track]	Railways, roads and tracks	A track connecting the Weraroa clearing to birding camps on the Arapaepae Ridge.
James Prouse's house, 'Ashleigh'	Buildings and structures	Two storey villa in near original condition and with multiple out-buildings in various states of repair/disrepair. James Prouse was one of two brothers, the other being Richard Prouse, recognised for their contribution to the early life and success of Levin.
Queen Street East	Railways, roads and tracks	A local road that was constructed in the 19th century.
Waimarie stream	Geology and fauna	A temporary stream that flowed during periods of inundation, the dry bed serving as a walking track leading to clearings the Arapaepae Ridge at other times of the year.
[house]	Buildings and structures	Possible pre-1900 house site, but may also be a shed. Other outbuildings and sheds are located on same property. Tentatively identifed as pre-1900 on the basis of the building footprint and an established garden of mature trees.
[house]	Buildings and structures	Possible pre-1900 house with some outbuildings or sheds, now used as a packhouse (?). Tentatively identifed on the basis of the building footprint and a few mature trees and hedges.
Waitaiki stream	Geology and fauna	A 'taiki' is a wicker basket, perhaps indicating the manufacture or use of hinaki at or nearby this stream. The name was provided to Adkin by Hori Wirihana of the Muaūpoko iwi. The stream was also feed by the Punaoho spring that was known as a source of excellent drinking water.

[house]	Buildings and structures	Possible pre-1900 house tentatively identifed on the basis of the building footprint and mature trees.
Te Aratoaka track	Railways, roads and tracks	A track connecting Kawiu clearing, on the north shore of Lake Horowhenua, to the Arapaepae Ridge.
Waihou Road	Railways, roads and tracks	A local road that was constructed in the 19th century.
Te Awa a te Tau/Koputaroa stream	Geology and fauna	The upper reaches of the Koputaroa steam also go by the name Te Awa-a-Te Tau, 'the stream of Te Tau', and contain tuna (eel), koeke (fresh-water crayfish), kakahi (fresh-water mussel). Adkin states that the banks of this stream are of high archaeological interest, with "very numerous remains of umu or hangi... occur along the course of the stream or in its immediate vicinity."
[house]	Buildings and structures	Possible pre-1900 house tentatively identifed on the basis of the building footprint.
[house]	Buildings and structures	Possible pre-1900 house tentatively identifed on the basis of the building footprint.
[house]	Buildings and structures	Possible pre-1900 house tentatively identifed on the basis of the building footprint. Unclear if still standing or demolished and rebuild on top.

Assessment and Scoring of Intersections

The Prouse homestead, 'Ashleigh', is the only verified archaeological site within the East of Levin MCA area of analysis and there is one Queen Street option that would have a minor effect on the historic gardens within the curtilage of this site: this option, Q7 – Local road over top, comes with minor areas of difficulty. All other options for the Tararua Road and Queen Street intersections have the potential to result in adverse effects to a small number of archaeological sites, but these options are expected to provide few areas of difficulty. Adverse effects for options other than Q7 are expected to be less than minor, primarily for the following reasons:

- The location of the Waiore site at Tararua Road is only tentatively known from a sketch map provided to the Native Land Court in 1873. There is likely to be a low level of accuracy for the location provided and the site may be located outside the designation extent.
- Additional research has removed a number of tentatively identified pre-1900 houses from the list of potential archaeological sites at other locations along the Ō2NL Project's alignment. Further houses are expected to be eliminated from consideration as archaeological sites as research continues.

Following the above assessment, scoring for the East of Levin intersection options is as presented in Table 2.

INTERSECTION	OPTION	SCORE	DESCRIPTION
Queen Street	Q0 - Expressway fully below grade (DBC)	1	The option presents few difficulties on the basis of the criterion being evaluated and may provide significant benefits in terms of the attribute.
	Q1 - Expressway partially below grade	1	
	Q2 - Local road partially below grade	1	
	Q3 - At-grade: Roundabout	1	
	Q4 - At-grade: Close Queen, upgrade Liverpool	1	
	Q5 - At-grade: Queen diverted north	1	
	Q6 - Expressway over top	1	
	Q7 - Local road over top	2	The option presents only minor aspects of difficulty on the basis of the criterion being evaluated, and may provide some benefits in terms of the criterion.
	Q8 - At-grade: 5-arm, shift SH57 connection South*	1	The option presents few difficulties on the basis of the criterion being evaluated and may provide significant benefits in terms of the attribute.
Tararua Road	T0 - Expressway fully below grade (DBC)	1	
	T1 - Expressway partially below grade	1	
	T2 - Local road partially below grade	1	
	T3 - At-grade: Roundabout	1	

	T6 - Expressway over top	1	
	T7 - Local road over top	1	

Assessment and Scoring of Midblock

There are no verified archaeological sites in the vicinity of the midblock options and there is only one potential archaeological site, an unnamed Māori track linking the Lake Horowhenau/Weraroa clearing to the Tararua foothills. Physical remains of historic tracks and trails can survive to be found in archaeological contexts, but this is rare circumstances and there is a low probability of physical remains associated with the trail being found. Archaeological remains associated with activity areas, such as overnight camps or bird/rat snaring, may also be found along these tracks, but relative to the length of the actual track there is only a low probability that activity area related to the track will be affected by the Ō2NL Project. There are few difficulties associated with either of the midblock options and they are scored as shown in Table 3.

Option	Score	Description
Option 1 – Ground Level	1	The option presents few difficulties on the basis of the criterion being evaluated and may provide significant benefits in terms of the attribute.
Option 2 – Below Ground Level	1	

Conclusion

The intersection and midblock options considered as part of the East of Levin MCA are located in areas of low archaeological potential along the proposed Ō2NL expressway alignment. In general there are few difficulties associated with any of the intersection or midblock options presented, though the Queen Street intersection option Q7 would result in a relatively minor level of adverse effect to the only verified archaeological site in the East of Levin MCA which would otherwise be avoided by the remaining Queen Street options.

Appendix J Noise / Vibration Assessment Report

Altissimo Consulting

Ōtaki to North of Levin Project

East of Levin Intersection and Midblock
Multi Criteria Analysis – Noise and Vibration

Prepared for
Stantec (for Waka Kotahi)

Date: 20 October 2021
Ref: 20-110/R03/A

Quality information

Prepared for (the Client):
Stantec (for Waka Kotahi)

Prepared by (the Consultant):
Altissimo Consulting Ltd (NZBN 9429046516350)

Project:	Ōtaki to North of Levin
Report:	East of Levin Intersection and Midblock Multi Criteria Analysis Noise and Vibration
Reference:	20-110/NV_R03/A

Prepared by:

Michael Smith
Principal

Version history:

Version	Date	Comment
A	20 Oct 2021	Draft issued to client

Contents

1 Introduction

This acoustics report has been prepared to support the development of the Ō2NL Detailed Business Case, and in particular Waka Kotahi's *East of Levin Intersection and Midblock Multi Criteria Analysis* process.

In September 2021, Waka Kotahi decided to undertake a multi criteria analysis (MCA) process to help further inform its decision-making on the intersection designs for the new Ō2NL highway at Queen Street and Tararua Road. In addition, Waka Kotahi requested an MCA evaluation of the road grade level between Tararua Road and Queen Street be also undertaken to inform it's design decision-making processes. Collectively these MCA processes are referred to as the "East of Levin MCA".

This assessment criterion considers the noise and vibration impacts on dwellings and other community buildings (sensitive receptors) located within 300m of the alignment and interchange options. Potential effects on the proposed Tara-Ika subdivision have also been considered.

2 Methodology

This assessment is focussed on potential noise effects at the most affected PPFs nearest to the highway using the following methodologies:

- For the midblock vertical alignment option, a quantitative assessment has been made considering the likely noise levels at nearby PPFs, based on computer noise modelling.
- For the interchange options at Queen Street and Tararua Road, the assessment has been made qualitative basis considering the character of noise generated by different interchange types.
- For the Queen Street interchange, the effect of the change in horizontal and vertical alignment has also been assessed on a qualitative basis.

Options have been rated using the following scale, to allow comparisons with other disciplines:

Table 1 MCA rating definition (provided by Stantec)

Score	Description
1	The option presents few difficulties on the basis of the criterion being evaluated and may provide significant benefits in terms of the attribute.
2	The option presents only minor aspects of difficulty on the basis of the criterion being evaluated, and may provide some benefits in terms of the criterion.
3	The option presents some aspects of reasonable difficulty in terms of the criterion being evaluated and problems cannot be completely avoided. There are few apparent benefits in terms of the criterion.
4	The option includes clear aspects of difficulty in terms of the criterion being evaluated, and very limited perceived benefits.
5	The option includes significant difficulties or problems in terms of the criterion being evaluated and no apparent benefits.

Consistent with the Phase 1 MCA assessments[1], and the current assessment that is being prepared for the RMA Application, reference has been made to criteria and guidance set out in NZS 6806[2]. The most stringent criterion in NZS 6806 is 57 dB $L_{Aeq(24h)}$ outside a PPF. Below this level road-traffic noise may still be audible and may still change the amenity of an area but should generally be at a reasonable level. If external levels do not exceed 57 dB $L_{Aeq(24h)}$ then internal levels should generally be below 40 dB $L_{Aeq(24h)}$ even with windows ajar for ventilation.

A secondary health-based criteria has also been adopted, with reference to World Health Organisation guidance[3]. Above a sound level of 50 dB $L_{Aeq(24h)}$ outside a PPF there are increased risk of health effects, including annoyance and sleep disturbance.

As other assessments are currently underway to support the RMA approvals (and project design in genera), there is a more complete understanding potential effects from the project than during the Phase 1 assessments performing in 2020. In particular, detailed acoustics modelling has been performed for the DBC design.

Mitigation

This assessment is also on the basis that "reasonable mitigation" will be included.

The forms of mitigation considered for the DBC design thus far have been noise walls of different heights, earth bunds, and a high-performance low-noise road surface. These mitigation options were subject to a multi-disciplinary analysis guided by NZS 6806 which balanced the noise reductions achieved with engineering constrains, as well as effects that the mitigation would have on visual effects / landscape values, ecology, and social and heritage values.

The preferred mitigation for the current DBC design was established by consensus by a range of experts at a Noise Mitigation Workshop held in July 2021. The mitigation in this area was the selection of a high-performance noise surface which provides approximately 2 dB of reduction of a standard low-noise surface.

This process would be repeated for any updated design.

For interchanges, mitigation in the form of visual treatment to encourage smooth speed transitions is likely to be required. This is being addressed in the Cultural and Environmental Design Framework (CEDF) which is being prepared for the RMA Application.

In relation to the Tara-Ika subdivision, "reasonable mitigation" is less clear. Ideally, a non-sensitive land use such as commercial development would separate the highway corridor from residential sections. While Waka Kotahi is participating in the Plan Change as a submitter, its ability to influence the masterplan and zone rules is limited. This assessment assumes that sound insulation rules requiring internal noise levels not exceeding 40 dB $L_{Aeq(24h)}$ will be in place, consistent with Waka Kotahi policy[4].

[1] Chiles (2021) Detailed Business Case, Multi Criteria Analysis 24 May 2021
[2] Standards NZ (2010). *NZS 6806:2010 Acoustics – road-traffic noise – new and altered road*
[3] World Health Organisation (2018). *Noise Guidelines for the European Region*
[4] NZ Transport Agency (2015). *Guide to the management of effects on noise sensitive land use near to the state highway network*

Ratings

Consistent with the Phase 1 assessments, the definitions on Table 2 have been used.

Table 2 MCA scores

Score	Alignment rating	Intersection rating
1	n/a – all of the options have adverse noise effects and noise provide significant benefits	No interchange. Free-flowing highway traffic no closer to any PPFs with no additional braking / acceleration
2	Options with no PPFs* above Category A (57 dB) and few above 50 dB	Interchange remote from PPFs and minor consequential effects on local roads
3	Options with no PPFs above Category A (57 dB) and many above 50 dB	Few PPFs affected, or maintenance of free-flowing highway traffic
4	Options with some PPFs in Category B (>57 dB)	Numerous PPFs affected by significant braking/acceleration noise of secondary traffic flow
5	n/a – none of the options should cause significant difficulties	Numerous nearby PPFs affected by significant braking / acceleration noise of the main traffic flow

* PPFs are limited to existing dwellings, and does not include Tara-Ika

3 Information

This assessment has relied specifically on the following information:

- Stantec, Ō2NL Draft multi criteria analysis report: Assessment of new highway alignment, interchange and local road options, July 2020
- Stantec, Ō2NL Draft multi criteria analysis: Post-MCA design update report, 24 August 2020
- Chiles Ltd, Detailed Business Case, Multi Criteria Analysis 24 May 2021
- Horowhenua District Council, Tara-Ika Plan Change 4 as notified
- Waka Kotahi, Submission on Plan Change 4
- Stantec, F2 Geometric Design, May 2021
- Altissimo Consulting, Draft assessment of noise and vibration effects, September 2021
- Stantec, Specialist briefing note and presentation, 22 September 2021
- Stantec, Specialist briefing update and Q&A session, 4 October 2021
- Stantec, GIS vertical alignment options, received 7 October 2021

The author of this report has performed multiple site visits in this area.

4 Existing environment

Noise modelling of existing road traffic noise has been performed for the RMA assessments currently underway. The noise contours from traffic on Arapaepae Road are shown in Figure 1 below.

It is noted that a roundabout on the intersection of Arapaepae Road and Queen Street in the process of being constructed. An additional roundabout at Tararua Road will be installed prior to Ō2NL being constructed.

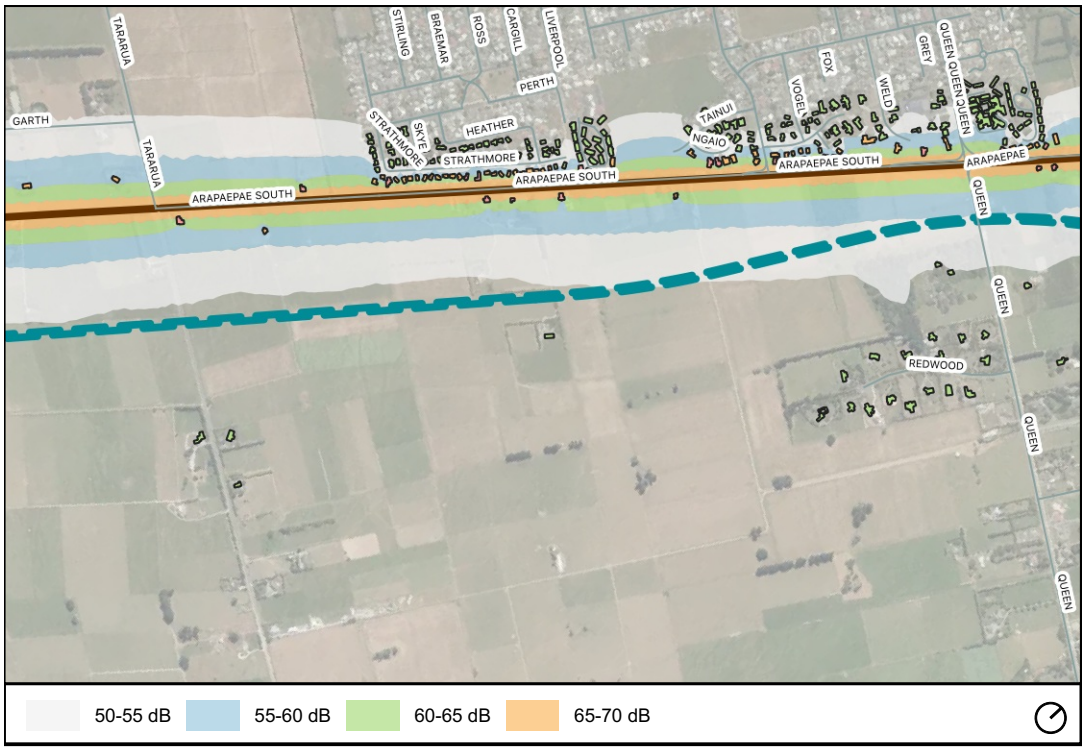


Figure 1 Existing noise environment, dB $L_{Aeq(24h)}$

5 Queen Street

There are few existing PPFs in the vicinity of where the Ō2NL alignment crosses Queen Street. The closest PPF to the alignment is the Prouse Homestead "Ashleigh", with the cluster of dwellings on Redwood Grove being over 300m from the DBC alignment.

Most of the options being considered maintain the grade separation of the expressway and east-west local roads (either Queen Street or an alternative) and therefore do not result in additional braking and acceleration from an at-grade roundabout.

As this option includes changes to the alignment and/or wider transportation network, and alignment rating has also been included.

The evaluation of the options is presented in Table 3. The rating in **bold** is the overall rating.

Table 3 Queen Street options and evaluations

No.	Highway	Queen St	Comment	Alignment Rating	Intersection rating
Q0 (DBC)	Fully submerged	Over (at grade)	• Highway traffic uninterrupted, and significant screened by terrain to Prouse homestead and Redwood Grove dwellings • Queen St traffic uninterrupted • All options result in reduced noise levels at PPFs on Arapaepae Rd than existing traffic network	2	**3**
Q1	Partially submerged	Over (bridge)	• Highway traffic uninterrupted, and moderate screening by terrain • Queen St traffic uninterrupted • Concrete safety barriers on Queen St may reduce sound levels to Prouse homestead	2	**3**
Q2	Bridge	Under	• Highway traffic uninterrupted, and moderate screening by concrete safety barrier. This will mostly benefit the Prouse homestead, with less benefit to more remote dwellings • Queen St traffic uninterrupted	2	**3**
Q3	At grade (roundabout)	At grade	• Both highway and Queen Street interrupted • Slight uphill approached to roundabout may reduce braking / acceleration noise • Approaches to roundabout will require a stone mastic asphalt (SMA) surface to accommodate additional stresses, and the high-performance low-noise surface cannot be used.	2	**5**
Q4	At grade	Close Liverpool Upgrade	• Highway uninterrupted • Dwellings on existing Liverpool St to experience increased traffic noise. Journeys will be primarily from Tara-Ika rather than existing landuse	3	**3**
Q5	At grade	Diverted north Bridge over highway	• Highway uninterrupted • Few PPFs near northern diversion	2	**3**
Q6	Bridge over (~8m AGL)	At grade	• Highway traffic uninterrupted, and moderate screening by concrete safety barrier. This will mostly benefit the Prouse homestead, with less benefit to more remote dwellings resulting in more PPFs above 50 dB • Queen St traffic uninterrupted	3	**3**
Q7	At grade	Bridge over	• Increased distance from Queen St to Prouse Homestead, as well as screening from concrete safety barrier.	2	**3**
Q8	At grade – 5 arm roundabout		• Poor performing roundabout • Increased acceleration and braking noise • Traffic moved away from Prouse homestead and Redwood Close dwellings • Approaches to roundabout will require a stone mastic asphalt (SMA) surface to accommodate additional stresses, and the high-performance low-noise surface cannot be used.	3	**5**

The scores show that there is differentiation between the interchange and non-interchange options, with little differentiation between changes to the alignment.

Scores were circulated prior to the MCA workshop held on 13 October 2021 in terms of an Interchange Rating only. Option Q6 was given a rating of 4 on the basis that an elevated noise source may result in increased noise propagation. An explicit Alignment Rating has now been provided, and ratings of 3 have been evaluated for both Alignment and Intersection.

There were no other questions or issues raised at the workshop that resulted in changes to the pre-workshop scores.

6 Tararua Road

Similar to Queen Street, there are few existing PPFs in this area. We understand that the property at 198 Tararua Road has changed ownership and will be converted to commercial development.

The proximity between the road and adjacent PPFs remains the same, and an assessment is made in Table 4 for the intersection rating only.

Table 4 Tararua Road options and evaluations

No.	Highway	Queen St	Comment	Alignment Rating	Intersection rating
T0 (DBC)	Fully submerged	Over (at grade) Uphill ramps	• Highway uninterrupted • Uphill ramps assist with braking • Closely spaced roundabouts. 2.6% gradient between Arapaepae Rd and roundabout		4
T1	Partially submerged	Over (bridge) Uphill ramps	• Highway uninterrupted • Uphill ramps maintained assist with braking • 4% gradient between Arapaepae Rd and roundabout		4
T2	Over bridge	Partially under Downhill ramps	• Highway uninterrupted • Downhill ramp to roundabouts will increase • Flat between ramp and Arapaepae Rd		4
T3	At grade roundabout		• Highway interrupted • Increased braking and acceleration noise		5
T6	Over	At grade	• Highway uninterrupted • Concrete safety barriers to provide screening		4
T7	At grade	Over (bridge) Ramps at grade	• Highway uninterrupted • 5% gradient between Arapaepae Rd and roundabout		4

The scores show that there is differentiation between the interchange and non-interchange options. There were no questions or issues raised at the workshop that resulted in changes to the pre-workshop scores.

7 Midblock

A computer noise model of the three different vertical alignments (including associated earthworks) has been performed, using the following parameters:

- Traffic volume: 21,000 vehicles per day and 14% Heavy Vehicles
- Posted speed limit: 100 km/h
- Road surface: High performance (50mm thick EPA-7)

The results of the noise model in terms of the 57 and 50 dB $L_{Aeq(24h)}$ contours is presented in Figure 2, overlaid with the Tara-Ika Masterplan from PC4. This midblock noise model excludes the effects from the Queen Street and Tararua Road interchange options.

While the fully submerged option has been included as a reference, it does not require assessment as part of the MCA.

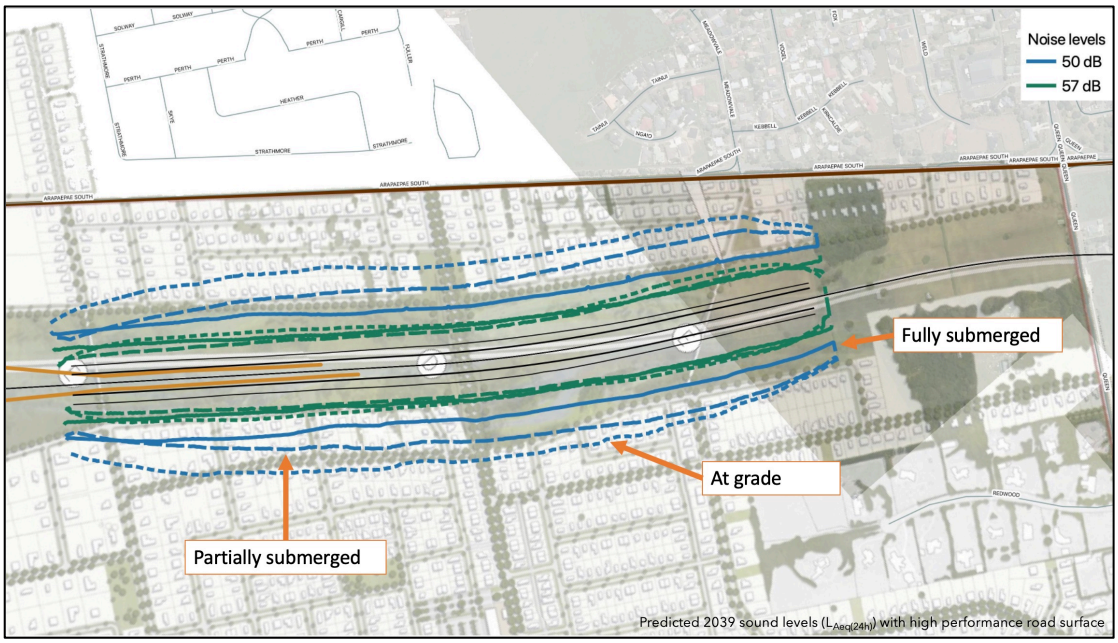


Figure 2 Comparison of noise levels (dB $L_{Aeq(24h)}$)

The noise contours do not include noise mitigation (other than the high-performance road surface). With the inclusion of noise walls and/or bunds within the Ō2NL designation, it is anticipated that the noise contours for each option would be similar. On this basis, there is no differentiation between the two options on a pure noise perspective.

The evaluation is provided in Table 5. There were no questions or issues raised at the workshop that resulted in changes to the pre-workshop scores.

Table 5 Midblock options and evaluations

Option	Highway	Comment	Alignment Rating	Intersection rating
Option 1	Ground level	• NZS 6806 Category A achieved for all residential sections shown in Tara-Ika Masterplan (marginal levels for first row of houses) • Options available for noise mitigation within designation and/or landscape treatment • All options result in reduced noise levels at PPFs on Arapaepae Rd than existing traffic network	3	
Option 2	Below ground	• Terrain screening provides benefit over Option 1 • Options available for noise mitigation within designation and/or landscape treatment	3	

Appendix K Productive Land Assessment Report

To: **Selwyn Blackmore, Stantec NZ**

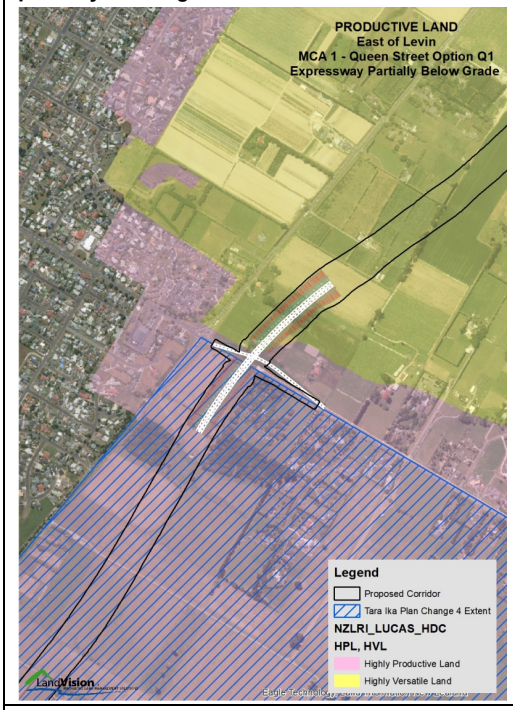
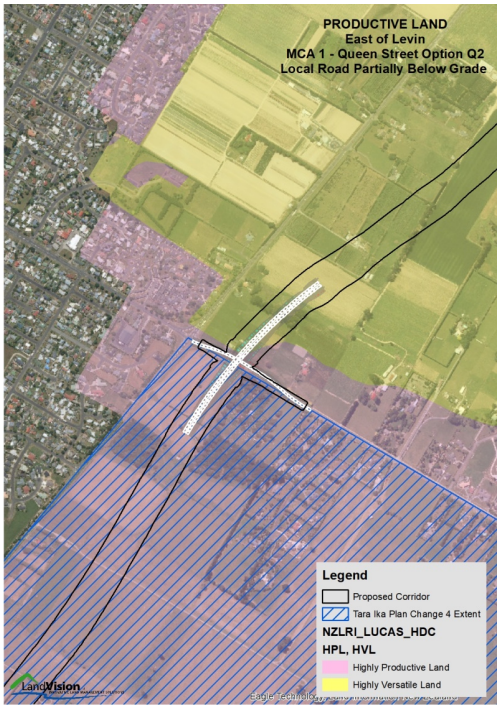
From: **Lachie Grant**

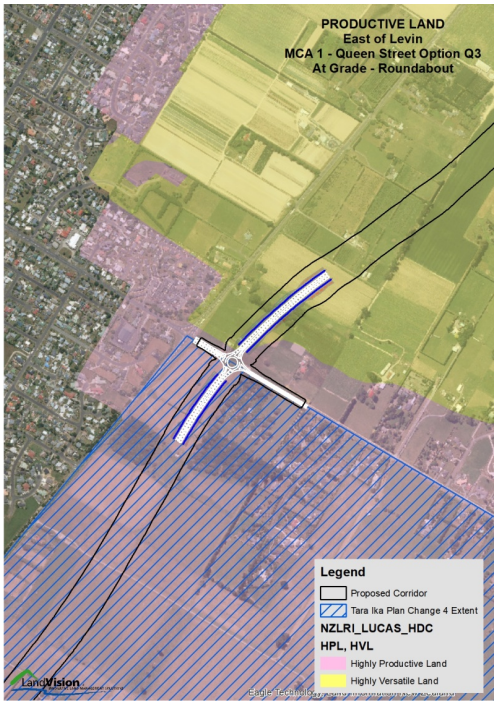
Date: **15 November 2021**

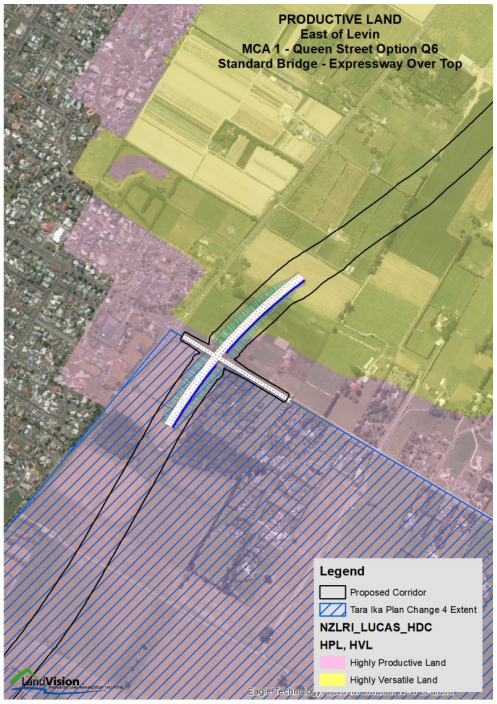
Subject: OTAKI TO NORTH LEVIN MCA WORKSHOP – EAST OF LEVIN 12 OCTOBER '21

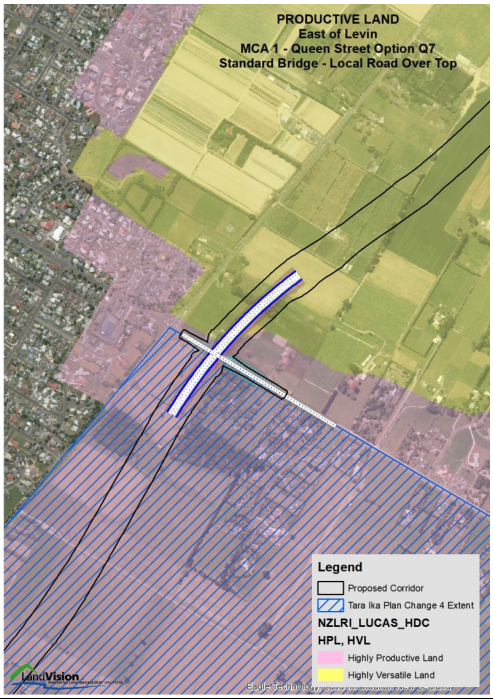
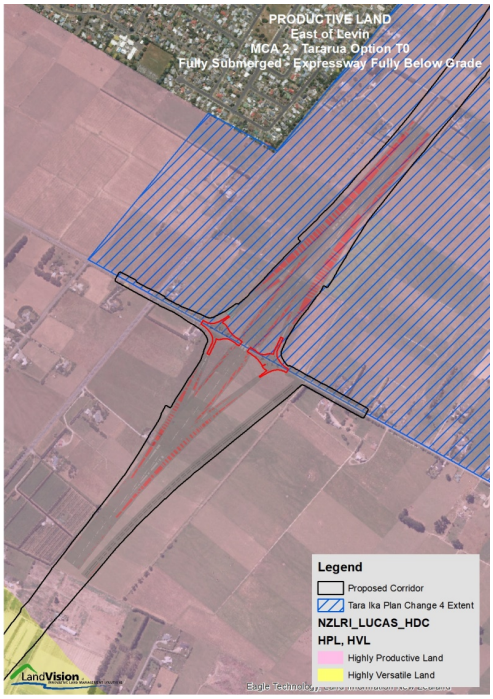
The following options were MCA assessed for productive land.

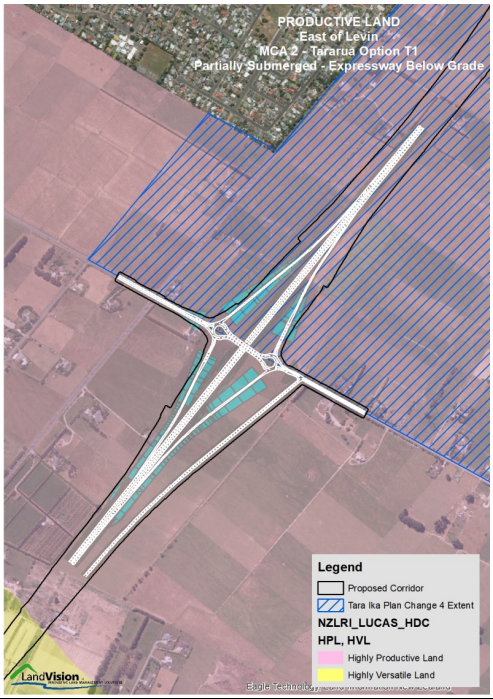
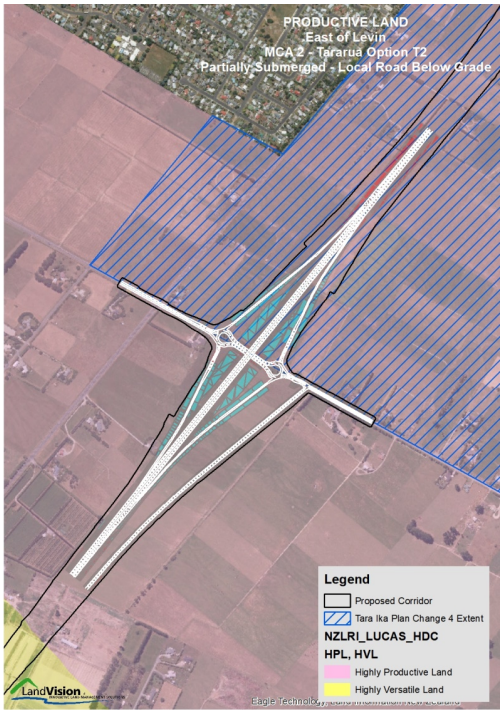
Option	Comment / Score
Option Q0 – Fully submerged, expressway fully below grade 	• Potential effects on soil hydrology of the remaining highly productive and highly versatile land from being fully below grade across the geological tilt. • Generally within the proposed corridor. **MCA Score: 4**

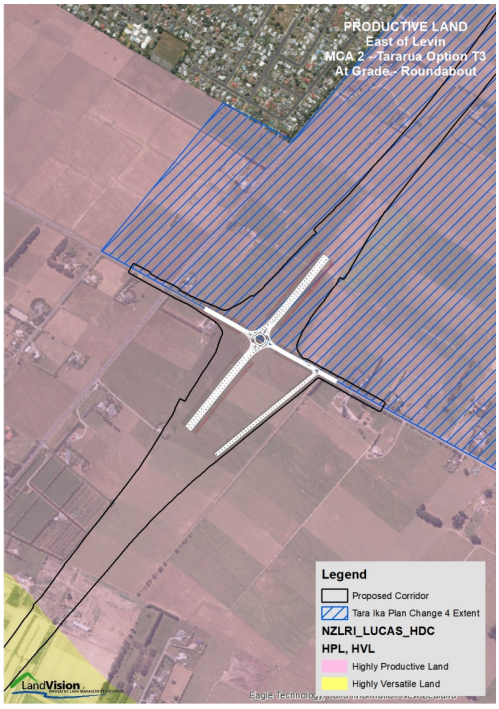
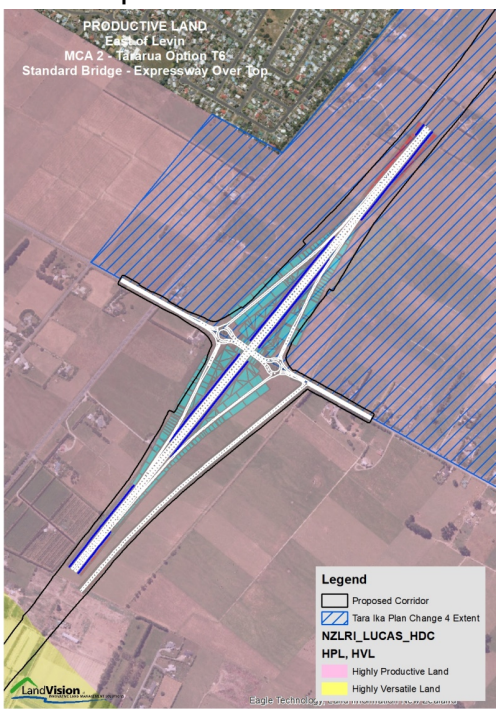
Option Q1 – Partially submerged, expressway partially below grade 	• Potential effects on soil hydrology of the remaining highly productive and highly versatile land from being below grade. Potentially less impactive compared with Option Q1 **MCA Score: 3**
Option Q2 – Partially submerged, Local road partially below grade 	• Local road is submerged with the geological tilt therefore having less impact on the soil hydrology of remaining surrounding highly productive and highly versatile land. • Generally within Plan Change 4 zone **MCA Score: 2**

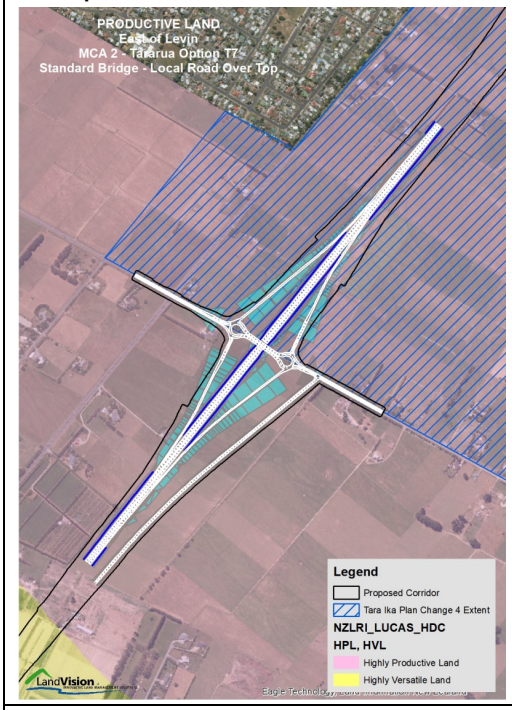
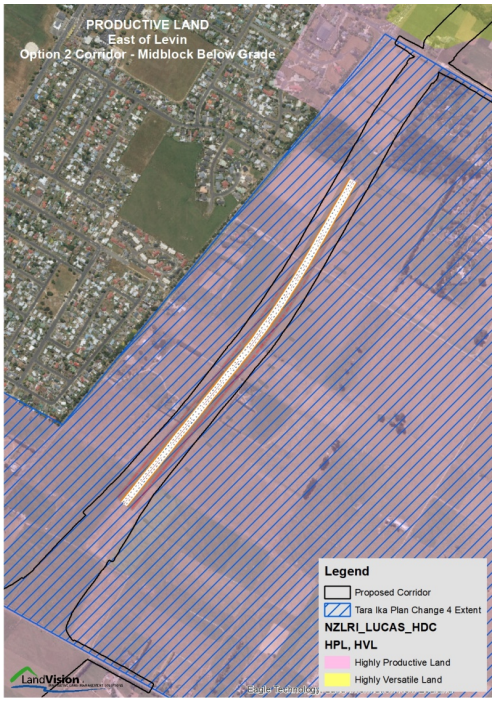
Option Q3 – At Grade – Roundabout 	• Generally contained within the proposed corridor and mostly within Plan Change 4 **MCA Score: 2**
Option Q4 – At Grade – Close Queen, Upgrade Liverpool	• Generally all occurring on highly versatile land but it has a smaller footprint compared with other options • Within Plan Change 4 Zone. **MCA Score: 2**
Option Q5 – At Grade – Queen diverted North 	• Increased loss of highly versatile land. **MCA Score: 3**

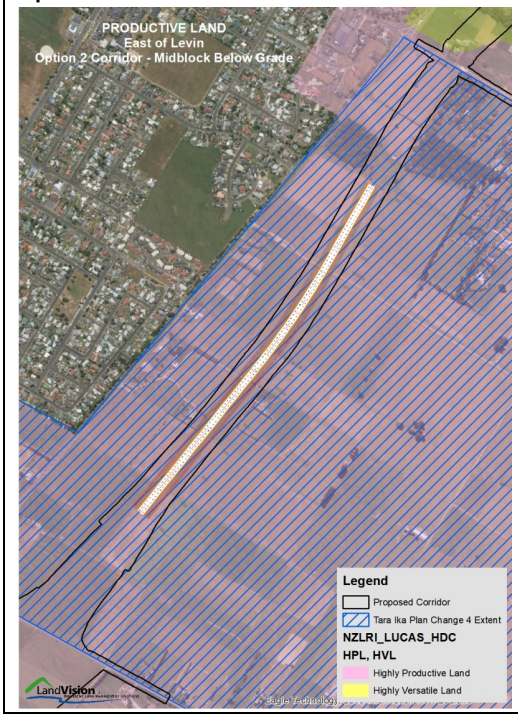
Option Q8 – At Grade – 5 Arm, Shift SH57 South 	• Increased loss of highly versatile land compared with Option Q5. **MCA Score: 4**
Option Q6 – Standard Bridge – Expressway over the Top 	• Generally contained within the proposed corridor and half within Plan Change 4. **MCA Score: 2**

Option Q7 – Standard Bridge – Local Road over the Top 	• More preferable to Option Q6 as the expressway will have a smaller footprint. • Half in Plan Change 4 Zone. **MCA Score: 2**
Option T0 – Fully submerged, expressway fully below grade 	• Potential effects on soil hydrology on the remaining adjacent highly productive land from being fully below grade. **MCA Score: 4**

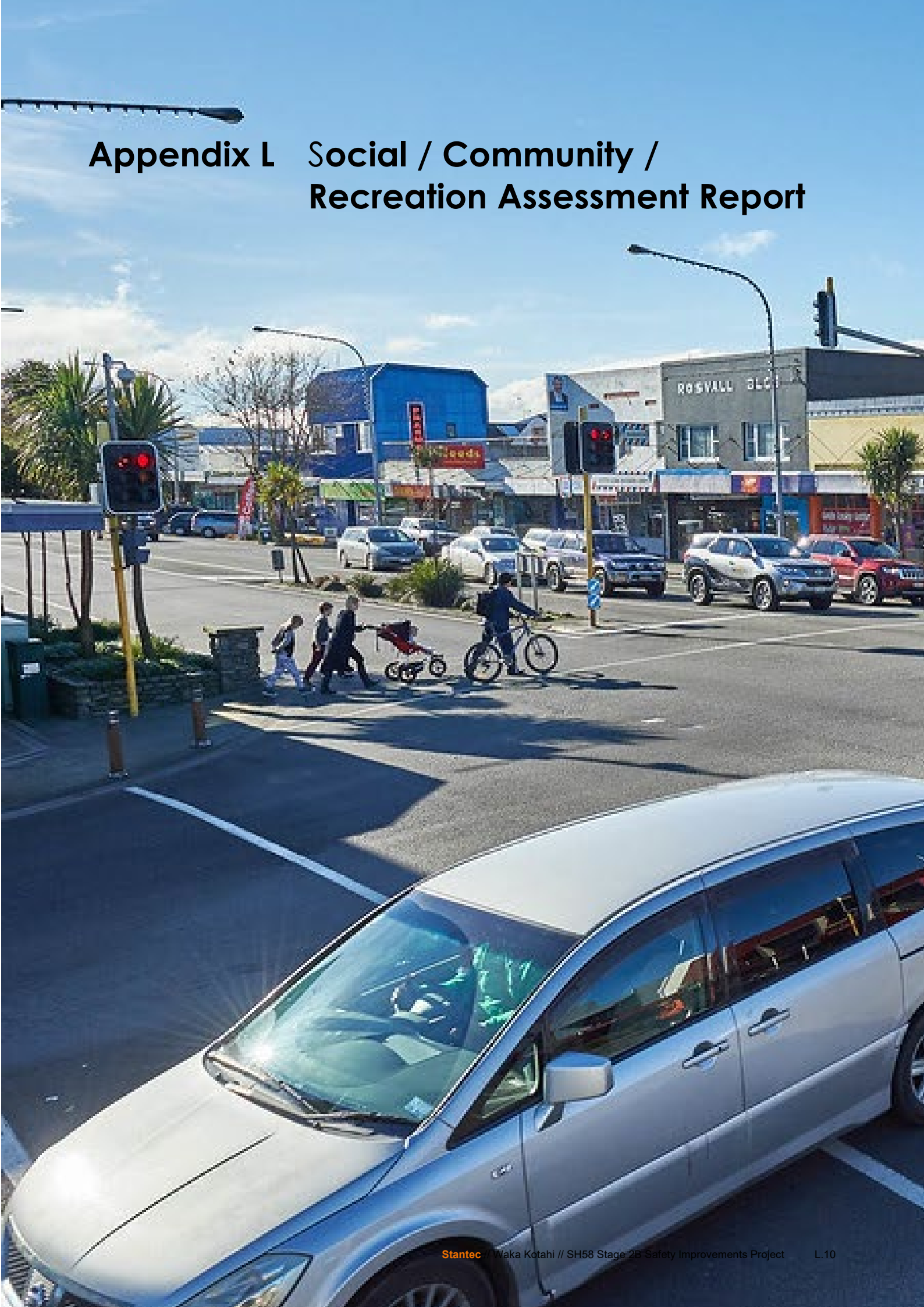
Option T1 – Partially submerged, expressway partially below grade 	• Potential effects on soil hydrology from being below grade but less than Option T1. **MCA Score: 3**
Option T2 – Partially submerged, Local road partially below grade 	• Local road is submerged with the geological tilt therefore having less impact. **MCA Score: 3**

Option T3 – At Grade – Roundabout  	• Larger footprint of highly productive land. • Half within Plan Change 4. **MCA Score: 3**
Option T6 – Standard Bridge – Expressway over the Top  	• Half in Plan Change 4 Zone • Bigger impact on HPL compared with Option T7 **MCA Score: 3**

Option T7 – Standard Bridge – Local Road over the Top 	• Half in Plan Change 4 Zone • Less impactive on soil hydrology. **MCA Score: 3**
Option 1 Corridor – Midblock at Grade 	• Half in Plan Change 4 Zone • Bigger impact on HPL compared with Option T7 **MCA Score: 2**

Option 2 Corridor – Midblock Below Grade 	• Potential impact on soil hydrology • Within Plan Change 4 zone **MCA Score: 3**

Appendix L Social / Community / Recreation Assessment Report



Social Criteria - Options Assessment Report

East of Levin Intersection and Midblock Multi Criteria Analysis- Ōtaki to North of Levin Highway

Prepared for Waka Kotahi
Prepared by Beca Limited

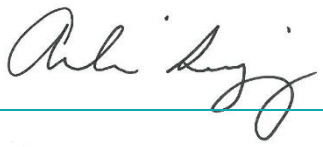
29 October 2021

Creative people together transforming our world

Revision History

Revision Nº	Prepared By	Description	Date
1	Paige Rundle	Draft for team review	28/10/2021
2	Paige Rundle	Draft for client review	29/10/2021
3	Paige Rundle	Final report	29/10/2021

Document Acceptance

Action	Name	Signed	Date
Prepared by	Paige Rundle		28/10/2021
Reviewed by	Sarah MacCormick		28/10/2021
Approved by	Amelia Linzey		29/10/2021
on behalf of	Beca Limited		

Contents

Appendices

1 Introduction

1.1 Purpose of this report

This report has been prepared to support the development of the Ōtaki to north of Levin (Ō2NL) Expressway Detailed Business Case (DBC), and in particular Waka Kotahi's *East of Levin Intersection and Midblock Multi Criteria Analysis (MCA)* process. This report was prepared following the preliminary scoring and MCA workshop held on 13th October 2021.

This report includes:

- The methodology that has been undertaken to assess the options against the social criteria
- The relevant existing social environment
- A summary of scoring and assessment for each option

1.2 Background

A Social Impact Assessment (SIA) has been prepared to support the Ō2NL DBC, the social research done as part of this work has been used to complete this current MCA assessment.

In September 2021, Waka Kotahi decided to undertake an MCA process to help further inform its decision-making on the intersection designs for the new Ō2NL expressway at Queen Street and Tararua Road. In addition, Waka Kotahi requested an MCA evaluation of the road grade level between Tararua Road and Queen Street be also undertaken to inform it's design decision-making processes. Collectively these MCA processes are referred to as the "East of Levin MCA".

2 Methodology

2.1 Criteria for assessment

The MCA included the following social criteria:

"the social / community and recreational impacts on local communities, including community severance / opportunities, and construction phase impacts"

Using IAIA and Waka Kotahi SIA guidelines the following areas of potential social impacts were selected and assessed:

- **Impacts on way of life** – How people carry out and get to their activities of daily living including consideration of access to and between communities and places / centres where people live, work, study and play;
- **Impacts on community cohesion** – Connectivity between people including potential impacts relating to severance of communities and loss of communities (through the physical impact / land take of the project);
- **Impacts on health and wellbeing -** This encompasses a state of complete physical, mental, social and spiritual wellbeing and is not merely the absence of disease or infirmity;
- **Impacts on the quality of the environment** – The sense of place, identity and changes to the character and amenity of living environments and valued community characteristics.

The assessment of potential social impacts is considered as either: positive or negative on the basis of whether the anticipated social consequences will either enhance or detract from the community values, social processes or social infrastructure being assessed. For the assessment of options, it was considered

that most of the positive impacts were related to the general project rather than differentials for specific options, therefore the focus was on potential negative impacts and level of difficulty these present.

There are some similarities between these criteria and those considered by other assessors (for example noise and landscape and visual effects). However, this social assessment focuses on the actual community in which the works are being undertaken and is therefore specific to the potential effects and experience of these at a community and people (user) level, whereas other assessors may focus more on ‘best practice’ or ‘good design’ principles. The social criteria rely on a review of information received from previous community and stakeholder engagement as a basis for completing the assessment as well as drawing on experience from assessing the effects of similar infrastructure and case study and guidance documents

2.2 Social area of influence

For this MCA potential impacts are considered at a local community (Levin) and sub local level (East Levin) (see Figure 1 below). This options evaluation and assessment does not consider impacts at a regional level. This is because the process is to inform decision making on two specific intersections and the road grade level between these. As such it is considered that potential differential impacts between options are most likely to occur at a sub local level (and in some cases local), with impacts and outcomes of the alignment options not being differentiated at a regional scale.

Figure 1: Approximate location of the sub local “East Levin community” (blue) located east of SH57/Arapaepae Rd within the local “Levin community” (red).

Throughout this assessment it is important to note that the SIA does not attempt to account for all ‘individual’ impacts rather an aggregate or collective community impact. As such, it is acknowledged that different

people within a community will experience a project and the impacts of a project in different ways. These individual issues an important consideration to any project and are most appropriately considered through individual submissions from those parties.

2.3 Scoring

Each of the options was assessed in line with the 6-point scoring system provided to all assessors. As described in Table 1 below, scores range from one (few difficulties) to five (significant difficulties) and a fatal flaw score (F) which indicates that an option would result in unacceptable adverse impacts. Based on this scoring system we have taken a balanced approach considering both potential positive and negative impacts; however, for the purpose of differentiation there has been a focus on highlighting potential negative impacts (in particular in the scoring explanations) and whether there is a reasonable possibility of the impacts being minimised through mitigation (or not). This is because potential positive impacts are generally from the wider project and are similar across all of the options. It is mostly the potential negative impacts which change across the options and at the local and sub local scale, so these have been prioritised in scoring to assist the project team in differentiating options.

Table 1: 6 point scoring system to be used by MCA assessors

Score	Description
1	The option presents few difficulties on the basis of the criterion being evaluated and may provide significant benefits in terms of the attribute
2	The option presents only minor aspects of difficulty on the basis of the criterion being evaluated, and may provide some benefits in terms of the criterion
3	The option presents some aspects of reasonable difficulty in terms of the criterion being evaluated and problems cannot be completely avoided. There are few apparent benefits in terms of the criterion
4	The option includes clear aspects of difficulty in terms of the criterion being evaluated, and very limited perceived benefits
5	The option includes significant difficulties or problems in terms of the criterion being evaluated and no apparent benefits
F	The option will result in completely unacceptable adverse effects that cannot be appropriately avoided, remedied or mitigated (including offsetting)

The option plans used in this assessment can be found in Appendix A. As directed each option is assessed against the existing environment i.e. the “do nothing” scenario where the Ō2NL expressway is not constructed (see assumptions below on what is considered to be part of this existing environment).

2.4 Assumptions

As part of this assessment it is assumed that:

- the existing environment includes the Tara Ika plan change (Plan Change 4)
- the planned Ō2NL expressway is included in each option (not just the treatment of local road intersection)
- roundabouts at the intersections of SH57/Arapaepae Rd and Queen St and SH57/Arapaepae Rd and Tararua Rd are part of the existing environment and are not assessed
- reasonable mitigation measures have been assumed (mitigation assumed for specific options is described in Sections 4, 5, and 6.
- the construction of Queen St and Tararua Rd intersections will be staged so that one remains open and access can be maintained throughout this period
- the existing carpark at the start of the Queen St East walkway will be retained or moved to an appropriate nearby location

- walking and cycling facilities are provided on both sides of the road where possible. If only provided on one side (e.g. on a dedicated walking and cycling bridge) it is assumed that safe and appropriate crossing points are provided.

2.5 Data collection

Social research has been carried out in the communities across the Ō2NL project corridor (both with stakeholders and community members) to better understand potential impacts on communities, as well as gain insight into community character, values, challenges and opportunities. This research was led by Jo Healy to assist in completion of the wider SIA and the information gathered has also been used to inform this MCA assessment. This included research activities in Levin and East Levin where the options for this MCA are located; however, all activities are listed below as they provided information and understanding of the wider area (especially as Levin is a major town in the Horowhenua District).

2.5.1 Site visits

Several site visits along the corridor have been undertaken on four separate occasions including two with iwi partners from 2019 to 2021

2.5.2 Community online survey and follow up phone calls

Between June-July 2020, letters were sent to properties within 500m to the east and 300m to the west of the initial 300m corridor, inviting them to participate in an online survey. This survey asked respondents a series of questions around their community, the values, challenges and opportunities of this community, services they access in the community and their thoughts on Ō2NL. Following receipt of responses phone interviews were conducted with a sample group (approximately 20% of respondents) to further canvas community views and understanding of place. For a summary of survey responses see Appendix B.

2.5.3 Stakeholder interviews

Interviews were also conducted with key stakeholders in the community. The majority of these were conducted over the phone, however a smaller number were carried out in person where this was specifically requested by the stakeholder organisation. These interviews followed a similar structure to the online surveys; stakeholders were asked about their role within the community, their insights into community values, opportunities and challenges, and their perceptions on how Ō2NL could impact on themselves and the community they represent.

Interviews were conducted with representatives of the following organisations (noting that some other organisations were contacted but did not respond to a request for an interview):

- Horowhenua District Council (strategic planners involved in the Ōhau and Manukau Community Plans);
- Fairfield School;
- Levin East School;
- Ōtaki College;
- Ōhau School;
- Manakau School;
- Manakau Residents and Ratepayers Association; and
- Horowhenua Ratepayers Association.

In addition to this independent data, public consultation was conducted by Waka Kotahi and the data was reviewed as part of this assessment it included social pinpoint comments, open day feedback and public queries and emails.

2.5.4 Community group engagement

Attendance at community engagement sessions with North Levin, Central Levin, Ōhau and Kuku and Manakau.

3 Existing social environment

Levin is the main town within the Horowhenua District and functions as the business, administrative, retail, civic, cultural, social and recreational hub for the surrounding area. The centre of Levin is situated on SH1 (Oxford St), which along with Queen St form the main streets that define the central business district. Surrounding the civic centre, residential development provides an urban/suburban living environment for the majority of Levin's residents. The urban centre of Levin is surrounded by peri-urban dwellings on the periphery of the town, including in East Levin.

The intersection and road grade options assessed in this MCA are located east of SH57/Arapaepae Rd which borders Levin's more densely populated residential area and between Queen St East and Tararua Rd.

Queen St is the main connector between Central Levin and East Levin. Many facilities and amenities are located around Queen St East in central Levin including two medical centres, Levin East School and Waiopehu college (Figure 2). Residents of East Levin use Queen St to travel to Central Levin to access these and other services, while those in Central Levin access recreational opportunities to the East with the Queen St Walkway, Waiopehu reserve and Kohitere (Trig) walkway (Figure 3).

Figure 2: Key social facilities / services in the Levin (Source: Horowhenua District Council GIS, 2021)

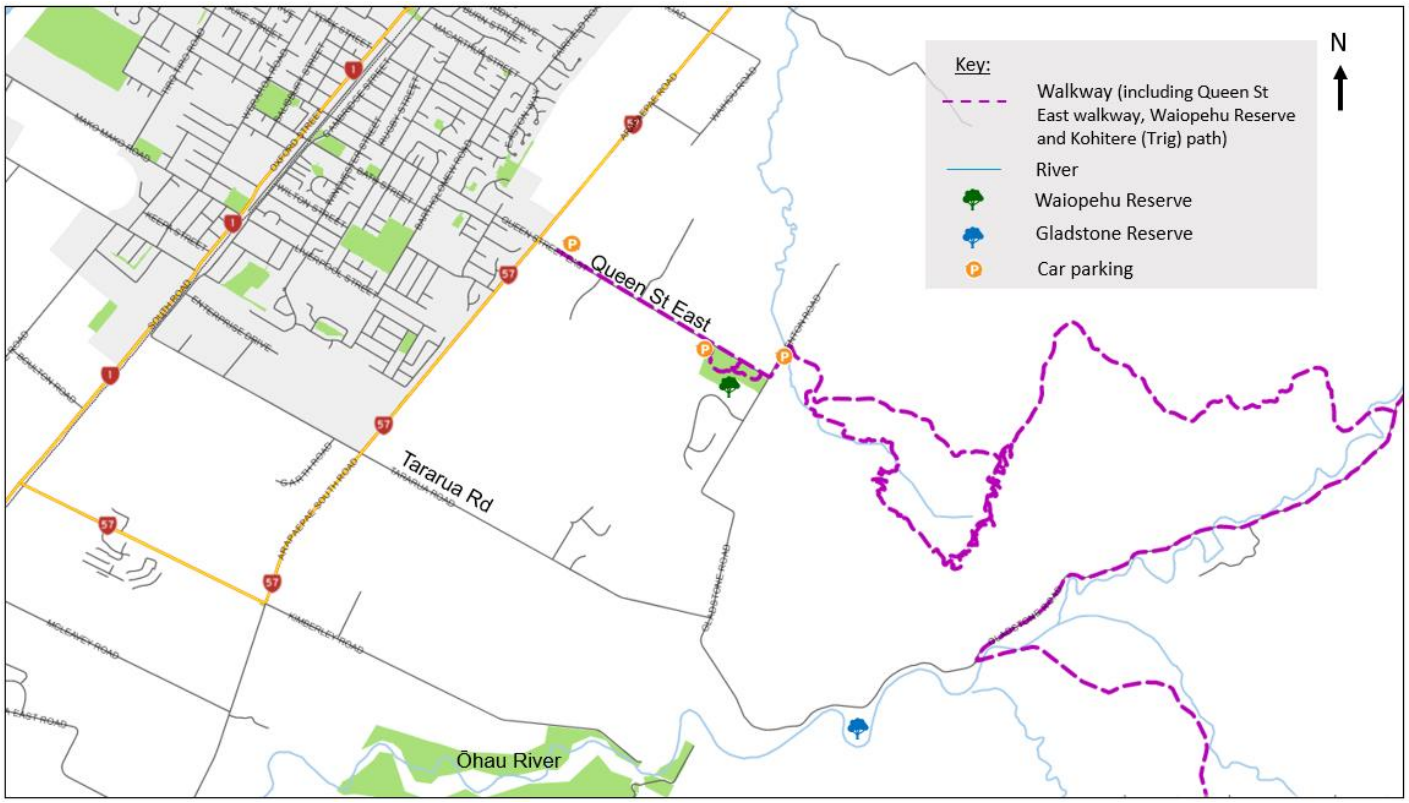


Figure 3: Location of key recreational facilities in East Levin (Source: Horowhenua District Council GIS, 2021)

Tararua Rd connects South Levin and South East Levin providing access for the community into central Levin for services and amenities (less direct route than Queen St) and also access to recreational areas of Ōhau river and Gladstone reserve to the east.

The area between Queen St East and Tararua Rd, known as Tara Ika, is subject to a notified plan change (Plan Change 4) that will change its current zoning and enable more concentrated residential growth in an area that is primarily made up of rural and lifestyle properties. This Plan Change proposes to accommodate up to 2,500 new houses as well as a commercial area, parks and a new school.

While this plan change has not been implemented at the time of this report the assessment assumes that the plan change will be made operative and is part of the existing environment.

4 Queen St Intersection Options

This section assesses the options provided for the intersection between the Ō2NL Expressway and Queen St East. An upgrade of the intersection between SH57 and Queen St East is currently under construction and is considered part of the existing environment that these options are assessed against.

All options have potentially high negative permanent impacts on the existing social environment. Though there are positive impacts of the project (e.g. reduction in death and serious injury crashes, easier movement throughout the region, reduction in congestion and traffic going through Levin) these are not discussed below as they are common across all options.

All options will also present a level of temporary disruption to the community during construction. Where a particular option means disruption is likely to be for a more sustained period or require more disruptive construction methods than other options, this is noted below.

All options will impact on the current car parking facility at the start of the Queen St walkway. It is assumed in the assessment that this will be relocated to an appropriate nearby location.

Option name	Option ref	SIA score	Comments
Expressway full below grade	Q0	2	**Description-** Expressway located fully below grade and Queen St East remains at grade. **Way of life-** Queen St is maintained at current grade providing ease of access for people traversing Queen St by car, foot and bike and minimising disruption of current movements to access services and recreation. Traffic travelling on SH57 (and SH1) may decrease (as people travelling north or south would be expected to use the new expressway) which may make it easier to travel in an east west direction. The excavation below grade will likely result in more sustained construction impacts (in particular noise, vibration) compared to at-grade options, and potentially more disruptive construction methods (for excavation) compared to options with structures. **Community cohesion-** All options create a physical division or separation between the sub local community east of the expressway and the rest of Levin. Connections are maintained across Queen St although some people may lose neighbours and as such there is potential for those people to become more isolated. **Health and wellbeing-** There could be some potential impacts on people's wellbeing due to the change in the environment they are used to and value (mainly related to criteria below 'quality of living environment') and disruption of existing social networks (as some people may need to move out of the

Option name	Option ref	SIA score	Comments
			area), however overall physical and mental health is unlikely to be impacted due to access to health services in Levin and walking/cycling access (which has added health benefits) being maintained. There will likely be some temporary impacts on people's wellbeing due to stress and anxiety arising from uncertainty around property impacts however this can be mitigated through effective communication, fast property purchase and other support mechanisms. **Quality of environment-** The quality of living and recreational environment will potentially be reduced as the rural character and peaceful and quiet environment that are currently valued may be negatively impacted. Locating the expressway below grade may minimise this disruption and the perceived change in environment as it will be less visually prominent than other options. **Overall comment:** Although disruptions on all aspects are minimised and ease of access for people traversing Queen St by car, foot and bike including recreation opportunities is maintained, the expressway still forms a physical division or separation (albeit underground) that provides a potential severance to the wider Levin community and potentially reduces the quality of the living environment (although mitigation is more likely to minimise this compared to other options). Therefore, this option is considered to present minor aspects of this potential impact and this is not sufficiently less to differentiate in the scoring from Q1.
Expressway partially below grade	Q1	2	**Description-** Expressway is located partially below grade and Queen St East overbridge is constructed slightly above grade (and realigned slightly to the north). It is assumed that this bridge is only slightly raised (and would be less prominent than Q7). Walking and cycling facilities are provided on this bridge and it is assumed that this will be on both sides of the road (or if only on one side that appropriate and safe crossing points would be provided). **Way of life -** Queen St is maintained in a condition similar to the existing situation. Minimised disruption to existing movements to access services and recreation. For example, it is considered these are still accessible to walking and cycling although a higher bridge might make this slightly more difficult for some (gradients for travel). The excavation below grade will likely result in more sustained construction impacts compared to at-grade options, and potentially more disruptive construction methods (for excavation) compared to options with structures. **Community cohesion -** Similar to Q0, this option creates a physical division or separation between sub local community east of the expressway and the rest of Levin. Connections are maintained across Queen St although as such there is potential for some people to become more isolated.

Option name	Option ref	SIA score	Comments
			Health and wellbeing - There could be some potential impacts on people's wellbeing due to the change in the environment they are used to and value (mainly related to criteria below 'quality of living environment') and disruption of existing social networks (as some people may need to move out of the area), however overall physical and mental health is unlikely to be impacted due to access to health services in Levin and walking/cycling access (which has added health benefits) being maintained. There will likely be some temporary impacts on people's wellbeing due to stress and anxiety arising from uncertainty around property impacts however this can be mitigated through effective communication, fast property purchase and other support mechanisms. **Quality of environment -** Reduction in quality of living environment is slightly worse than Q0 as the expressway is more visible. This is not considered to warrant a differentiation in scores and is still considered to represent minor level of difficulty. **Overall comment:** Although disruptions on all aspects are minimised and access for people traversing Queen St by car, foot and bike including recreation opportunities is maintained, the expressway still forms a physical 'division' (albeit partially underground) that provides a potential severance to the wider Levin community and potentially reduces the quality of the living environment. Slight reduction in quality of living environment when compared to Q0 however other aspects are similar. While Q0 is better than Q1 based on these criteria, this option is still considered to present only minor aspects of difficulty and the difference between the options does not justify a differentiation in scores.
Local Rd partially below grade	Q2	3	**Description:** Expressway is at grade and an underpass is constructed for Queen St. Walking and cycling facilities would also be provided on this underpass. Queen St realigned slightly north and speed limit reduced. **Way of life -** Direct access along Queen St to access services and recreational facilities is maintained. Though this is now through an underpass (which maybe a less desirable environment for pedestrians and cyclists) people can still travel by car, bike or foot to carry out their day-to-day activities. The excavation below grade will likely result in more sustained construction impacts compared to at-grade options, and potentially more disruptive construction methods (for excavation) compared to options with structures. **Community cohesion -** At grade expressway is more visible forming a physical 'division' between East Levin and the wider local community that is more prominent and have a greater potential impact on perceived connectivity. Though direct connections across this barrier are present this may potentially be

Option name	Option ref	SIA score	Comments
			perceived as a greater barrier and therefore is considered to have a greater potential cohesion severance, than options with the expressway below grade. **Health and wellbeing -** There could be some potential impacts on people's wellbeing due to the change in the environment they are used to and value (mainly related to criteria below 'quality of living environment') and disruption of existing social networks (as some people may need to move out of the area), however overall physical and mental health is unlikely to be impacted due to access to health services in Levin and walking/cycling access (which has added health benefits) being maintained. There will likely be some temporary impacts on people's wellbeing due to stress and anxiety arising from uncertainty around property impacts however this can be mitigated through effective communication, fast property purchase and other support mechanisms. The underpass has the potential to be perceived as less safe for pedestrians and cyclists if visibility, lighting and passive surveillance is reduced (potentially reducing use or increasing wellbeing impacts for users). **Quality of environment -** Potential reduction in quality of living environment (for current and future community) as the at grade expressway may reduce the amenity of the area and disrupt the quiet and natural aspects of the rural environment that are valued. Below grade options are often less desirable for walking and cycling connections and the underpass may reduce the quality and enjoyment of environment for recreation. **Overall comment -** Due to the increased visual presence of the expressway, this option may present some aspects of reasonable difficulty in terms of community cohesion and quality of environment. Depending on how the underpass is perceived this could also have a potential impact on health and wellbeing and quality of the environment. While some mitigation may be possible through screening this cannot be completely avoided as the physical 'division' and separation of central and east Levin by the expressway will remain prominent.
At grade roundabout	Q3	3	**Description:** The expressway and Queen St intersect at a roundabout which is at-grade. A separate walking and cycling bridge is provided on the northern side. It is assumed that safe crossing points would be provided to enable pedestrians and cyclists to access the bridge from both sides of Queen St. **Way of life -** Travel in an east west direction will change (potentially take longer for people depending on the level of traffic passing along the expressway) as people will now have to travel through an additional intersection to access services or recreational facilities, impeding this direct connection. This option also means that those travelling east or west will have to interact with vehicles on the expressway. This is similar to the existing environment where people have to interact with through-traffic which currently

Option name	Option ref	SIA score	Comments
			travels along SH57 or SH1; however, this option still introduces an additional conflict point (that some other options avoid). Movement for pedestrians and cyclists is also less direct than the existing environment as they will need to cross to the appropriate side of the road and also travel up the bridge (which may be a barrier for some). **Community cohesion -** Provides some potential severance as it introduces a slight (though permeable) barrier to east west movements along Queen St as well as the visual separation noted with other at grade options. There is a benefit of direct access to the expressway and north south movement which would aid connection to communities in the surrounding area and down to Wellington. **Health and wellbeing -** There could be some potential impacts on people's wellbeing due to the change in the environment they are used to and value (mainly related to criteria below 'quality of living environment') and disruption of existing social networks (as some people may need to move out of the area), however overall physical and mental health is unlikely to be impacted due to access to health services in Levin and walking/cycling access (which has added health benefits) being maintained. There will likely be some temporary impacts on people's wellbeing due to stress and anxiety arising from uncertainty around property impacts however this can be mitigated through effective communication, fast property purchase and other support mechanisms. **Quality of environment -** The roundabout introduces a new physical structure into the existing environment and will potentially increase noise and air pollution from vehicles braking and accelerating, especially from those potentially travelling at a higher speed along the expressway (which could be mitigated by lowering speed limits in certain areas). This has the potential to reduce the quality of the environment for living and recreation that is valued for its rural character. While this will change as the area becomes more urbanised this will still likely be a disruption and negatively impact the enjoyment of a tranquil environment, views and birdlife. The walking and cycling bridge does offer an opportunity for enjoyment and interpretation of views of the surrounding landscape but overall this will likely be reduced. **Overall comment-** This option presents aspects of reasonable difficulty as it potentially disrupts the existing community in regard to quality of living environment, community cohesion and way of life, and has the potential to make traversing Queen St more difficult. The walking and cycling bridge may reduce the ease of movement across this road when compared to the existing environment where no expressway is present; however, this bridge is likely to be more desirable than the underpass in Q2, especially if there are opportunities to enjoy views from the top.

Option name	Option ref	SIA score	Comments
At grade close Queen St and upgrade Liverpool	Q4	4	**Description:** Expressway is at grade and Queen St East is closed to vehicles. Pedestrians and cyclists will be able to cross the expressway at Queen St via a separate walking and cycling bridge. Liverpool St is upgraded to replace the connection at Queen St including the extension of Liverpool St to SH57, a new roundabout at SH57/Liverpool St, and a Liverpool St bridge over the expressway with walking and cycling facilities. It is assumed the rest of the Central Spine connection (that connects through to Gladstone Rd) is included in this option and would be constructed prior to the closure of Queen St (which could be prior to the development of Tara Ika). **Way of life**- Queen St East currently connects East Levin to the centre of Levin's CBD so this closure has the potential to disrupt current movements and way of life. Residents living along Queen St and Denton Rd will lose the existing direct vehicle connection to the centre of Levin. Instead, a longer indirect route back along Queen St in the opposite direction to Gladstone Rd and across Liverpool St will potentially be required to access services, schools and workplaces. Those travelling from Central Levin to use recreational facilities may also have to use a less direct route from South Levin. Vehicle access to the start of the Queen St walkway is also impeded. Though this could still be accessed by walking and cycling it may be more difficult for residents that live further away to access this recreational facility. A parking facility may be able to be relocated on the closed stretch of Queen St between SH57 and the expressway. This has not been assumed for the purposes of this assessment (but is unlikely to change the overall score). **Community cohesion**- An at grade expressway will be more visibly present and the closure of Queen St to vehicles will form a physical barrier between Central and East Levin and sever the existing direct connection. This has the potential to contribute to perceived isolation of current Queen St East residents from the rest of the Levin community they identify with, especially prior to the development and establishment of a new residential community at Tara Ika – this has potential adverse impacts on community cohesion. **Health and wellbeing**- There could be some potential impacts on people's wellbeing due to the change in the environment they are used to and value (mainly related to criteria below 'quality of living environment') and disruption of existing social networks (as some people may feel isolated from wider Levin and also have neighbours leaving the area). Though access to health services in Levin and walking/cycling access (which has added health benefits) is potentially made more difficult, it is still possible and unlikely to impact overall physical and mental health. There will likely be some temporary impacts on people's wellbeing due

Option name	Option ref	SIA score	Comments
			to stress and anxiety arising from uncertainty around property impacts however this can be mitigated through effective communication, fast property purchase and other support mechanisms. **Quality of environment**- Potential reduction in quality of living environment (for current and future community) as the at grade expressway may reduce the amenity of the area and disrupt the quiet and natural aspects of the rural environment that are valued (to a similar extent as other at grade options). The closure of Queen St to vehicles has potential to improve the enjoyment of the Queen St walkway however this is considered to be of minor benefit when compared to the potential negative impacts arising from loss of direct access and severance. **Overall comment**- Clear aspects of difficulty are presented as the direct connection with Central Levin for vehicles is severed through the closure of Queen St (Liverpool St is not as direct) which has the potential to increase perceived severance and isolation of East Levin residents from the wider Levin community. It also has the potential to create a change in environment for those to the west where traffic is diverted. It is assumed that a central spine connection of some form connecting Tara Ika to SH57 will be present in the future to enable this residential development (but that this may not extend into Liverpool St). It is worth noting that if the upgrade of Liverpool St was considered on its own and not associated with closure of Queen St it would likely be given a more positive score.
At grade Queen Street diverted north	Q5	3	**Description**: Expressway is at grade and Queen St East is closed to vehicles. Vehicles are redirected northwards on a new road from Redwood Grove to a new roundabout on SH57 approximately 600 metres north of the existing Queen St/SH57 intersection. Pedestrians and cyclists will be able to travel along the existing Queen St East alignment via a walking and cycling bridge. This assessment assumes that the redirected local road will be raised above the expressway (rather than the realigned Queen St being at grade with the expressway raised over top which may have additional negative impacts). **Way of life-** Queen St East currently connects East Levin to the centre of Levin's CBD so this closure has the potential to disrupt current movements to access services, schools, workplaces and recreation. Direct connection to services and recreation is disrupted however east west vehicle movement is still possible, just slightly longer and less direct (approximately 800m from the start of the diversion at Redwood Grove). For residents of Queen St this is likely to be a more direct route to the CBD than the upgrading of Liverpool St in Q4. This option includes a new section of road, through sites off SH57/Arapaepae Road, in particular a large agricultural site which it bisects through which will be an impact on that business

Option name	Option ref	SIA score	Comments
			operation as it may be difficult to operate going forward in two sections. Property purchase agreements may go some way to mitigate but it will likely be difficult to relocate that operation to another site. **Community cohesion**- At grade expressway forms a physical division and separation and the existing direct connection between Central and East Levin is closed. This has the potential to be perceived as a severance and may make current residents of Queen St East feel more isolated from the wider Levin community, especially prior to the development and establishment of new communities at Tara Ika. **Health and wellbeing-** There could be some potential impacts on people's wellbeing due to the change in the environment they are used to and value (mainly related to criteria below 'quality of living environment') and disruption of existing social networks (as some people may feel isolated from wider Levin and also have neighbours leaving the area). Though access to health services in Levin and walking/cycling access (which has added health benefits) is potentially made more difficult, it is still possible and unlikely to impact overall physical and mental health. There will likely be some temporary impacts on people's wellbeing due to stress and anxiety arising from uncertainty around property impacts, and in particular the large agricultural site; however, this can be mitigated through effective communication, fast property purchase and other support mechanisms. The large orchard site could be classified as a potentially contaminated site due to past/current horticultural activities; the construction works in this area would need to be carefully managed for the health of surrounding neighbours and construction workers. **Quality of environment-** Potential reduction in quality of living environment (for current and future community) as the at grade expressway may reduce the amenity of the area and disrupt the quiet and natural aspects of the rural environment that are valued (to a similar extent as other at grade options). **Overall comment**- At grade expressway forms a physical 'division' between East Levin and wider community. Diverted Queen St also disrupts the existing direct connection to recreation and services; however, this diversion is more direct than the option to upgrade Liverpool St which justifies a lower score. Some potential benefit as bridge continues to provide walking and cycling access and this could be improved by having reduced traffic on this section of Queen St.
Expressway over top	Q6	4	**Description**- Queen St remains it is current form at grade with walking and cycling facilities provided. Expressway rises above Queen St on a 70-metre-long bridge. **Way of life**- Queen St is maintained at current grade providing ease of access for people traversing Queen St by car, foot and bike and minimising disruption of current movements to access services and recreation.

Option name	Option ref	SIA score	Comments
			Community cohesion- Above grade expressway is more visually prominent than below and at grade options therefore may be perceived as a greater division or separation between East Levin and the wider Levin community. Though direct local road connections under the bridge are retained this may be perceived as potential severance. **Health and wellbeing**- There could be some potential impacts on people's wellbeing due to the change in the environment they are used to and value (mainly related to criteria below 'quality of living environment') and disruption of existing social networks (as some people may need to move out of the area), however overall physical and mental health is unlikely to be impacted due to access to health services in Levin and walking/cycling access (which has added health benefits) being maintained. There will likely be some temporary impacts on people's wellbeing due to stress and anxiety arising from uncertainty around property impacts however this can be mitigated through effective communication, fast property purchase and other support mechanisms. **Quality of environment**- Potential reduction in quality of living environment (for current and future community) as the elevated expressway may reduce the amenity of the area and disrupt the quiet and natural aspects of the rural environment that are valued. Although noise levels may be quieter than at grade or below grade options, the elevated expressway will be more visible from a further distance and will potentially reduce the enjoyment of the recreation and living environment over a larger area. Some existing views from Levin across the rural landscape to the Tararua Ranges may be disrupted. **Overall comment**- Elevated expressway is more visually prominent than at-grade options resulting in a potential perceived severance and reducing the quality and enjoyment of environment over a larger area. Although local road connection is retained the raised expressway represents a greater degree of change than at grade options. These are considered to be aspects of clear difficulty and justifies a higher score that options with the expressway at grade.
Local road over top	Q7	3	**Description-** Expressway is at grade and Queen St is raised above on an overbridge (and realigned slightly northwards). Walking and cycling facilities are provided on Queen St overbridge and speed limit on Queen St is reduced. **Way of life-** Small potential reduction in existing ease of access of services and recreation but connection is maintained. Overbridge for walking and cycling connection is a potential barrier for some (but also presents an opportunity to provide a lookout point).

Option name	Option ref	SIA score	Comments
			Community cohesion- Though connection along Queen St is maintained, the at grade expressway still forms a physical 'division' which has the potential to provide perceived severance between East Levin and the wider Levin community. The raised Queen St overbridge is likely to be perceived as less of a severance than the expressway overbridge in Q6 as it does not elevate an east west divide. **Health and wellbeing-** There could be some potential impacts on people's wellbeing due to the change in the environment they are used to and value (mainly related to criteria below 'quality of living environment') and disruption of existing social networks (as some people may need to move out of the area), however overall physical and mental health is unlikely to be impacted due to access to health services in Levin and walking/cycling access (which has added health benefits) being maintained. There will likely be some temporary impacts on people's wellbeing due to stress and anxiety arising from uncertainty around property impacts however this can be mitigated through effective communication, fast property purchase and other support mechanisms. **Quality of environment-** Potential reduction in quality of living environment (for current and future community) as the at grade expressway may reduce the amenity of the area and disrupt the quiet and natural aspects of the rural environment that are valued. **T**his option has the potential to disrupt views to the Tararua ranges from Levin; however, this is likely to be to a lesser extent than Q6 as the overbridge will be in an east west direction (rather than in a north south direction with the raised expressway). **Overall comment-** At grade expressway forms a physical 'division' that provides potential severance to the wider Levin community and potentially reduces the quality of the living environment. Raising Queen St is considered to present less difficulty than Q6 as it does not form a visual west to east barrier which reflects the main directions of movement and is less disruptive views to Tararua Ranges (which could be enjoyed from a lookout point on the overbridge).
At grade 5 arm shift SH57 connection south	Q8	3	**Description-** Expressway is at grade and Queen St East closed to vehicles. Queen St and SH57 are diverted to connect to the expressway at a 5-arm roundabout. This replaces the connection in other options where the expressway connects to SH57 north of Levin near McDonald Rd. Pedestrians and cyclists will be able to travel along the existing Queen St East alignment via a walking and cycling bridge. **Way of life-** Potential reduction in ease of access for people traversing Queen St by car as vehicles are diverted north and interact with expressway and SH57 traffic. Adds an additional major intersection which drivers have to travel through. It is also assumed that this area around East Levin and Queen St leading into the CBD would receive greater traffic volumes as this replaces the connection to the north of Levin. This option includes a new roundabout and connections through a large agricultural orchard site off

Option name	Option ref	SIA score	Comments
			SH57/Arapaepae Road, which provides a further severance of this site (compared to just the expressway) and will be an impact on that business operation as it may be difficult to operate going forward. Property purchase agreements may go some way to mitigate but it will likely be difficult to relocate that operation to another site. **Community cohesion-** At grade expressway forms a physical division or barrier that separates central and east Levin. Though the ability to move between central and east Levin is maintained this connection is less direct than existing connection and may form a potential perceived severance. **Health and wellbeing-** There could be some potential impacts on people's wellbeing due to the change in the environment they are used to and value (mainly related to criteria below 'quality of living environment') and disruption of existing social networks (as some people may need to move out of the area), however overall physical and mental health is unlikely to be impacted due to access to health services in Levin and walking/cycling access (which has added health benefits) being maintained. There will likely be some temporary impacts on people's wellbeing due to stress and anxiety arising from uncertainty around property impacts however this can be mitigated through effective communication, fast property purchase and other support mechanisms. The large orchard site could be classified as a potentially contaminated site due to past/current horticultural activities; the construction works in this area would need to be carefully managed for the health of surrounding neighbours and construction workers. **Quality of environment**- Potential reduction in quality of living environment (for current and future community) as the at grade expressway and roundabout may reduce the amenity of the area and disrupt the quiet and natural aspects of the rural environment that are valued. **Overall comment-** At grade expressway forms a physical 'division' between East Levin and wider community and potentially reduces the quality of environment. Diverted Queen St also disrupts the existing direct connection to recreation and services by car and the walking and cycling bridge may reduce the ease of movement along this road for some. These are aspects of reasonable difficulty and are similar to Q3 and Q5.

5 Tararua Rd Intersection Options

This section assesses the options provided for the intersection between the Ō2NL Expressway and Tararua Rd. An upgrade of the intersection between SH57 and Tararua Rd is considered part of the existing environment that these options are assessed against.

As with the Queen St intersection, all options have potentially high negative permanent impacts on the existing social environment. Though there are positive impacts of the project (e.g. reduction in death and serious injury crashes, easier movement throughout the region, reduction in congestion and traffic going through Levin) these are not discussed below as they are common across all options.

All options will also present a level of temporary disruption to the community during construction. However, where a particular option means disruption is likely to be for a more sustained period or require more disruptive construction methods than other options, this is noted below.

Some scores are higher than the corresponding option for the Queen St intersection. This is because the infrastructure providing entry to and exit from the expressway at this location have additional potential negative effects.

Option name	Option ref	SIA score	Comments
Expressway full below grade	T0	3	**Description:** Expressway located fully below grade and Tararua remains at grade. Two new roundabouts either side of the expressway provide access on and off the expressway. No walking and cycling facilities are provided. **Way of life-** Tararua Rd is maintained at current grade however ease of access for people traversing Queen St by car, foot and bike to access services and recreation is reduced. People travelling in an east west direction will have to traverse three roundabouts (two additional to the base environment) which has the potential to increase difficulty, particularly for pedestrians and cyclists. The excavation below grade will likely result in more sustained construction impacts compared to at-grade options, and potentially more disruptive construction methods (for excavation) compared to options with structures. **Community cohesion-** All options create a physical division or separation between the sub local community east of the expressway and the rest of Levin. Connections are maintained across Queen St although some people may lose neighbours and become more isolated. **Health and wellbeing-** The new roundabouts have the potential to create perceived and actual safety concerns for pedestrians and cyclists who will have to navigate two additional conflict points with high-speed traffic coming on and off the expressway. While it is assumed that the provided walking and cycling

Option name	Option ref	SIA score	Comments
			facilities will include safe crossing points this will still likely be a disruption to the existing environment and may impact on how safe people feel when using this intersection. **Quality of environment-** The quality of living and recreational environment will potentially be reduced as the rural character and peaceful and quiet environment that are currently valued may be negatively impacted. Locating the expressway below grade may minimise this disruption and the perceived change in environment as it will be less visually prominent than other options. **Overall comment:** Although disruption to community cohesion and quality of living environment may be minimised by the location of the expressway below grade, the new roundabouts introduce additional conflict points with high-speed traffic which present reasonable difficulty (in particular for pedestrians and cyclists) that cannot be completely avoided. These difficulties are considered to be more than minor and of a reasonable level.
Expressway partially below grade	T1	3	**Description**: Expressway is located partially below grade and Tararua Rd is slightly raised on an overbridge. Two additional roundabouts (located either at grade or slightly raised) either side of the provide access on and off the expressway. Walking and cycling facilities are provided on Tararua Rd and it is assumed that this will be on both sides of the road and provide safe passage through the new feeder roundabouts. **Way of life-** Ease of access for people traversing Tararua Rd by car, foot and bike to access services and recreation is reduced. People travelling in an east west direction will have to traverse three roundabouts (two additional to the existing environment) which may increase difficulty, particularly for pedestrians and cyclists. The excavation below grade will likely result in more sustained construction impacts compared to at-grade options, and potentially more disruptive construction methods (for excavation) compared to options with structures. **Community cohesion-** Similar to T0 and this option also creates a physical division or separation between sub local community east of the expressway and the rest of Levin. Connections are maintained across Queen St although some people may lose neighbours and become more isolated. **Health and wellbeing-** The new roundabouts have the potential to create perceived and actual safety concerns for pedestrians and cyclists who will have to navigate two additional conflict points with high-speed traffic coming on and off the expressway. While it is assumed that the provided walking and cycling

Option name	Option ref	SIA score	Comments
			facilities will include safe crossing points this will still likely be a disruption to the existing environment and may impact on how safe people feel when using this intersection. **Quality of environment-** Reduction in quality of living environment is slightly worse than T0 as the expressway is more visible. This is not considered to warrant a differentiation in scores and is still considered to represent minor level of difficulty. **Overall comment:** Although disruption to community cohesion and quality of living environment may be minimised by the location of the expressway below grade, the new roundabouts introduce additional conflict points with high-speed traffic which present reasonable difficulty (in particular for pedestrians and cyclists) that cannot be completely avoided. These difficulties are considered to be more than minor and of a reasonable level. While T0 is better than T1 based on these criteria, this option is still considered to present only reasonable aspects of difficulty and the difference between the options does not justify a differentiation in scores.
Local Rd partially below grade	T2	3	**Description:** Expressway is at grade and an underpass is constructed for Tararua Rd. Walking and cycling facilities would also be provided on this underpass. Two additional roundabouts (located either at grade or partially below) either side of the provide access on and off the expressway. **Way of life-** Ease of access for people traversing Tararua Rd by car, foot and bike to access services and recreation is reduced. People travelling in an east west direction will have to traverse three roundabouts (two additional to the existing environment) which has the potential to increase difficulty, particularly for pedestrians and cyclists. The excavation below grade will likely result in more sustained construction impacts compared to at-grade options, and potentially more disruptive construction methods (for excavation) compared to options with structures. **Community cohesion-** At grade expressway is more visible forming a physical division or separation between East Levin and the wider Levin community that is likely to feel more prominent and have a greater potential impact on perceived connectivity. Though direct connections across this barrier are present this may potentially be perceived as a greater severance than options with the expressway below grade. **Health and wellbeing-** The new roundabouts have the potential to create perceived and actual safety concerns for pedestrians and cyclists who will have to navigate two additional conflict points with high-speed traffic coming on and off the expressway. While it is assumed that the provided walking and cycling facilities will include safe crossing points this will still likely be a disruption to the existing environment and

Option name	Option ref	SIA score	Comments
			may impact on how safe people feel when using this intersection. The underpass has the potential to be perceived as less safe for pedestrians and cyclists if visibility, lighting and passive surveillance is reduced (potentially reducing use or increasing wellbeing impacts for users). **Quality of environment-** Potential reduction in quality of living environment (for current and future community) as the at grade expressway may reduce the amenity of the area and disrupt the quiet and natural aspects of the rural environment that are valued. Below grade options are often less desirable for walking and cycling connections and the underpass may reduce the quality and enjoyment of environment for recreation. **Overall comment-** Due to the increased visual presence of the expressway and the additional roundabouts, this option may present some aspects of reasonable difficulty in terms of way of life, community cohesion and quality of environment. Depending on how the underpass is perceived this could also have a potential impact on health and wellbeing and quality of the environment.
At grade roundabout	T3	3	**Description: T**he expressway and Tararua Rd intersect at a roundabout which is at-grade. A separate walking and cycling bridge is provided on the northern side. It is assumed that safe crossing points would be provided to enable pedestrians and cyclists to access the bridge from both sides of Tararua Rd. **Way of life-** Ease of movement is potentially reduced as people travelling in an east west direction will have to traverse an additional intersection and interact with expressway traffic. Slight reduction in ease of movement for pedestrians and cyclists (travelling up the bridge may be a barrier for some). **Community cohesion-** Provides some potential severance as it introduces a slight (though permeable) barrier to east west movements along Tararua Rd as well as the visual separation noted with other at grade options. **Health and wellbeing-** There could be some potential impacts on people's wellbeing due to the change in the environment they are used to and value (mainly related to criteria below 'quality of living environment') and disruption of existing social networks (as some people may need to move out of the area), however overall physical and mental health is unlikely to be impacted due to access to health services in Levin and walking/cycling access (which has added health benefits) being maintained. There will likely be some temporary impacts on people's wellbeing due to stress and anxiety arising from uncertainty around property impacts however this can be mitigated through effective communication, fast property purchase

Option name	Option ref	SIA score	Comments
			and other support mechanisms. Separate walking and cycling bridge is likely to improve perceived safety relative to other options as it reduces the need to cross in front of potentially fast moving traffic. **Quality of environment-** The roundabout introduces a new physical structure into the existing environment and will potentially increase noise and air pollution from vehicles braking and accelerating. This is likely to be more pronounced than T0-T3 as this option requires all cars travelling along the expressway to slow down and travel through the intersection, rather than only those using on and off ramps. This has the potential to reduce the quality of the environment for living and recreation that is valued for its rural character. While this will change as the area becomes more urbanised this will still likely be a disruption and negatively impact the enjoyment of a tranquil environment, views and birdlife. The walking and cycling bridge does offer an opportunity for enjoyment and interpretation of views of the surrounding landscape but overall this will likely be reduced. **Overall comment-** This option presents aspects of reasonable difficulty as it potentially disrupts the existing community in regard to quality of living environment, community cohesion and way of life, and has the potential to make traversing Tararua Rd more difficult. This option includes less conflict points than other options (now east west travellers only have to cross 2 roundabouts rather than 3); however, interaction with high-speed through-traffic remains and is to a greater extent. Access for pedestrians and cyclists is improved relative to other options through the separate bridge.
Expressway over top	T6	4	**Description**- Expressway rises above Tararua Rd on an overbridge. Tararua Rd remains at grade with two new roundabouts (assumed to be at grade) providing access on and off the expressway. Walking and cycling facilities are provided along Tararua Rd. **Way of life**- Ease of access for people traversing Tararua Rd by car, foot and bike to access services and recreation is reduced due to the new roundabouts. Though Tararua Rd remains at grade, people travelling in an east west direction will have to traverse three roundabouts (two additional to the existing environment) which has the potential to increase difficulty, particularly for pedestrians and cyclists. **Community cohesion**- Above grade expressway is more visually prominent than below and at grade options therefore may be perceived as a greater division and separation between East Levin and the wider Levin community. Though direct local road connections under the bridge are retained this may be perceived as potential severance. **Health and wellbeing**- The new roundabouts have the potential to create perceived and actual safety concerns for pedestrians and cyclists who will have to navigate two additional conflict points with high-

Option name	Option ref	SIA score	Comments
			speed traffic coming on and off the expressway. While it is assumed that the provided walking and cycling facilities will include safe crossing points this will still likely be a disruption to the existing environment and may impact on how safe people feel when using this intersection. **Quality of environment**- Potential reduction in quality of living environment (for current and future community) as the elevated expressway may reduce the amenity of the area and disrupt the quiet and natural aspects of the rural environment that are valued. Although noise levels may be quieter than at grade or below grade options, the elevated expressway will be more visible from a further distance and will potentially reduce the enjoyment of the recreation and living environment over a larger area. Some existing views from Levin across the rural landscape to the Tararua Ranges may be disrupted. **Overall comment**- Elevated expressway become more visibly present than at-grade options that may be perceived as a greater a dividing barrier. Although local road connection is retained the raised expressway would reduce enjoyment of recreation and living environment and represents a greater degree of change than at grade options that justifies a higher score.
Local road over top	T7	3	**Description-** Expressway is at grade and Tararua Rd is raised above on an overbridge. Two roundabouts provide access on and off the expressway. Walking and cycling facilities provided on Tararua Rd overbridge. **Way of life-** Ease of access for people traversing Tararua Rd by car, foot and bike to access services and recreation is reduced. People travelling in an east west direction will have to traverse three roundabouts (two additional to the existing environment) and overbridge which increases difficulty, particularly for pedestrians and cyclists. **Community cohesion-** At grade expressway still forms a physical division or separation which has the potential to provide perceived severance between East Levin and the wider Levin community. The raised Tararua Rd overbridge is likely to be perceived as less of a severance than the expressway overbridge in T6 as it does not elevate an east west divide. **Health and wellbeing-** The new roundabouts have the potential to create perceived and actual safety concerns for pedestrians and cyclists who will have to navigate two additional conflict points with high-speed traffic coming on and off the expressway. While it is assumed that the provided walking and cycling facilities will include safe crossing points this will still likely be a disruption to the existing environment and may impact on how safe people feel when using this intersection.

Option name	Option ref	SIA score	Comments
			Quality of environment- Potential reduction in quality of living environment (for current and future community) as the at grade expressway may reduce the amenity of the area and disrupt the quiet and natural aspects of the rural environment that are valued. **T**his option has the potential to disrupt views to the Tararua ranges from Levin; however, this is likely to be to a lesser extent than T6 as the overbridge will be in an east west direction (rather than in a north south direction with the raised expressway). **Overall comment-** At grade expressway forms a physical 'division' that provides potential severance to the wider Levin community, increases difficulty of movement and potentially reduces the quality of the living environment. Raising Tararua Rd is considered to present less difficulty than T6 as it does not form a visual west to east barrier which reflects the main directions of movement and is less disruptive views to Tararua Ranges (which could be enjoyed from a lookout point on the overbridge).

6 Midblock options

Option name	Option ref	SIA score	Comments
Expressway at grade	Option 1	3	**Description:** Expressway between Tararua Rd and Queen St is at grade (area subject to Tara Ika plan change). **Way of life-** Minimal to no negative impact on the current movement of people via car, foot or bike (other than may be affected by a reduction in quality of the environment) as no existing intersections or movements to access employment, education, recreation and other services are affected. Ease of movement and access to central Levin for future communities of Tara Ika is potentially reduced. **Community cohesion-** All options create a physical division or separation between community east of the expressway and the rest of Levin. The at grade expressway may be perceived as a severance of the future community at Tara Ika from wider Levin and any future local road connections would need to provide for this. **Health and wellbeing-** There could be some potential impacts on people's wellbeing due to the change in the environment they are used to and value (mainly related to criteria below 'quality of living environment' and disruption of existing social networks due to property acquisition, however overall physical and mental health is unlikely to be impacted due to access to health services in Levin and walking/cycling access (which has added health benefits) being maintained. There will likely be some temporary impacts on people's wellbeing due to stress and anxiety arising from uncertainty of property impacts however this can be mitigated through effective communication, support, and fast property purchase. **Quality of environment-** The quality of living environment for current (in particular residents of Redwood Grove) and future communities will be reduced as the rural character and peaceful quiet environment that are currently valued will be negatively impacted. It is acknowledged that this will change as Tara Ika is developed into a more urban form; however, the presence of the expressway next to this development still reduces the quality and enjoyment of this future living space. **Overall comment:** This option presents some potential aspects of difficulty in terms of community cohesion and quality of environment that cannot be completely avoided. Though the impacts are similar these are to a greater extent than Option 2.

Option name	Option ref	SIA score	Comments
Expressway below grade	Option 2	2	**Description**: Expressway between Tararua Rd and Queen St is below grade (area subject to Tara Ika plan change). **Way of life-** Minimal to no negative impact on the current movement of people via car, foot or bike (other than may be affected by a reduction in quality of the environment) as no existing intersections or movements to access employment, education, recreation and other services are affected. Ease of movement and access to Central Levin for future communities of Tara Ika is reduced though this is slightly better than Option 1. **Community cohesion-** All options create a physical 'division' between current and future community east of the expressway and wider Levin. Locating the expressway below grade minimises this to some extent as it is less visible and therefore potentially perceived as less of a severance than Option 1. **Health and wellbeing-** There could be some potential impacts on people's wellbeing due to the change in the environment they are used to and value (mainly related to criteria below 'quality of living environment' and disruption of existing social networks due to property acquisition, however overall physical and mental health is unlikely to be impacted due to access to health services in Levin and walking/cycling access (which has added health benefits) being maintained. There will likely be some temporary impacts on people's wellbeing due to stress and anxiety arising from uncertainty of property impacts however this can be mitigated through effective communication, support, and fast property purchase. **Quality of environment-** The quality of living environment will be potentially reduced as the rural character and peaceful quiet environment that are currently valued will be negatively impacted. It is acknowledged that this will change as Tara Ika is developed into a more urban form; however, the presence of the expressway next to this development still has the potential to reduce the quality and enjoyment of this future living space. Locating the expressway below grade will minimise this disruption and the perceived change in environment as it will be less visually prominent than Option 1. **Overall comment:** This option is considered to present minor aspects of difficulty. The quality of living environment and community cohesion will potentially be reduced; however, it does not impact any existing local roads that connect central and east Levin. While these negative impacts cannot be completely avoided the extent of these is less than in Option 1.

7 Summary

An assessment has been provided against the social criteria for the East Levin MCA. Though there are positive impacts of the project (e.g. reduction in crashes causing death and serious injury, easier movement throughout the region, reduction in congestion and traffic going through Levin) all options have been assessed as having potentially high negative permanent impacts on the existing social environment. The ability to address or minimise these impacts through potential mitigation has been noted in the assessment. It is also noted all options will also present a level of temporary disruption to the community during construction. A summary of these scores is provided below in Table 2.

Queen Street options

Options Q0 and Q1 score lower than other options due to the expressway posing less of a physical barrier for the surrounding community and therefore less impact on the quality of the living environment and social cohesion.

Options Q4 and Q6 score highest. Q4 represents a higher level of difficulty due to closure of Queen street, resulting on potential severance and isolation of East Levin residents form the wider Levin community. Q6 presents an elevated expressway which will be larger dominant structure in the community reducing the enjoyment of recreational areas and the overall quality of the living environment.

Tararua options

Most options have scored a '3' with T6 scored the highest. Though there are some differences in the potential impacts of these options, on balance they are considered to all present 'some aspects of reasonable difficulty' and that these differences did not warrant a score differential. Similar to Q6, T6 presents an elevated expressway, also having a higher negative impact on the overall quality of the living environment compared to the other options.

Midblock options

Similar to Q0 and Q1, Option 1 scored lower than Option 2 due to the expressway posing less of a physical barrier for the surrounding community and therefore less impact on the quality of the living environment and social cohesion.

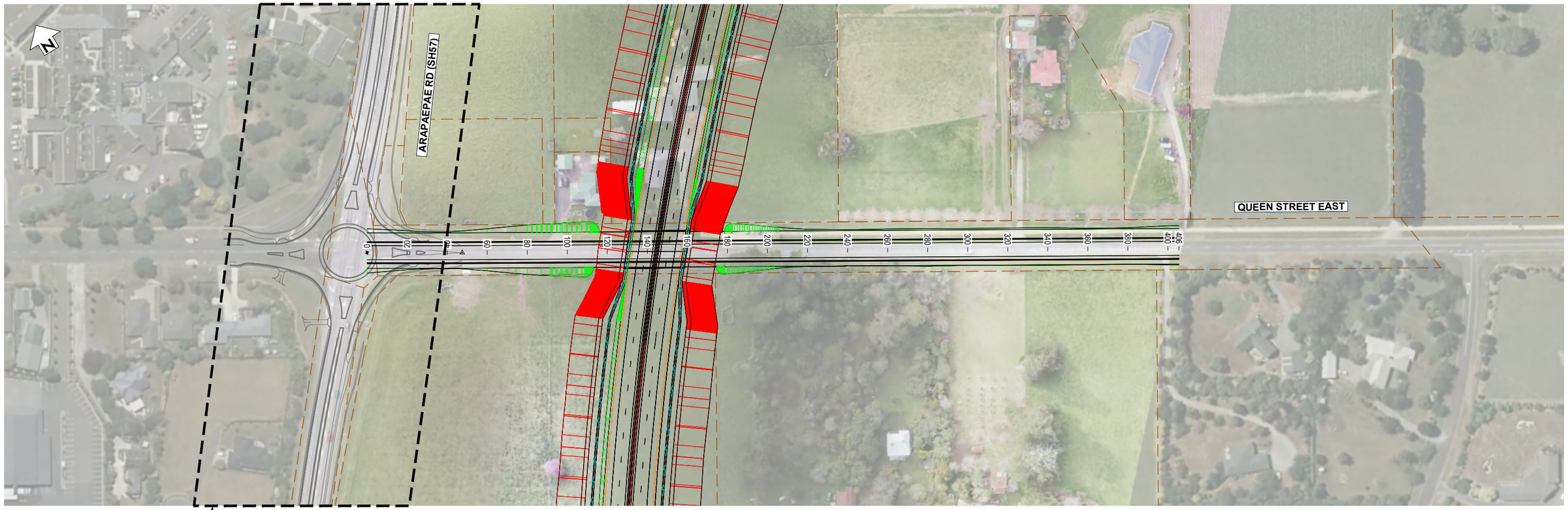
Table 2: Summary of social scores for East of Levin MCA

	Option name	Option ref	SIA score
Queen St	Expressway full below grade	Q0	2
	Expressway partially below grade	Q1	2
	Local Rd partially below grade	Q2	3
	At grade roundabout	Q3	3
	At grade close Queen St and upgrade Liverpool	Q4	4
	At grade Queen Street diverted north	Q5	3
	Expressway over top	Q6	4
	Local road over top	Q7	3

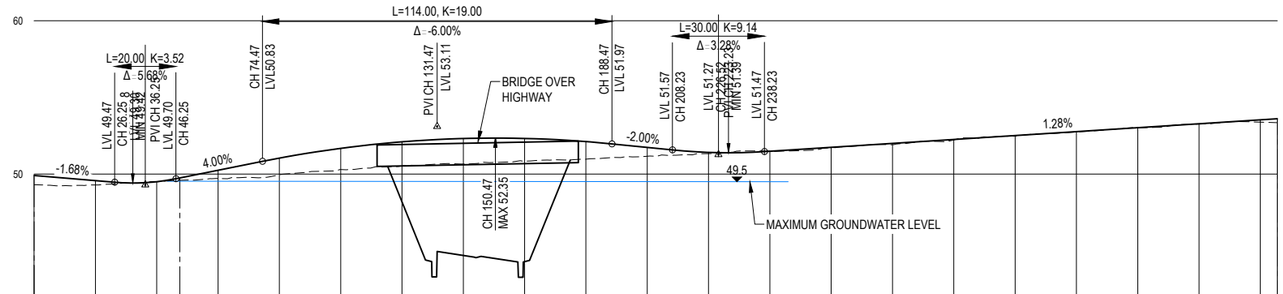
	At grade 5 arm shift SH57 connection south	Q8	3
Tararua Rd	Expressway full below grade	T0	3
	Expressway partially below grade	T1	3
	Local road partially below grade	T2	3
	At grade roundabout	T3	3
	Expressway over the top	T6	4
	Local road over top	T7	3
Mid-block	At grade	Option 1	3
	Below grade	Option 2	2

A

Appendix A – Option Plans



ALREADY IN CONSTRUCTION.
NOT SUBJECT TO MCA



HAD = 42.00

-CUT +FILL	+0.60	+0.28	0.00	+0.15	+0.54	+1.08	+1.38	+1.57	+1.67	+1.48	+1.15	+0.57	+0.08	-0.01	+0.02	+0.08	+0.03	+0.04	+0.02	0.00	+0.02	+0.15	+0.25
FINISHED LEVEL	49.91	49.57	49.51	49.75	50.25	51.04	51.68	52.11	52.32	52.33	52.12	51.74	51.41	51.49	51.75	52.00	52.26	52.51	52.77	53.03	53.28	53.54	53.61
GROUND LEVEL	49.31	49.29	49.51	49.60	49.71	49.96	50.30	50.53	50.65	50.85	50.97	51.16	51.33	51.50	51.72	51.92	52.23	52.48	52.75	53.03	53.26	53.39	53.36
CHAINAGE	0.00	20.00	40.00	47.52	60.00	80.00	100.00	120.00	140.00	160.00	180.00	200.00	220.00	240.00	260.00	280.00	300.00	320.00	340.00	360.00	380.00	400.00	405.52
VERTICAL GEOMETRY		L=27.82 -1.7%	L=20.00, Δ=5.68% K=3.52	L=28.22 4.0%		L=114.00, Δ=-6.00% K=19.00						L=19.76 -2.0%	L=30.00, Δ=3.28% K=9.14		L=191.86 1.3%								
HORIZONTAL GEOMETRY		47.52m 121°16'53"				358.00m 120°56'12"																	

LONGITUDINAL SECTION - Q0 - Queen H
SCALES: HOR 1:1000 VERT 1:200

LEGEND

CUT

FILL

NOTES / DESIGN ASSUMPTIONS

1. LONGSECTION IS FOR SURFACE OF LOCAL ROAD ONLY.
2. ORIGINAL DBC OPTION WITH STANDARD EARTHWORKS TRENCH IS NOT TECHNICALLY FEASIBLE DUE TO MAXIMUM GROUNDWATER LEVELS.

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE
A	ISSUED FOR INFORMATION	SS	JP	JP	21.09.21

SURVEYED	
DESIGNED	Melissa Nel
DRAWN	Steve Sutton
CAD REVIEW	
DESIGN CHECK	
DESIGN REVIEW	
APPROVED	
PROF REGISTRATION:	

Stantec

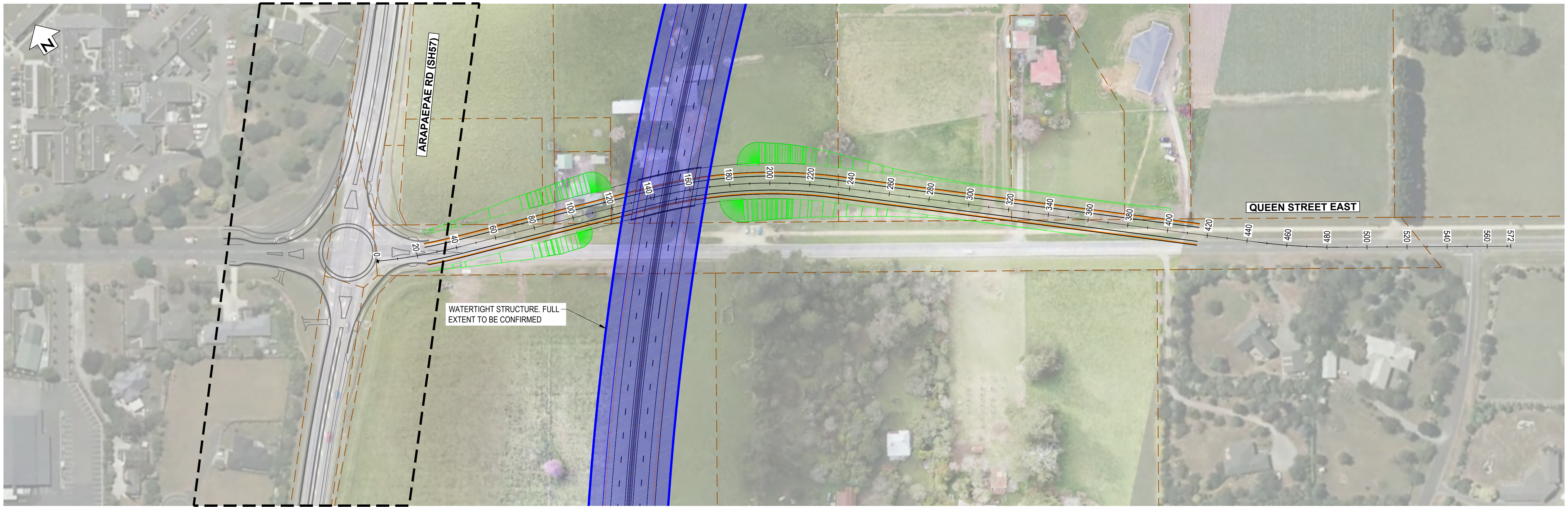
Client: WAKA KOTAHI NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

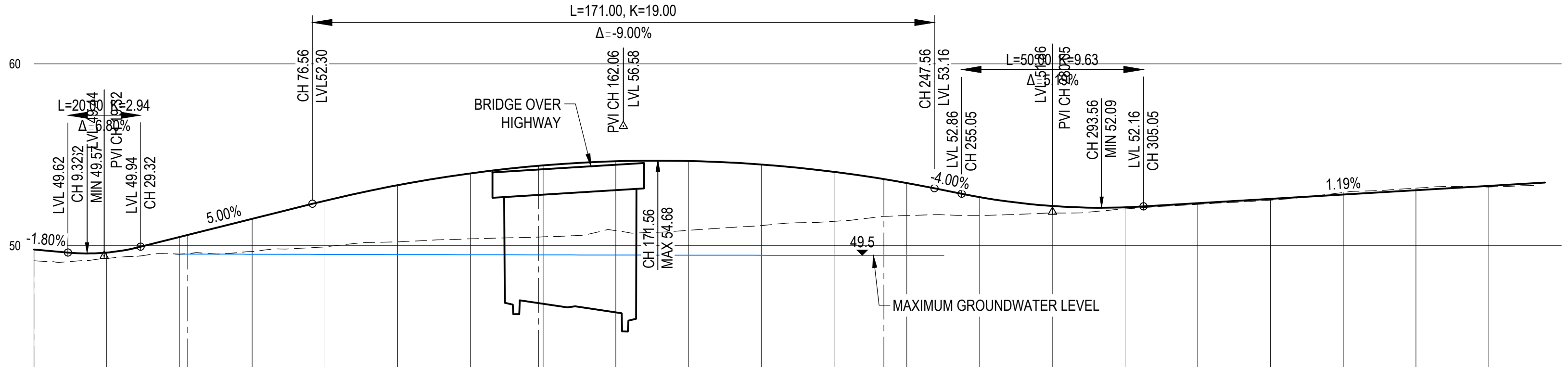
OPTION Q0 - QUEEN STREET
HIGHWAY FULLY BELOW GRADE (DBC)

Status Stamp: **WORKING PLOT**
Date Stamp:
Scales: AS SHOWN
Drawing No.: 310203848-01-001-SK1000
Rev.: A

pw:\\stantec-ap-pw.bentley.com:stantec-ap-pw-01\Documents\New Zealand Clients\NZTA (New Zealand Transport Agency)\310203848 - Otaki to North of Levin DBC\01\Optioneering East Levin MCA\310203848-01-001-SK1000



ALREADY IN CONSTRUCTION. NOT SUBJECT TO MCA



CHAINAGE	-CUT +FILL	FINISHED LEVEL	GROUND LEVEL
0.00	+0.62	49.79	49.17
20.00	+0.32	49.62	49.30
40.00	+0.94	50.47	49.53
42.27	+1.02	50.59	49.57
60.00	+1.79	51.47	49.68
80.00	+2.53	52.47	49.94
100.00	+3.11	53.33	50.21
120.00	+3.60	53.98	50.38
138.76	+3.92	54.39	50.48
140.00	+3.93	54.41	50.49
160.00	+3.81	54.64	50.83
180.00	+3.82	54.66	50.84
200.00	+3.36	54.46	51.11
220.00	+2.72	54.06	51.34
233.68	+2.05	53.66	51.61
240.00	+1.79	53.44	51.66
260.00	+1.00	52.67	51.67
280.00	+0.39	52.18	51.79
300.00	+0.09	52.11	52.02
320.00	+0.06	52.33	52.27
340.00	+0.07	52.57	52.51
360.00	-0.11	52.81	52.93
380.00	-0.12	53.05	53.17
400.00	+0.07	53.29	53.22
415.44		53.47	
420.00			

VERTICAL GEOMETRY: L=1 -1. | L=20.00, Δ=6.80% K=2.94 | L=47.24 5.0% | L=171.00, Δ=-9.00% K=19.00 | L=7.49 -4.0% | L=50.00, Δ=5.19% K=9.63 | L=110.39 1.2%

HORIZONTAL GEOMETRY: R 285.00 A 42.27 | 96.49m 106°57'52" | R 250.00 A 94.92 | 211.63m 128°43'05"

LONGITUDINAL SECTION - Q1 - Queen H
SCALES: HOR 1:1000 VERT 1:200

LEGEND
CUT
FILL

NOTES / DESIGN ASSUMPTIONS
1. LONGSECTION IS FOR SURFACE OF LOCAL ROAD ONLY.
2. BURIED STRUCTURES ARE WATERTIGHT AND GROUNDWATER DOES NOT ENTER.
3. BUOYANCY RESTRAINED VIA SCREW ANCHORS.
4. STORMWATER WOULD BE LOCALLY COLLECTED WITHIN THE STRUCTURE AND DISCHARGED VIA MECHANICAL MEANS.
5. SURFACE FLOOD WATERS WOULD BE INTERCEPTED, AND ROUTED AWAY/AROUND FROM BURIED STRUCTURES.
6. EXTENT OF WATERTIGHT STRUCTURE TO BE CONFIRMED BUT REQUIRED FOR FULL EXTENT OF INTERFACE WITH HIGH GROUNDWATER.
7. QUEEN STREET WOULD BE REDUCED TO 50 OR 60km/h LEGAL SPEED LIMIT.
8. WALKING AND CYCLING (W&C) FACILITIES WOULD BE PROVIDED ON THE QUEEN STREET OVERBRIDGE.
9. QUEEN STREET IS REALIGNED NORTHWARDS TO AVOID IMPACT ON PROUSE FRONTAGE.
10. SURFACE FLOOD WATERS / FLOW PATHS TO BE MAINTAINED WITH USE OF CULVERTS OR SIPHONS.

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE
A	ISSUED FOR INFORMATION	SS	JP	JP	21.09.21

SURVEYED
DESIGNED Melissa Nel
DRAWN Steve Sutton
CAD REVIEW
DESIGN CHECK
DESIGN REVIEW
APPROVED
PROF REGISTRATION:

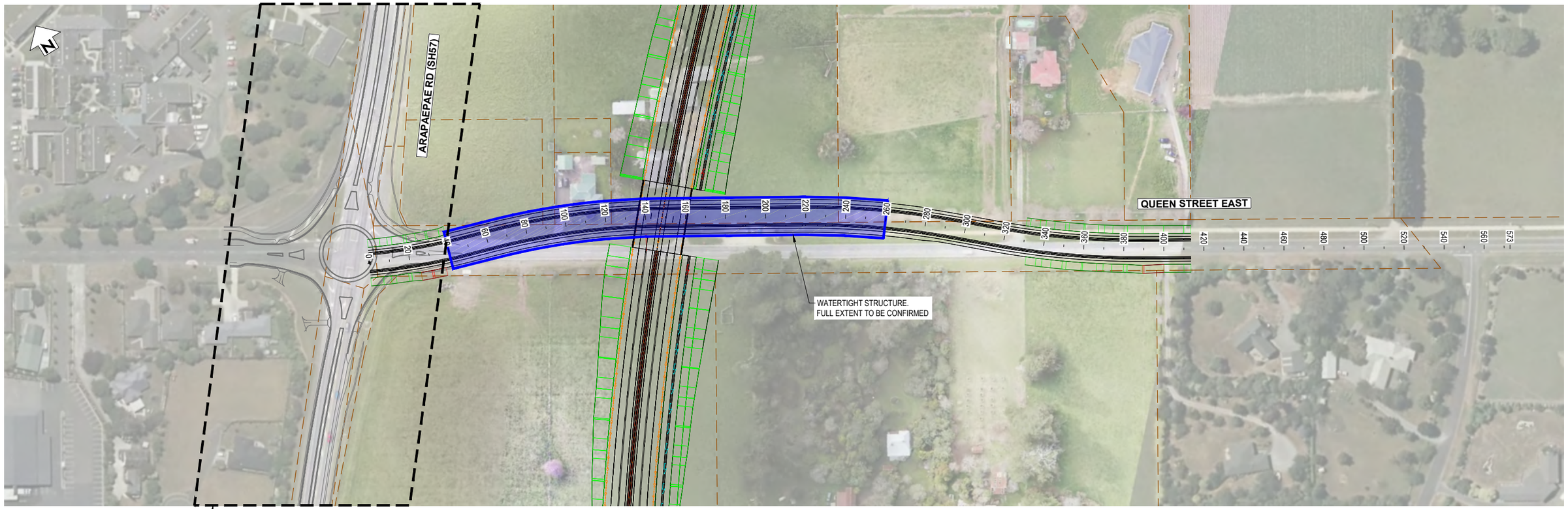
Stantec

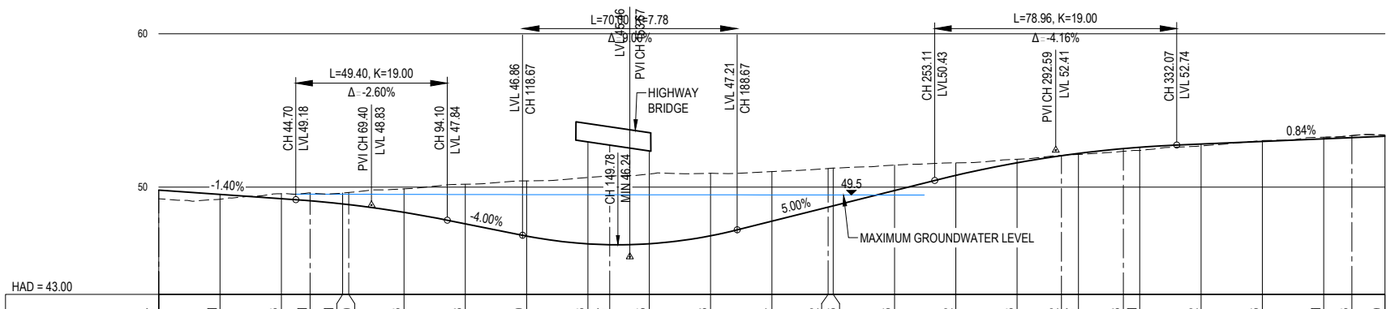
Client: WAKA KOTAHI NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

OPTION Q1 - QUEEN STREET
HIGHWAY PARTIALLY BELOW GRADE

Status Stamp: WORKING PLOT
Date Stamp
Scales: AS SHOWN
Drawing No. 310203848-01-001-SK1001
Rev. A





HAD = 43.00

-CUT +FILL	+0.57	+0.31	-0.33	-0.51	-0.71	-0.80	-1.53	-2.58	-3.60	-4.33	-4.47	-4.55	-4.08	-3.24	-2.52	-2.46	-1.66	-0.82	-0.23	-0.02	+0.07	+0.18	+0.21	+0.12	-0.06	-0.11	-0.13	-0.09	
FINISHED LEVEL	49.80	49.52	49.24	49.10	48.90	48.85	48.35	47.61	46.81	46.30	46.24	46.30	46.82	47.78	48.69	48.78	49.78	50.76	51.59	52.05	52.20	52.51	52.60	52.81	52.97	53.14	53.22	53.31	
GROUND LEVEL	49.24	49.21	49.57	49.61	49.61	49.65	49.88	50.19	50.41	50.63	50.71	50.85	50.90	51.01	51.21	51.24	51.44	51.58	51.81	52.07	52.13	52.33	52.39	52.68	53.03	53.25	53.36	53.40	
CHAINAGE	0.00	20.00	40.00	49.37	60.00	61.98	80.00	100.00	120.00	140.00	147.09	160.00	180.00	200.00	218.33	220.00	240.00	260.00	280.00	294.45	300.00	314.65	320.00	340.00	360.00	380.00	389.21	400.00	
VERTICAL GEOMETRY		L=44.86 -1.4%		L=49.40, Δ=-2.60% K=19.00			L=24.56 -4.0%		L=70.00, Δ=9.00% K=7.78					L=64.45 5.0%			L=78.96, Δ=-4.16% K=19.00					L=81.43 0.8%							
HORIZONTAL GEOMETRY		R 300.00 A 49.37		12.61m 106°46'45"			R 350.00 A 85.11			71.23m 120°42'45"				R 400.00 A 76.13			20.19m 131°37'00"		R 400.00 A 74.56			183.73m 120°56'12"							

LONGITUDINAL SECTION - Q2 - Queen H
SCALES: HOR 1:1000 VERT 1:200

LEGEND

CUT

FILL

NOTES / DESIGN ASSUMPTIONS

1. LONGSECTION IS FOR SURFACE OF LOCAL ROAD ONLY.
2. BURIED STRUCTURES ARE WATERTIGHT AND GROUNDWATER DOES NOT ENTER.
3. BUOYANCY RESTRAINED VIA SCREW ANCHORS.
4. STORMWATER WOULD BE LOCALLY COLLECTED WITHIN THE STRUCTURE AND DISCHARGED VIA MECHANICAL MEANS.
5. SURFACE FLOOD WATERS WOULD BE INTERCEPTED, AND ROUTED AWAY/AROUND FROM BURIED STRUCTURES.
6. EXTENT OF WATERTIGHT STRUCTURE TO BE CONFIRMED BUT REQUIRED FOR FULL EXTENT OF INTERFACE WITH HIGH GROUNDWATER.
7. QUEEN STREET WOULD BE REDUCED TO 50 OR 60km/h LEGAL SPEED LIMIT.
8. WALKING AND CYCLING FACILITIES WOULD BE PROVIDED ON THE QUEEN STREET UNDERPASS.
9. QUEEN STREET IS REALIGNED NORTHWARDS TO AVOID IMPACT ON PROUSE FRONTAGE.

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE
A	ISSUED FOR INFORMATION	SS	JP	JP	21.09.21

SURVEYED		
DESIGNED	Melissa Nel	
DRAWN	Steve Sutton	
CAD REVIEW		
DESIGN CHECK		
DESIGN REVIEW		
APPROVED		
PROF REGISTRATION:		

Stantec

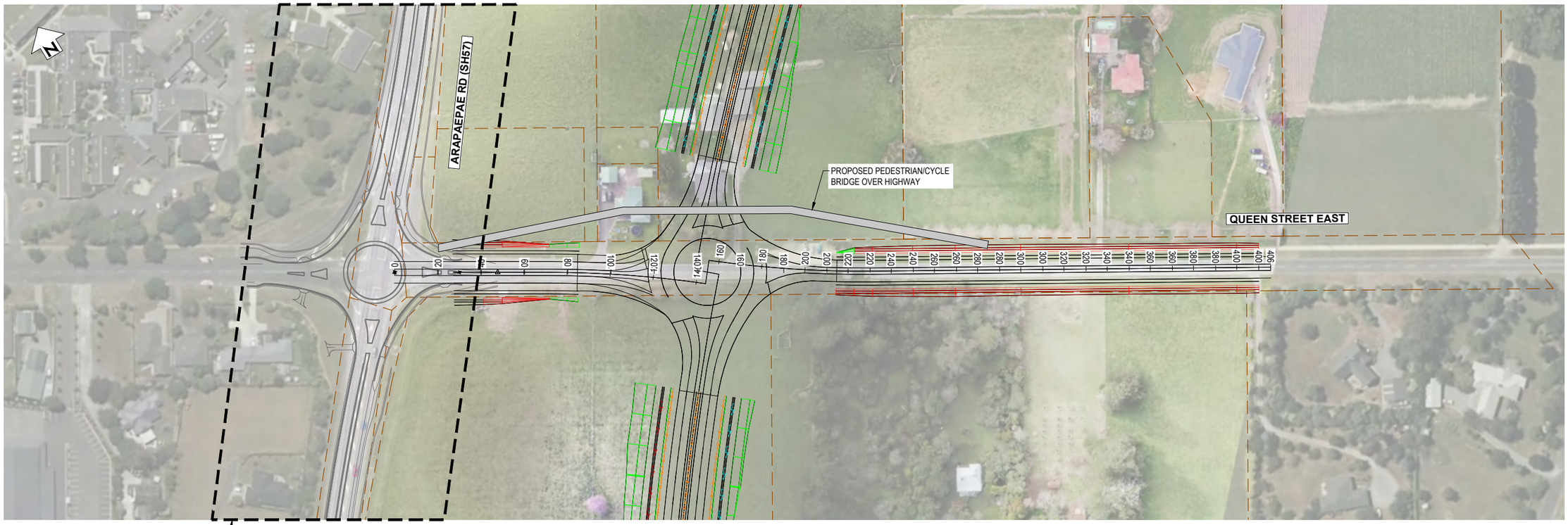
Client: WAKA KOTAHI NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

OPTION Q2 - QUEEN STREET
LOCAL ROAD PARTIALLY BELOW GRADE

Status Stamp: **WORKING PLOT**
Date Stamp:
Scales: AS SHOWN
Drawing No.: 310203848-01-001-SK1002
Rev.: A

pw:\\stantec-ap-pw.bentley.com:stantec-ap-pw-01\Documents\New Zealand Clients\NZTA (New Zealand Transport Agency)\310203848 - Otaki to North of Levin DBC\01\Optioneering East Levin MCA\310203848-01-001-SK1002



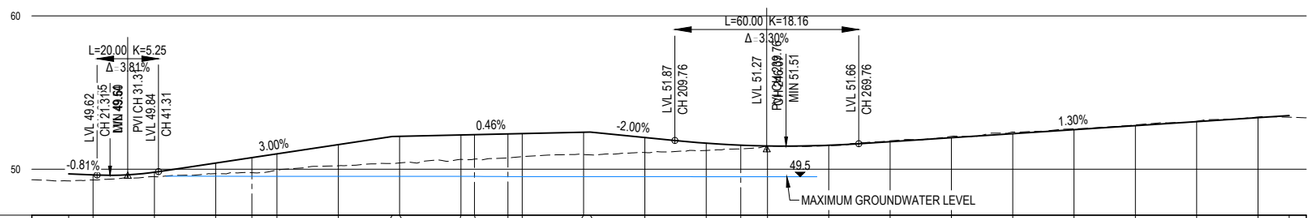
ALREADY IN CONSTRUCTION.
NOT SUBJECT TO MCA

LEGEND

🟥	CUT
🟩	FILL

NOTES / DESIGN ASSUMPTIONS

1. LONGSECTION IS FOR SURFACE OF LOCAL ROAD ONLY.
2. QUEEN STREET WOULD BE REDUCED TO 50 OR 60km/h LEGAL SPEED LIMIT.
3. WALKING AND CYCLING FACILITIES WOULD BE PROVIDED ON A SEPARATE BRIDGE.
4. SURFACE FLOOD WATERS / FLOW PATHS TO BE MAINTAINED WITH USE OF CULVERTS.



CHAINAGE	-CUT +FILL	FINISHED LEVEL	GROUND LEVEL
0.00			49.31
12.03	+0.46	49.70	49.23
20.00	+0.34	49.63	49.29
40.00	+0.29	49.80	49.51
60.00	+0.69	50.40	49.71
71.83	+0.98	50.76	49.77
80.00	+1.06	51.00	49.94
100.00	+1.38	51.60	50.22
117.60	+1.75	52.13	50.38
120.00	+1.73	52.14	50.41
140.00	+1.59	52.23	50.65
144.41	+1.59	52.25	50.66
155.35	+1.57	52.30	50.73
160.00	+1.50	52.32	50.82
180.00	+1.45	52.41	50.96
182.16	+1.49	52.42	50.93
200.00	+0.98	52.07	51.08
220.00	+0.47	51.69	51.22
231.27	+0.25	51.57	51.32
240.00	+0.02	51.52	51.50
260.00	+0.03	51.56	51.53
280.00	-0.05	51.80	51.85
300.00	-0.09	52.06	52.14
320.00	-0.10	52.32	52.42
340.00	-0.05	52.58	52.63
360.00	-0.05	52.84	52.89
380.00	-0.02	53.10	53.12
400.00	-0.04	53.36	53.40
410.20	+0.11	53.49	53.39
415.76			53.35

VERTICAL GEOMETRY: L=9 -0. | L=20.00, Δ=3.81% K=5.25 | L=76.29 3.0% | L=64.56 0.5% | L=27.60 -2.0% | L=60.00, Δ=3.30% K=18.16 | L=140.44 1.3%

HORIZONTAL GEOMETRY: 71.83m 121°16'53" | R 500.00 A 72.58 | 10.93m 39°28'36" | R 500.00 A 75.93 | 184.49m 120°43'07"

LONGITUDINAL SECTION - Q3 - Queen H
SCALES: HOR 1:1000 VERT 1:200

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE
A	ISSUED FOR INFORMATION	SS	JP	JP	21.09.21

SURVEYED	
DESIGNED	Melissa Nel
DRAWN	Steve Sutton
CAD REVIEW	
DESIGN CHECK	
DESIGN REVIEW	
APPROVED	
PROF REGISTRATION:	

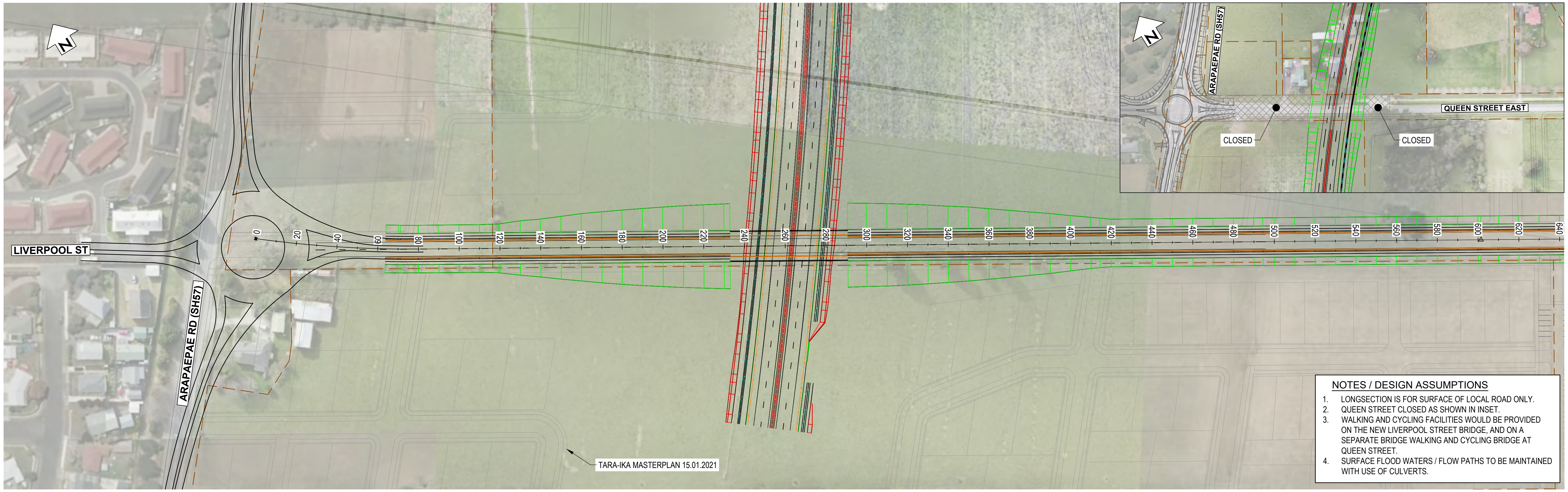
Stantec

Client:
WAKA KOTAHI NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

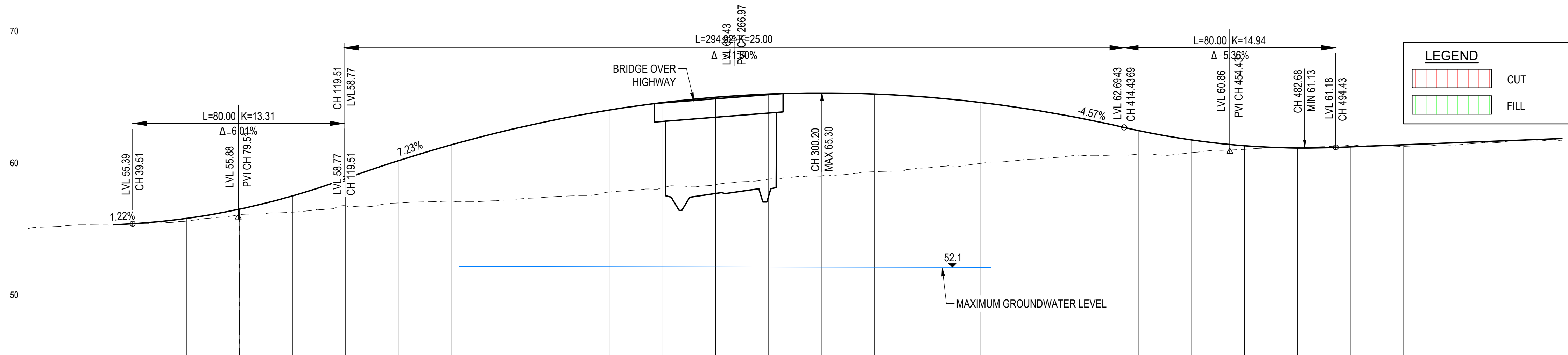
OPTION Q3 - QUEEN STREET
AT-GRADE: ROUNDABOUT

Status Stamp: **WORKING PLOT**
Date Stamp:
Scales: AS SHOWN
Drawing No.: 310203848-01-001-SK1003
Rev.: A



NOTES / DESIGN ASSUMPTIONS

1. LONGSECTION IS FOR SURFACE OF LOCAL ROAD ONLY.
2. QUEEN STREET CLOSED AS SHOWN IN INSET.
3. WALKING AND CYCLING FACILITIES WOULD BE PROVIDED ON THE NEW LIVERPOOL STREET BRIDGE, AND ON A SEPARATE BRIDGE WALKING AND CYCLING BRIDGE AT QUEEN STREET.
4. SURFACE FLOOD WATERS / FLOW PATHS TO BE MAINTAINED WITH USE OF CULVERTS.



LEGEND

- CUT
- FILL

HAD = 45.00

CHAINAGE	GROUND LEVEL	FINISHED LEVEL	-CUT +FILL
0.00	55.03		
20.00	55.31		
32.30	55.30	55.31	+0.01
40.00	55.38	55.40	+0.02
60.00	55.60	55.80	+0.20
79.92	56.08	56.50	+0.42
80.00	56.09	56.50	+0.42
100.00	56.27	57.50	+1.23
120.00	56.76	58.81	+2.05
140.00	56.97	60.17	+3.20
160.00	57.12	61.37	+4.25
180.00	57.18	62.41	+5.23
200.00	57.46	63.29	+5.83
220.00	57.80	64.01	+6.21
240.00	58.12	64.58	+6.45
260.00	58.36	64.98	+6.62
280.00	58.77	65.22	+6.45
300.00	59.01	65.30	+6.29
320.00	59.34	65.22	+5.88
340.00	59.63	64.98	+5.35
360.00	59.96	64.59	+4.62
380.00	60.29	64.03	+3.74
400.00	60.56	63.31	+2.75
420.00	60.68	62.45	+1.77
440.00	60.79	61.74	+0.96
460.00	61.03	61.30	+0.28
480.00	61.16	61.13	-0.02
500.00	61.36	61.22	-0.14
520.00	61.25	61.38	+0.13
540.00	61.36	61.54	+0.18
560.00	61.66	61.69	+0.04
580.00	61.74	61.85	+0.12

VERTICAL GEOMETRY: L=7.21 1.2% | L=80.00, Δ=6.01% K=13.31 | L=0.00 7.2% | L=294.92, Δ=-11.80% K=25.00 | L=0.00 -4.6% | L=80.00, Δ=5.36% K=14.94 | L=315.11 0.8%

HORIZONTAL GEOMETRY: R 550.00 A 79.92 | 521.48m 120°46'50"

LONGITUDINAL SECTION - Q4 - Liverpool H
SCALES: HOR 1:1000 VERT 1:200

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE
A	ISSUED FOR INFORMATION	SS	JP	JP	21.09.21

SURVEYED	
DESIGNED	Melissa Nel
DRAWN	Steve Sutton
CAD REVIEW	
DESIGN CHECK	
DESIGN REVIEW	
APPROVED	
PROF REGISTRATION:	

Stantec

Client: WAKA KOTAHI NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

OPTION Q4 - LIVERPOOL STREET
AT-GRADE: CLOSE QUEEN, UPGRADE LIVERPOOL

Status Stamp: **WORKING PLOT**
Date Stamp:
Scales: AS SHOWN
Drawing No.: 310203848-01-001-SK1004
Rev.: A

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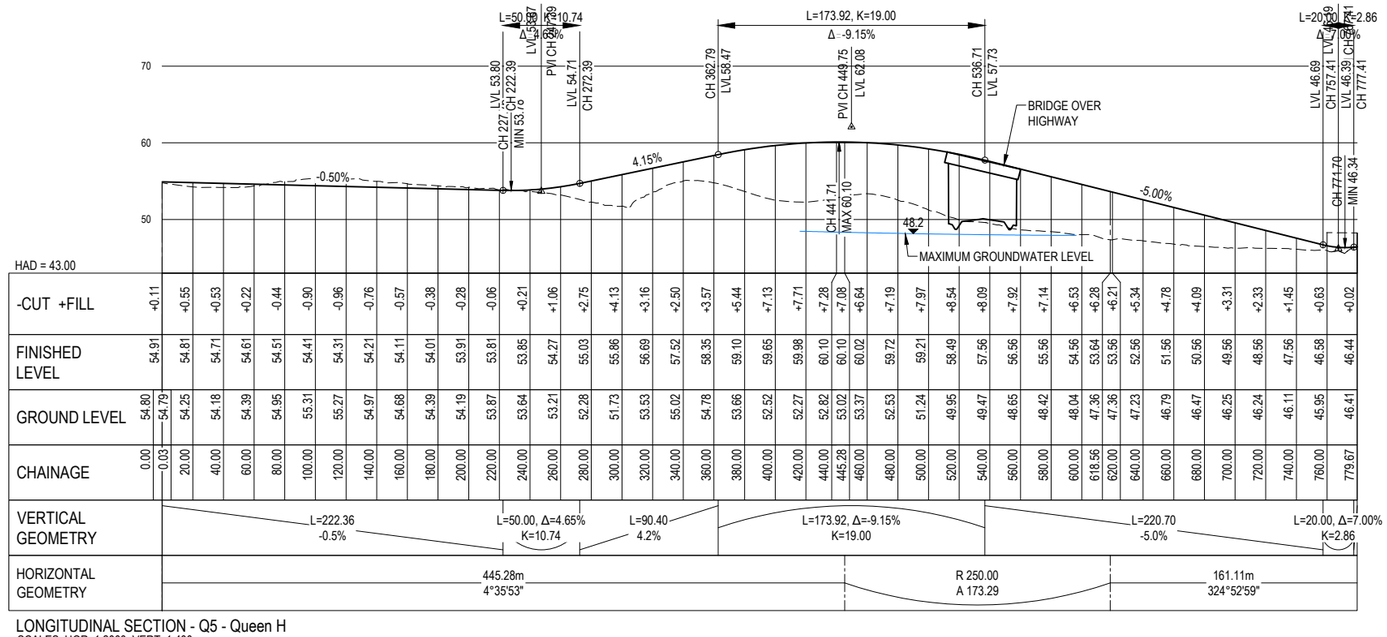

-CUT +FILL	+0.11		+0.55	+0.53	+0.22	-0.44	-0.90	-0.96	-0.76	-0.57	-0.38	-0.28	-0.06	+0.21
FINISHED LEVEL	54.91		54.81	54.71	54.61	54.51	54.41	54.31	54.21	54.11	54.01	53.91	53.81	53.85
GROUND LEVEL	54.80	54.79	54.25	54.18	54.39	54.95	55.31	55.27	54.97	54.68	54.39	54.19	53.87	53.64
CHAINAGE	0.00	0.03	20.00	40.00	60.00	80.00	100.00	120.00	140.00	160.00	180.00	200.00	220.00	240.00

-CUT +FILL	+1.06	+2.75	+4.13	+3.16	+2.50	+3.57	+5.44	+7.13	+7.71	+7.28	+7.08	+6.64	+7.19	+7.97
FINISHED LEVEL	54.27	55.03	55.86	56.69	57.52	58.35	59.10	59.65	59.98	60.10	60.10	60.02	59.72	59.21
GROUND LEVEL	53.21	52.28	51.73	53.53	55.02	54.78	53.66	52.52	52.27	52.82	53.02	53.37	52.53	51.24
CHAINAGE	260.00	280.00	300.00	320.00	340.00	360.00	380.00	400.00	420.00	440.00	445.28	460.00	480.00	500.00

-CUT +FILL	+8.54	+8.09	+7.92	+7.14	+6.53	+6.28	+6.21	+5.34	+4.78	+4.09	+3.31	+2.33	+1.45	+0.63	+0.02
FINISHED LEVEL	58.49	57.56	56.56	55.56	54.56	53.64	53.56	52.56	51.56	50.56	49.56	48.56	47.56	46.58	46.44
GROUND LEVEL	49.95	49.47	48.65	48.42	48.04	47.36	47.36	47.23	46.79	46.47	46.25	46.24	46.11	45.95	46.41
CHAINAGE	520.00	540.00	560.00	580.00	600.00	618.56	620.00	640.00	660.00	680.00	700.00	720.00	740.00	760.00	779.67

VERTICAL GEOMETRY
L=222.36 -0.5%
L=50.00, Δ=4.65% K=10.74
L=90.40 4.2%
L=173.92, Δ=-9.15% K=19.00
L=220.70 -5.0%
L=20.00, Δ=7.00% K=2.86

HORIZONTAL GEOMETRY
445.28m 4°35'53"
R 250.00 A 173.29
161.11m 324°52'59"

LONGITUDINAL SECTION - Q5 - Queen H
SCALES: HOR 1:2000 VERT 1:400

LEGEND

🟥	CUT
🟩	FILL

NOTES / DESIGN ASSUMPTIONS

1. LONGSECTION IS FOR SURFACE OF LOCAL ROAD ONLY.
2. HIGHWAY IS AT-GRADE THROUGH QUEEN STREET.
3. QUEEN STREET CLOSED AS SHOWN IN INSET.
4. WALKING AND CYCLING FACILITIES WOULD BE PROVIDED ON A SEPARATE BRIDGE WALKING AND CYCLING BRIDGE AT QUEEN STREET.
5. QUEEN STREET VEHICLE CONNECTION IS REALIGNED NORTHWARDS.
6. AS SHOWN, REALIGNED LOCAL ROAD RISES OVER NEW HIGHWAY WHICH STAYS AT-GRADE.
7. ALTERNATIVELY, THE LOCAL ROAD COULD STAY AT GROUND LEVEL AND THE HIGHWAY COULD BE RAISED.
8. SURFACE FLOOD WATERS / FLOW PATHS TO BE MAINTAINED WITH USE OF CULVERTS.

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE
A	ISSUED FOR INFORMATION	SS	JP	JP	21.09.21

SURVEYED	
DESIGNED	Melissa Nel
DRAWN	Steve Sutton
CAD REVIEW	
DESIGN CHECK	
DESIGN REVIEW	
APPROVED	
PROF REGISTRATION:	

Stantec

Client:
WAKA KOTAHI NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

OPTION Q5 - QUEEN STREET
AT-GRADE: QUEEN DIVERTED NORTH

Status Stamp **WORKING PLOT**
Date Stamp
Scales AS SHOWN
Drawing No. 310203848-01-001-SK1005
Rev. A

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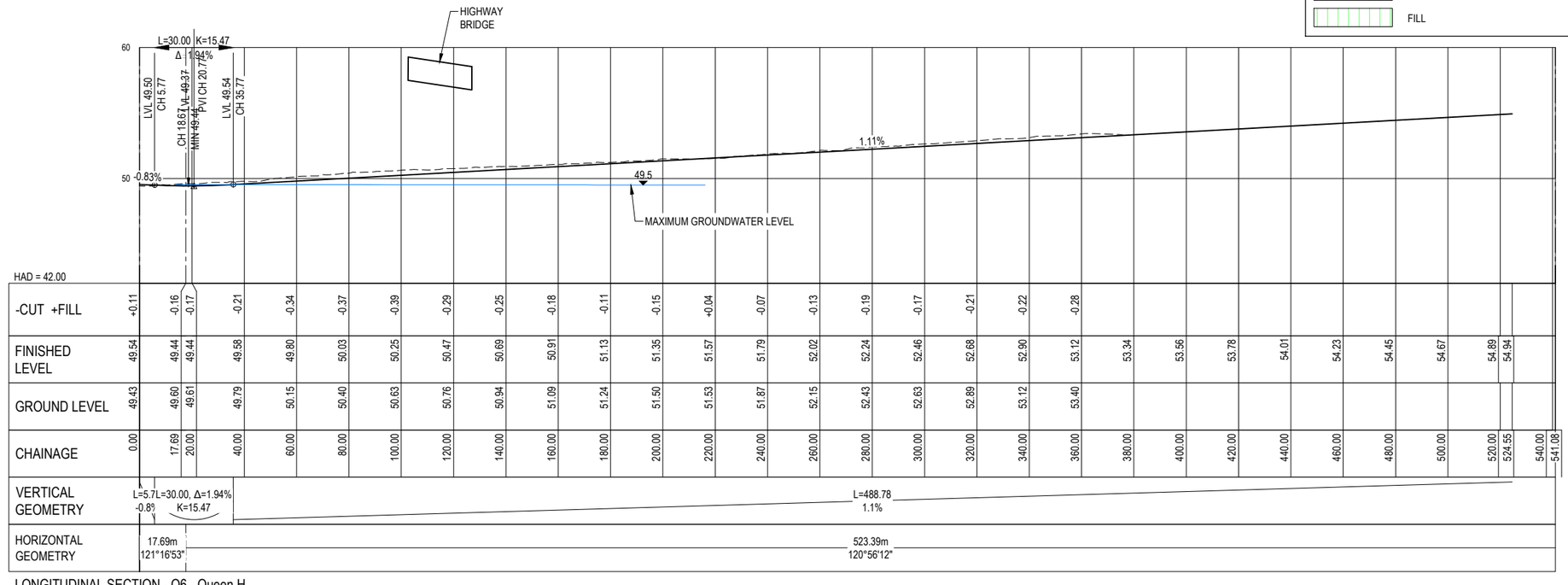

NOTES / DESIGN ASSUMPTIONS

1. LONGSECTION IS FOR SURFACE OF LOCAL ROAD ONLY.
2. QUEEN STREET REMAINS AT EXISTING GRADE, WITH HIGHWAY RISING OVER THE LOCAL ROAD.
3. WALKING AND CYCLING FACILITIES WOULD BE PROVIDED ON QUEEN STREET.
4. HIGHWAY BRIDGE TOTAL SPAN HAS BEEN EXTENDED TO 70m LENGTH TO PROVIDE A MORE OPEN STRUCTURE.
5. SURFACE FLOOD WATERS / FLOW PATHS TO BE MAINTAINED WITH USE OF CULVERTS.

LEGEND

🟥	CUT
🟩	FILL

-CUT +FILL	+0.11	-0.16	-0.17	-0.21	-0.34	-0.37	-0.39	-0.29	-0.25	-0.18	-0.11	-0.15	+0.04	-0.07	-0.13	-0.19
FINISHED LEVEL	49.54	49.44	49.44	49.58	49.80	50.03	50.25	50.47	50.69	50.91	51.13	51.35	51.57	51.79	52.02	52.24
GROUND LEVEL	49.43	49.60	49.61	49.79	50.15	50.40	50.63	50.76	50.94	51.09	51.24	51.50	51.53	51.87	52.15	52.43
CHAINAGE	0.00	17.69	20.00	40.00	60.00	80.00	100.00	120.00	140.00	160.00	180.00	200.00	220.00	240.00	260.00	280.00
VERTICAL GEOMETRY	L=5.7 -0.8%	L=30.00, Δ=1.94% K=15.47		L=488.78 1.1%												
HORIZONTAL GEOMETRY	17.69m 121°16'53"	523.39m 120°56'12"														

-CUT +FILL	-0.17	-0.21	-0.22	-0.28											
FINISHED LEVEL	52.46	52.68	52.90	53.12	53.34	53.56	53.78	54.01	54.23	54.45	54.67	54.89	54.94		
GROUND LEVEL	52.63	52.89	53.12	53.40											
CHAINAGE	300.00	320.00	340.00	360.00	380.00	400.00	420.00	440.00	460.00	480.00	500.00	520.00	524.55	540.00	541.08

LONGITUDINAL SECTION - Q6 - Queen H
SCALES: HOR 1:1000 VERT 1:200

NOT FOR CONSTRUCTION

A	ISSUED FOR INFORMATION	SS	JP	JP	21.09.21
REV	REVISIONS	DRN	CHK	APP	DATE

SURVEYED	
DESIGNED	Melissa Nel
DRAWN	Steve Sutton
CAD REVIEW	
DESIGN CHECK	
DESIGN REVIEW	
APPROVED	
PROF REGISTRATION:	

Stantec

Client:
WAKA KOTAHI
NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

OPTION Q6 - QUEEN STREET
HIGHWAY OVER TOP

Status Stamp **WORKING PLOT**
Date Stamp
Scales AS SHOWN
Drawing No. 310203848-01-001-SK1006
Rev. A

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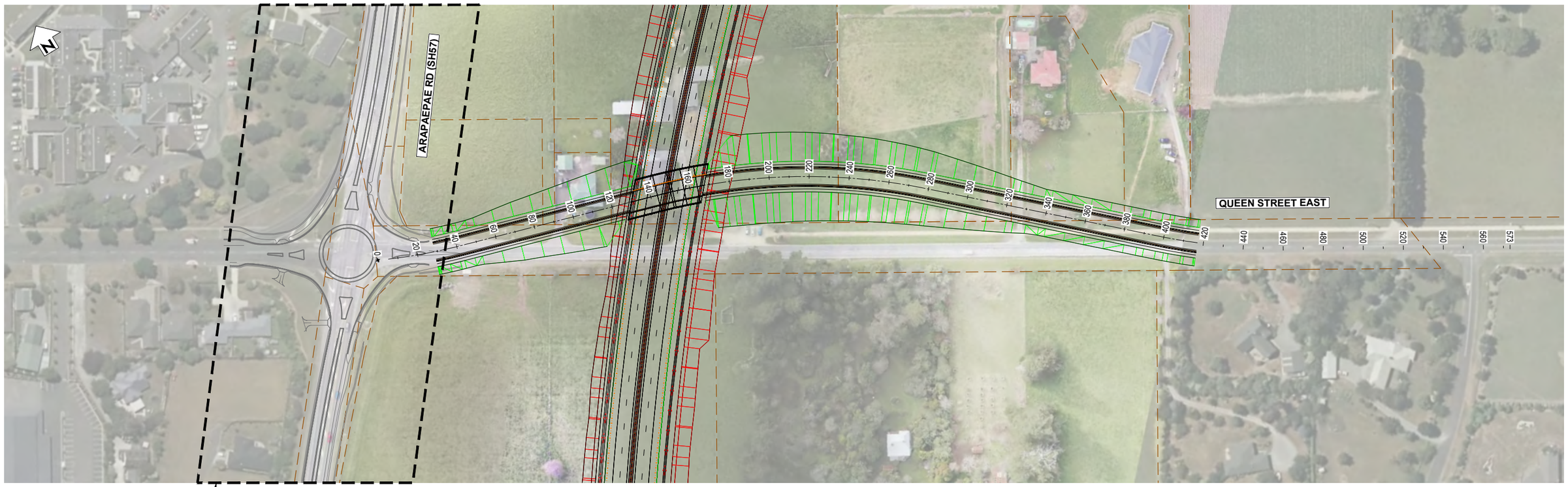
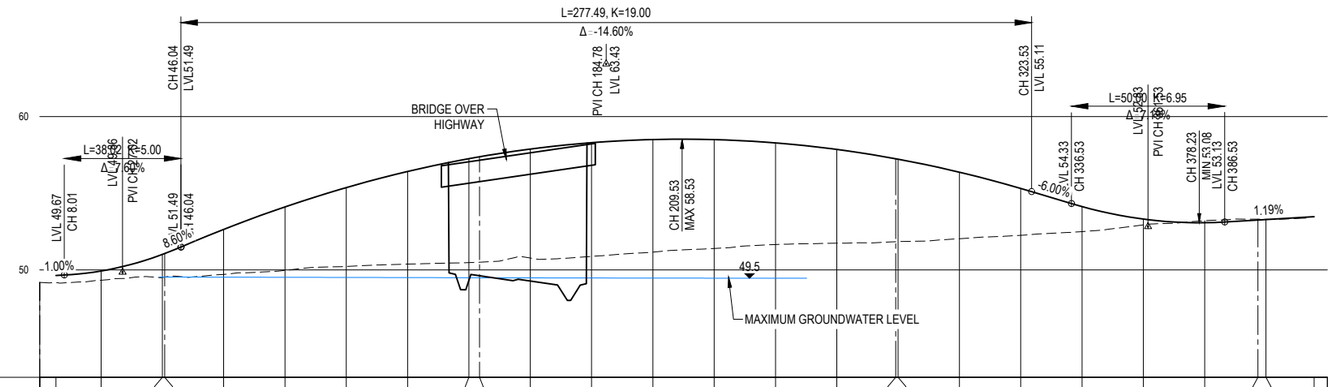


ALREADY IN CONSTRUCTION.
NOT SUBJECT TO MCA



HAD = 43.00

-CUT +FILL		+0.47	+0.60	+1.50	+1.53	+2.94	+4.14	+5.14	+6.04	+6.77	+6.87	+7.10	+7.42	+7.35	+7.10	+6.62	+6.11	+5.41	+5.37	+4.34	+3.06	+1.63	+0.38	-0.13	-0.06	-0.02		
FINISHED LEVEL		49.64	49.93	51.01	51.07	52.64	54.11	55.37	56.42	57.25	57.38	57.88	58.30	58.50	58.50	58.28	57.86	57.25	57.22	56.37	55.32	54.13	53.31	53.08	53.25	53.29	53.47	
GROUND LEVEL	49.19	49.17	49.33	49.51	49.54	49.71	49.97	50.23	50.38	50.48	50.51	50.78	50.88	51.16	51.40	51.66	51.74	51.84	51.85	52.04	52.26	52.50	52.93	53.21	53.31	53.30		
CHAINAGE	0.00	5.27	20.00	40.00	40.76	60.00	80.00	100.00	120.00	140.00	143.46	160.00	180.00	200.00	220.00	240.00	260.00	279.20	280.00	300.00	320.00	340.00	360.00	380.00	397.35	400.00	415.68	420.00
VERTICAL GEOMETRY		L=2.74 1.0%	L=38.02, Δ=7.60% K=5.00		L=0.00 8.6%									L=277.49, Δ=-14.60% K=19.00								L=13.00 -6.0%	L=50.00, Δ=7.19% K=6.95			L=29.15 1.2%		
HORIZONTAL GEOMETRY			R 275.85 A 40.76					102.70m 106°55'28"							R 300.00 A 135.74							118.15m 132°50'49"					R 300.00 A 62.36	

LONGITUDINAL SECTION - Q7 - Queen H
SCALES: HOR 1:1000 VERT 1:200

LEGEND

🟥	CUT
🟩	FILL

NOTES / DESIGN ASSUMPTIONS

1. LONGSECTION IS FOR SURFACE OF LOCAL ROAD ONLY.
2. QUEEN STREET WOULD BE REDUCED TO 50 OR 60KM/H LEGAL SPEED LIMIT.
3. WALKING & CYCLING (W&C) FACILITIES WOULD BE PROVIDED ON THE QUEEN STREET OVERBRIDGE.
4. QUEEN STREET IS REALIGNED NORTHWARDS TO AVOID IMPACT ON PROUSE FRONTAGE.
5. SURFACE FLOOD WATERS / FLOW PATHS TO BE MAINTAINED WITH USE OF CULVERTS.

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE
A	ISSUED FOR INFORMATION	SS	JP	JP	21.09.21

SURVEYED	
DESIGNED	Melissa Nel
DRAWN	Steve Sutton
CAD REVIEW	
DESIGN CHECK	
DESIGN REVIEW	
APPROVED	
PROF REGISTRATION:	

Stantec

Client:
WAKA KOTAHI
NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

OPTION Q7 - QUEEN STREET
LOCAL ROAD OVER TOP

Status Stamp **WORKING PLOT**
Date Stamp
Scales AS SHOWN
Drawing No. 310203848-01-001-SK1007
Rev. A

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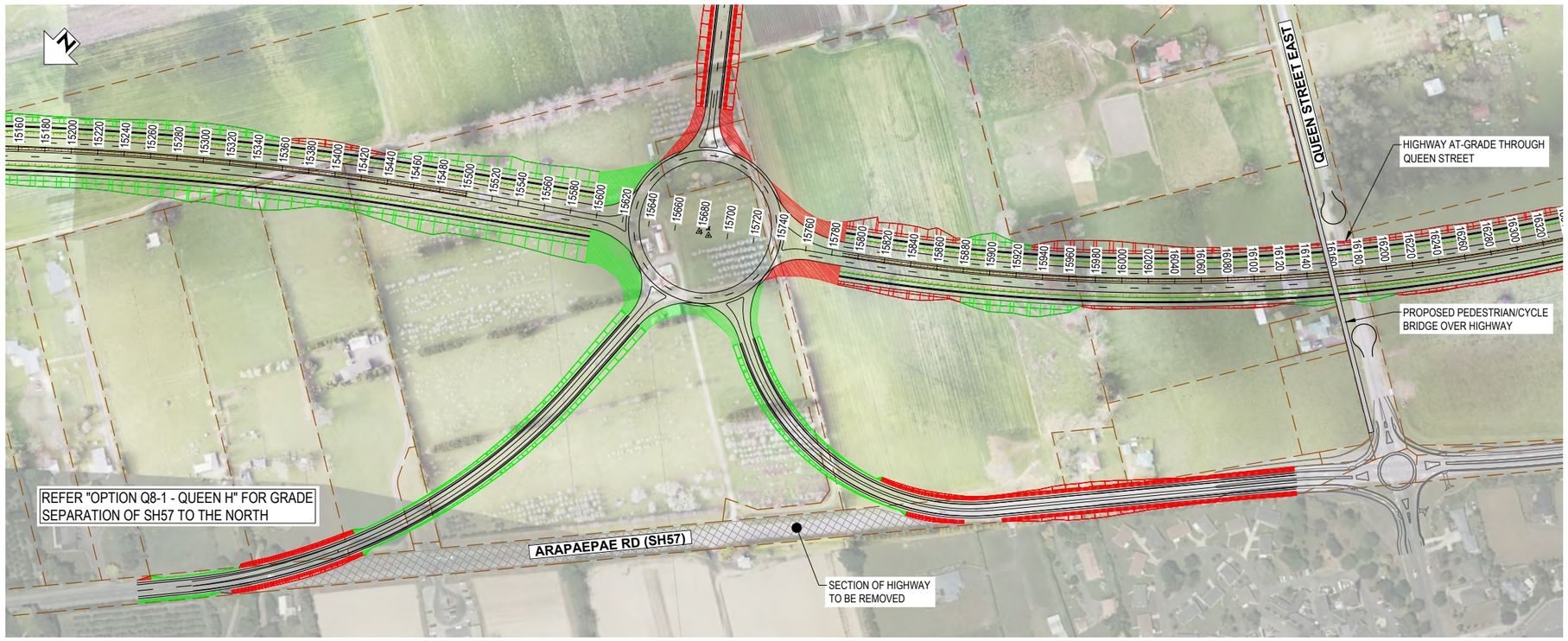
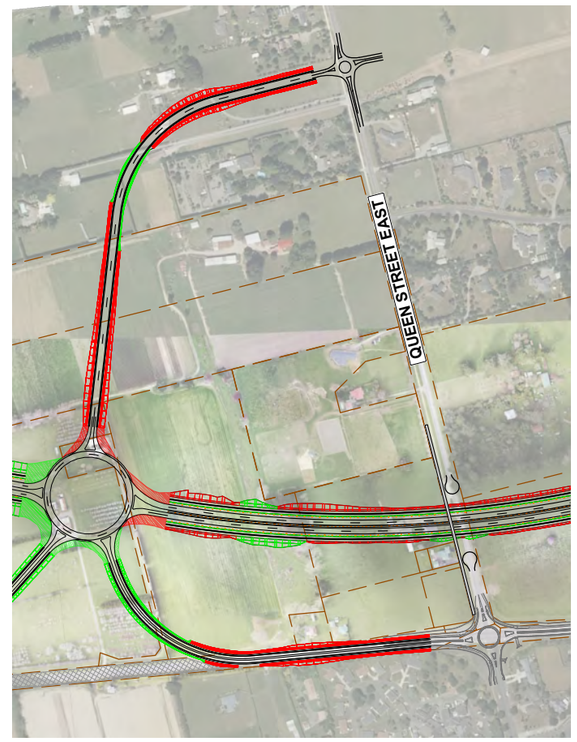
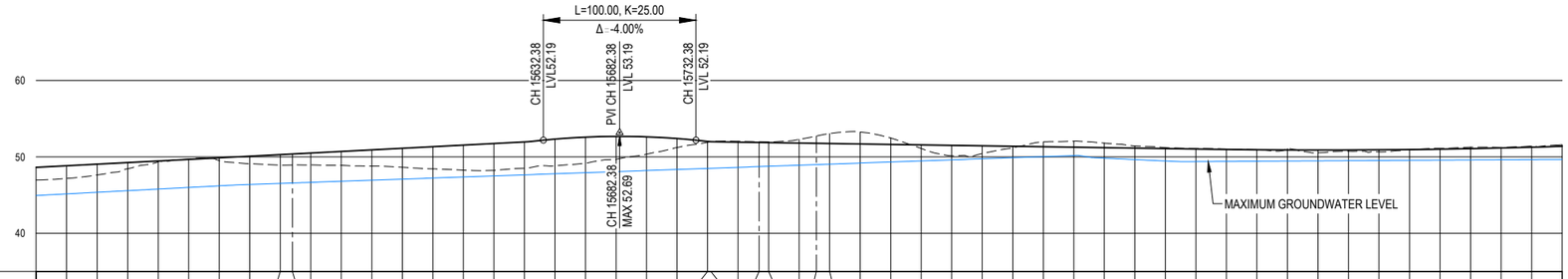




LEGEND

🟥 CUT

🟩 FILL



-CUT +FILL	+1.65	+1.66	+1.41	+0.81	+0.09	-0.03	+0.36	+0.98	+1.37	+1.44	+1.55	+1.81	+2.11	+2.49
FINISHED LEVEL	48.64	48.84	49.05	49.26	49.47	49.68	49.88	50.09	50.30	50.38	50.51	50.72	50.93	51.13
GROUND LEVEL	46.98	47.19	47.64	48.45	49.38	49.70	49.52	49.11	48.93	48.95	48.95	48.91	48.81	48.64
CHAINAGE	15300.00	15320.00	15340.00	15360.00	15380.00	15400.00	15420.00	15440.00	15460.00	15467.92	15480.00	15500.00	15520.00	15540.00

-CUT +FILL	+2.91	+3.29	+3.52	+3.44	+3.49	+3.43	+3.00	+2.27	+1.18	+0.12	-0.01	-0.10	-0.09	-0.09
FINISHED LEVEL	51.34	51.55	51.76	51.97	52.33	52.59	52.69	52.63	52.41	52.04	51.99	51.94	51.90	51.88
GROUND LEVEL	48.44	48.26	48.24	48.52	48.84	49.16	49.69	50.36	51.23	51.92	52.00	52.04	51.99	51.97
CHAINAGE	15560.00	15580.00	15600.00	15620.00	15640.00	15660.00	15680.00	15700.00	15720.00	15740.00	15742.22	15760.00	15773.77	15780.00

-CUT +FILL	-0.48	-0.95	-1.30	-1.56	-0.85	+0.47	+1.37	+1.03	+0.21	-0.65	-0.79	-0.59	-0.28	-0.12
FINISHED LEVEL	51.82	51.79	51.76	51.70	51.64	51.58	51.52	51.46	51.40	51.34	51.28	51.22	51.16	51.10
GROUND LEVEL	52.30	52.73	53.06	53.26	52.49	51.11	50.15	50.43	51.19	51.99	52.07	51.81	51.44	51.21
CHAINAGE	15800.00	15811.27	15820.00	15840.00	15860.00	15880.00	15900.00	15920.00	15940.00	15960.00	15980.00	16000.00	16020.00	16040.00

-CUT +FILL	-0.06	-0.05	+0.01	-0.16	+0.35	+0.15	+0.26	+0.02	-0.11	-0.19	-0.07	-0.14	-0.19
FINISHED LEVEL	51.04	50.98	50.94	50.91	50.90	50.91	50.93	50.96	51.02	51.09	51.17	51.27	51.39
GROUND LEVEL	51.10	51.03	50.93	51.07	50.55	50.75	50.67	50.94	51.13	51.28	51.24	51.41	51.58
CHAINAGE	16060.00	16080.00	16100.00	16120.00	16140.00	16160.00	16180.00	16200.00	16220.00	16240.00	16260.00	16280.00	16300.00

VERTICAL GEOMETRY
L=1342.48 1.0%
L=0.10L=9.79 6% K 2.0%
L=100.00, Δ=-4.00% K=25.00
L=9.84 -2.0%
L=326.48 -0.3%
L=330.48, Δ=1.32% K=250.00

HORIZONTAL GEOMETRY
R 2500.00 A 509.80
305.85m 234°10'36"
S 37.50
R 1500.00 A 606.03

LONGITUDINAL SECTION - Q8 - Highway H
SCALES: HOR 1:2000 VERT 1:400

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE
A	ISSUED FOR INFORMATION	SS	JP	JP	21.09.21

SURVEYED	
DESIGNED	Melissa Nel
DRAWN	Steve Sutton
CAD REVIEW	
DESIGN CHECK	
DESIGN REVIEW	
APPROVED	
PROF REGISTRATION:	

Stantec

Client:
WAKA KOTAHI
NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

OPTION Q8 - QUEEN STREET
AT-GRADE: 5-ARM ROUNDABOUT, SHIFT SH57 CONNECTION SOUTH

Status Stamp: WORKING PLOT
Date Stamp
Scales: AS SHOWN
Drawing No. 310203848-01-001-SK1008
Rev. A

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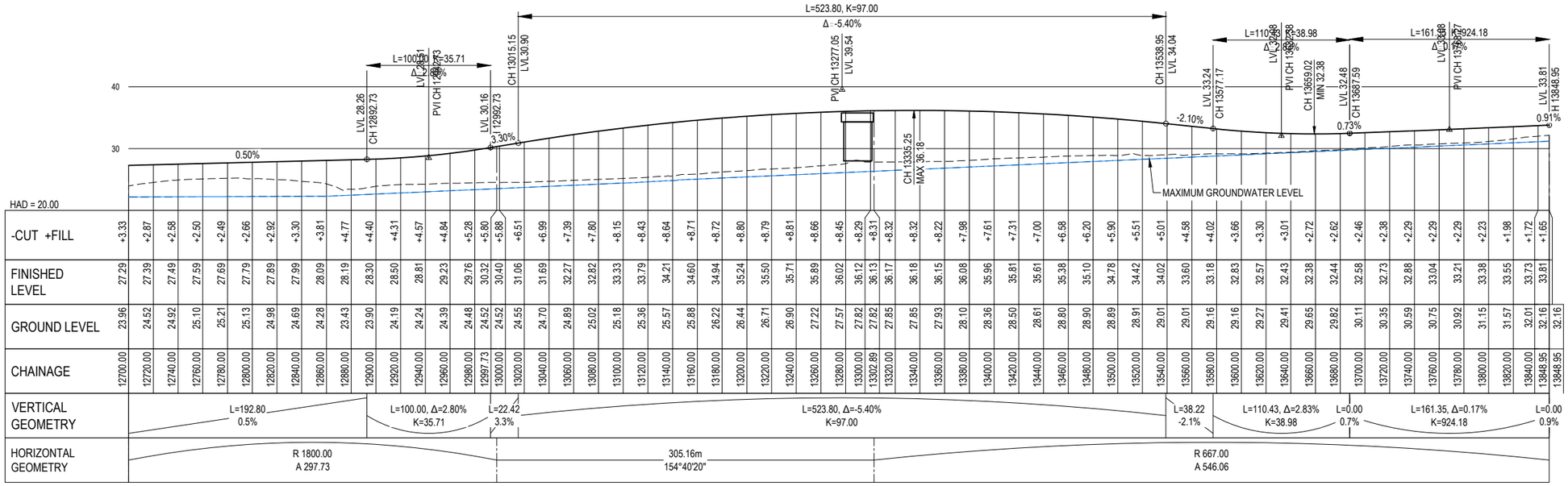
LEGEND

CUT

FILL



LONGITUDINAL SECTION - Q8-1 - Highway H
SCALES: HOR 1:2000 VERT 1:400

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE
A	ISSUED FOR INFORMATION	SS	JP	JP	21.09.21

SURVEYED		
DESIGNED	Melissa Nel	
DRAWN	Steve Sutton	
CAD REVIEW		
DESIGN CHECK		
DESIGN REVIEW		
APPROVED		
PROF REGISTRATION:		

Stantec

Client: WAKA KOTAHI NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

OPTION Q8-1 - QUEEN STREET
AT-GRADE: 5-ARM ROUNDABOUT, SHIFT SH57 CONNECTION SOUTH

Status Stamp: **WORKING PLOT**
Date Stamp:
Scales: AS SHOWN
Drawing No.: 310203848-01-001-SK1009
Rev.: A

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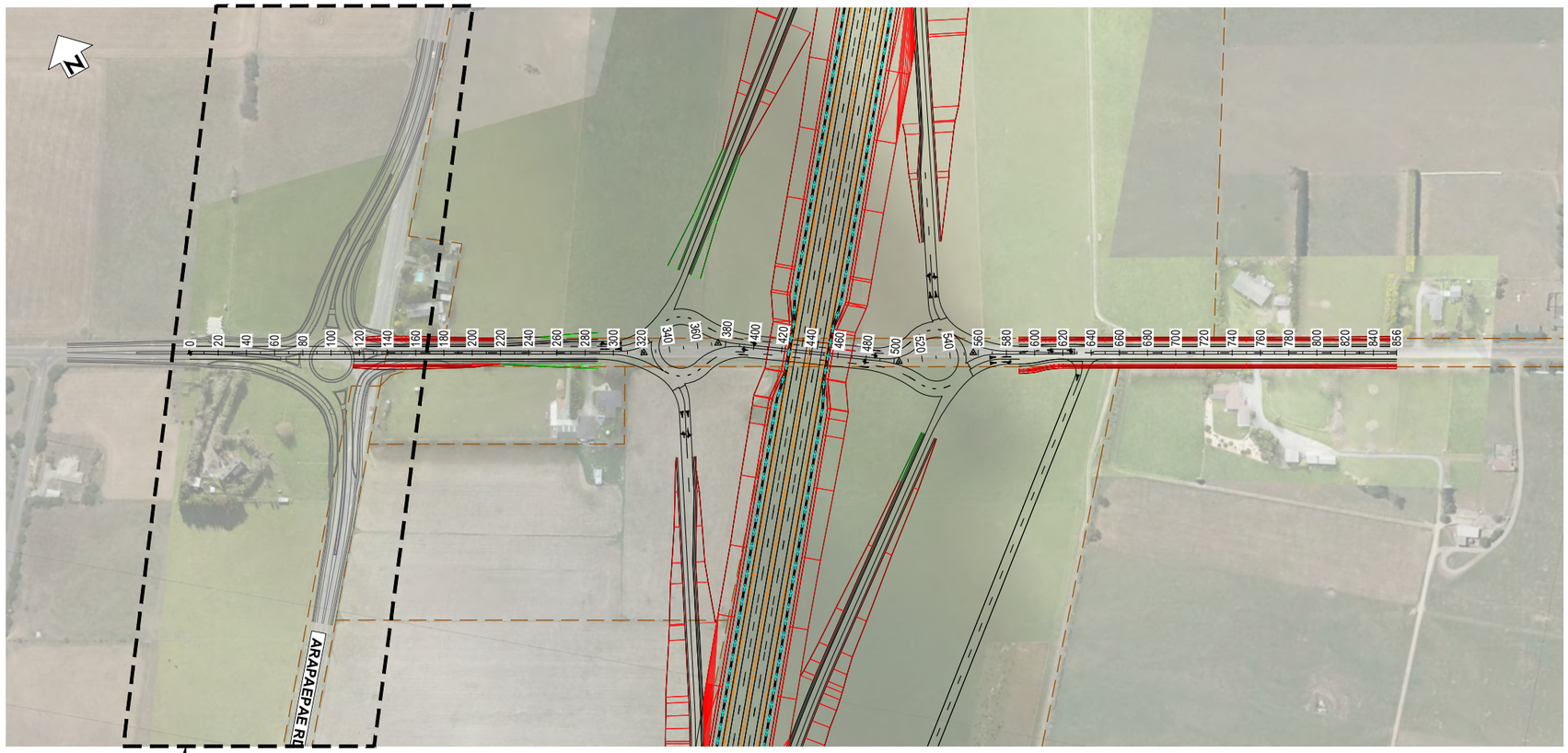
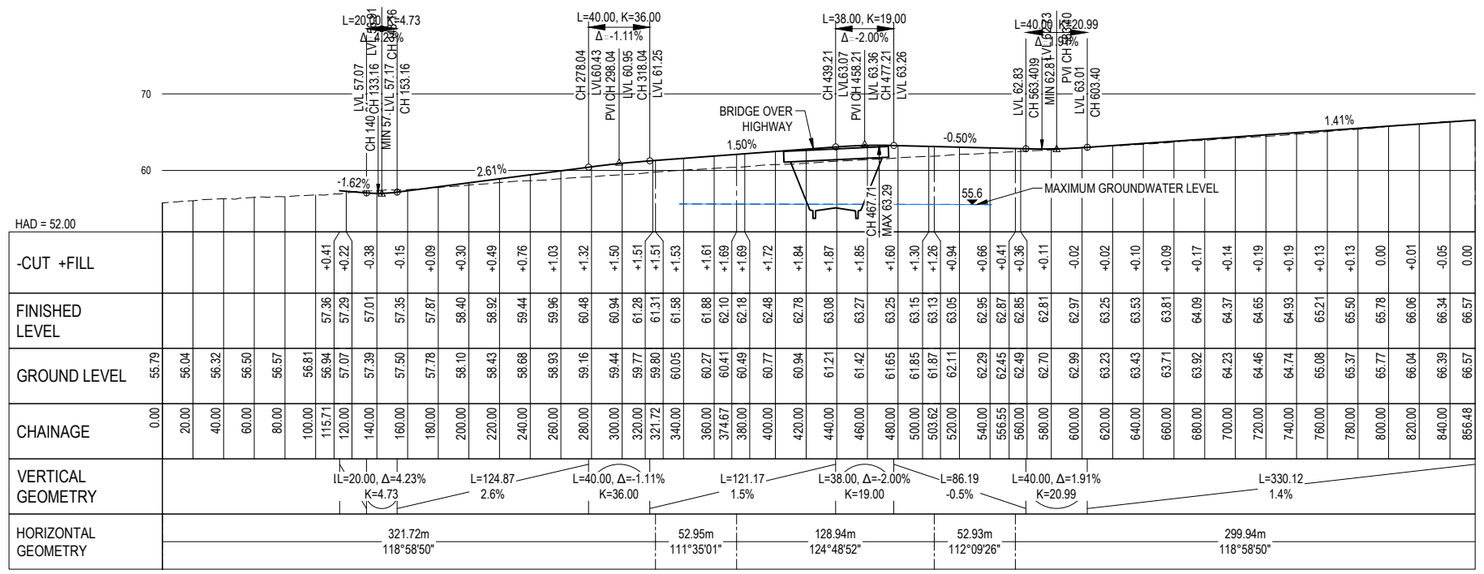




AREA NOT SUBJECT TO MCA

LEGEND

🟥	CUT
🟩	FILL

NOTES / DESIGN ASSUMPTIONS

1. LONGSECTION IS FOR SURFACE OF LOCAL ROAD ONLY.
2. ORIGINAL DBC OPTION WITH STANDARD EARTHWORKS TRENCH IS NOT TECHNICALLY FEASIBLE DUE TO MAXIMUM GROUNDWATER LEVELS.

CHAINAGE	0.00	20.00	40.00	60.00	80.00	100.00	115.71	120.00	140.00	160.00	180.00	200.00
-CUT +FILL							+0.41	+0.22	-0.38	-0.15	+0.09	+0.30
FINISHED LEVEL							57.36	57.29	57.01	57.35	57.87	58.40
GROUND LEVEL	55.79	56.04	56.32	56.50	56.57	56.81	56.94	57.07	57.39	57.50	57.78	58.10

CHAINAGE	220.00	240.00	260.00	280.00	300.00	320.00	321.72	340.00	360.00	374.67	380.00	400.00
-CUT +FILL	+0.49	+0.76	+1.03	+1.32	+1.50	+1.51	+1.51	+1.53	+1.61	+1.69	+1.69	+1.72
FINISHED LEVEL	58.92	59.44	59.96	60.48	60.94	61.28	61.31	61.58	61.88	62.10	62.18	62.48
GROUND LEVEL	58.43	58.68	58.93	59.16	59.44	59.77	59.80	60.05	60.27	60.41	60.49	60.77

CHAINAGE	420.00	440.00	460.00	480.00	500.00	503.62	520.00	540.00	556.55	560.00	580.00	600.00
-CUT +FILL	+1.84	+1.87	+1.85	+1.60	+1.30	+1.26	+0.94	+0.66	+0.41	+0.36	+0.11	-0.02
FINISHED LEVEL	62.78	63.08	63.27	63.25	63.15	63.13	63.05	62.95	62.87	62.85	62.81	62.97
GROUND LEVEL	60.94	61.21	61.42	61.65	61.85	61.87	62.11	62.29	62.45	62.49	62.70	62.99

CHAINAGE	620.00	640.00	660.00	680.00	700.00	720.00	740.00	760.00	780.00	800.00	820.00	840.00	856.48
-CUT +FILL	+0.02	+0.10	+0.09	+0.17	+0.14	+0.19	+0.19	+0.13	+0.13	0.00	+0.01	-0.05	0.00
FINISHED LEVEL	63.25	63.53	63.81	64.09	64.37	64.65	64.93	65.21	65.50	65.78	66.06	66.34	66.57
GROUND LEVEL	63.23	63.43	63.71	63.92	64.23	64.46	64.74	65.08	65.37	65.77	66.04	66.39	66.57

VERTICAL GEOMETRY	L=20.00, Δ=4.23% K=4.73	L=124.87 2.6%	L=40.00, Δ=-1.11% K=36.00	L=121.17 1.5%	L=38.00, Δ=-2.00% K=19.00	L=86.19 -0.5%	L=40.00, Δ=1.91% K=20.99	L=330.12 1.4%

HORIZONTAL GEOMETRY	321.72m 118°58'50"	52.95m 111°35'01"	128.94m 124°48'52"	52.93m 112°09'26"	299.94m 118°58'50"

LONGITUDINAL SECTION - T0 - Tararua H
SCALES: HOR 1:2000 VERT 1:400

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE
A	ISSUED FOR INFORMATION	SS	JP	JP	21.09.21

SURVEYED
DESIGNED Melissa Nel
DRAWN Steve Sutton
CAD REVIEW
DESIGN CHECK
DESIGN REVIEW
APPROVED
PROF REGISTRATION:

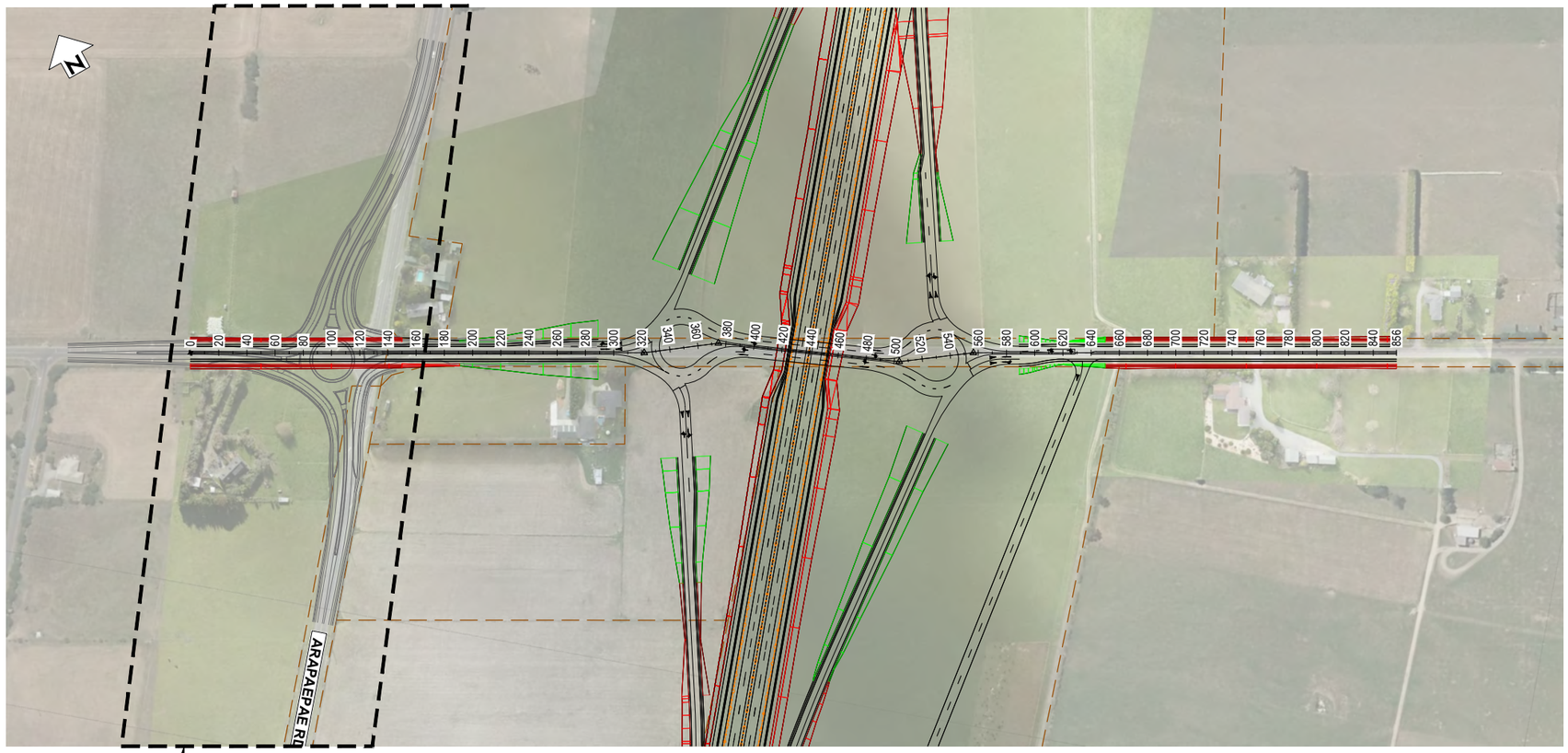
Stantec

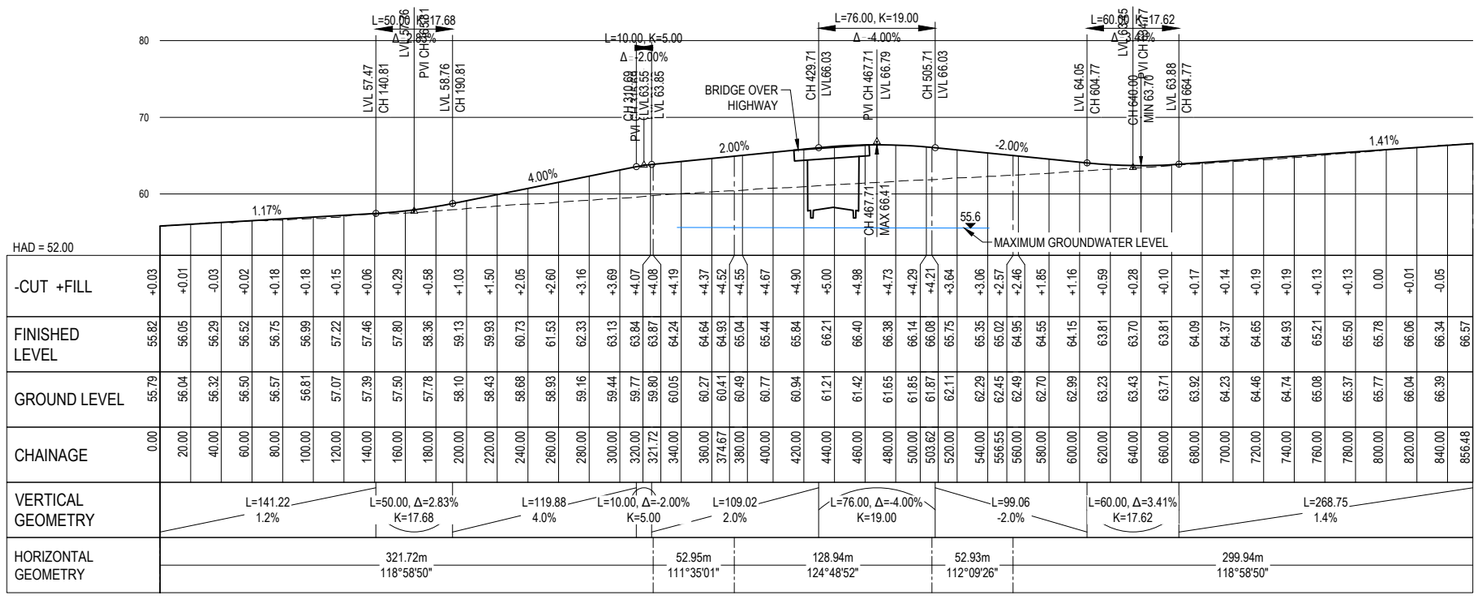
Client:
WAKA KOTAHI NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

OPTION T0 - TARARUA ROAD
HIGHWAY FULLY BELOW GRADE (DBC)

Status Stamp: **WORKING PLOT**
Date Stamp:
Scales: AS SHOWN
Drawing No.: 310203848-01-001-SK1010
Rev.: A





-CUT +FILL	+0.03	+0.01	-0.03	+0.02	+0.18	+0.18	+0.15	+0.06	+0.29	+0.58	+1.03	+1.50	+2.05	+2.60	+3.16	+3.69
FINISHED LEVEL	55.82	56.05	56.29	56.52	56.75	56.99	57.22	57.46	57.80	58.36	59.13	59.93	60.73	61.53	62.33	63.13
GROUND LEVEL	55.79	56.04	56.32	56.50	56.57	56.81	57.07	57.39	57.50	57.78	58.10	58.43	58.68	58.93	59.16	59.44
CHAINAGE	0.00	20.00	40.00	60.00	80.00	100.00	120.00	140.00	160.00	180.00	200.00	220.00	240.00	260.00	280.00	300.00

-CUT +FILL	+4.07	+4.08	+4.19	+4.37	+4.52	+4.55	+4.67	+4.90	+5.00	+4.98	+4.73	+4.29	+4.21	+3.64	+3.06	+2.57
FINISHED LEVEL	63.84	63.87	64.24	64.64	64.93	65.04	65.44	65.84	66.21	66.40	66.38	66.14	66.08	65.75	65.35	65.02
GROUND LEVEL	59.77	59.80	60.05	60.27	60.41	60.49	60.77	60.94	61.21	61.42	61.65	61.85	61.87	62.11	62.29	62.45
CHAINAGE	320.00	321.72	340.00	360.00	374.67	380.00	400.00	420.00	440.00	460.00	480.00	500.00	503.62	520.00	540.00	556.55

-CUT +FILL	+2.46	+1.85	+1.16	+0.59	+0.28	+0.10	+0.17	+0.14	+0.19	+0.19	+0.13	+0.13	0.00	+0.01	-0.05	
FINISHED LEVEL	64.95	64.55	64.15	63.81	63.70	63.81	64.09	64.37	64.65	64.93	65.21	65.50	65.78	66.06	66.34	66.57
GROUND LEVEL	62.49	62.70	62.99	63.23	63.43	63.71	63.92	64.23	64.46	64.74	65.08	65.37	65.77	66.04	66.39	
CHAINAGE	560.00	580.00	600.00	620.00	640.00	660.00	680.00	700.00	720.00	740.00	760.00	780.00	800.00	820.00	840.00	856.48

VERTICAL GEOMETRY	L=141.22 1.2%	L=50.00, Δ=2.83% K=17.68	L=119.88 4.0%	L=10.00, Δ=-2.00% K=5.00	L=109.02 2.0%	L=76.00, Δ=-4.00% K=19.00	L=99.06 -2.0%	L=60.00, Δ=3.41% K=17.62	L=268.75 1.4%

HORIZONTAL GEOMETRY	321.72m 118°58'50"	52.95m 111°35'01"	128.94m 124°48'52"	52.93m 112°09'26"	299.94m 118°58'50"

LONGITUDINAL SECTION - T1 - Tararua H
SCALES: HOR 1:2000 VERT 1:400

LEGEND

🟥	CUT
🟩	FILL

NOTES / DESIGN ASSUMPTIONS

1. LONGSECTION IS FOR SURFACE OF LOCAL ROAD ONLY.
2. HIGHWAY PARTIALLY BELOW GRADE, BUT SHALLOWER THAN ESTIMATED MAX GROUNDWATER.
3. WALKING AND CYCLING (W&C) FACILITIES TO BE PROVIDED ON TARARUA ROAD.
4. SURFACE FLOOD WATERS / FLOW PATHS TO BE MAINTAINED WITH USE OF CULVERTS OR SIPHONS.

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE
A	ISSUED FOR INFORMATION	SS	JP	JP	21.09.21

SURVEYED	
DESIGNED	Melissa Nel
DRAWN	Steve Sutton
CAD REVIEW	
DESIGN CHECK	
DESIGN REVIEW	
APPROVED	
PROF REGISTRATION:	

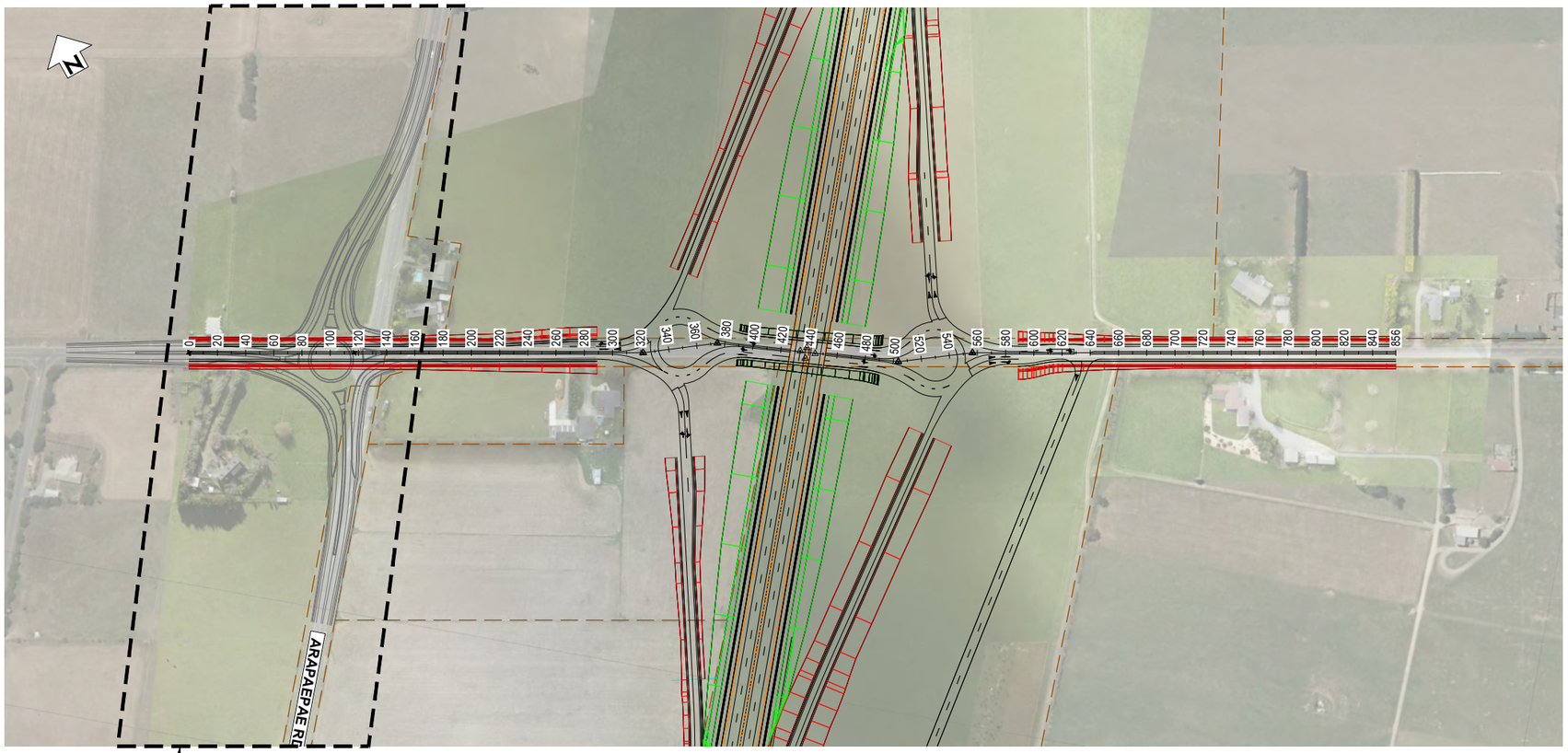
Stantec

Client:
WAKA KOTAHI NZ TRANSPORT AGENCY

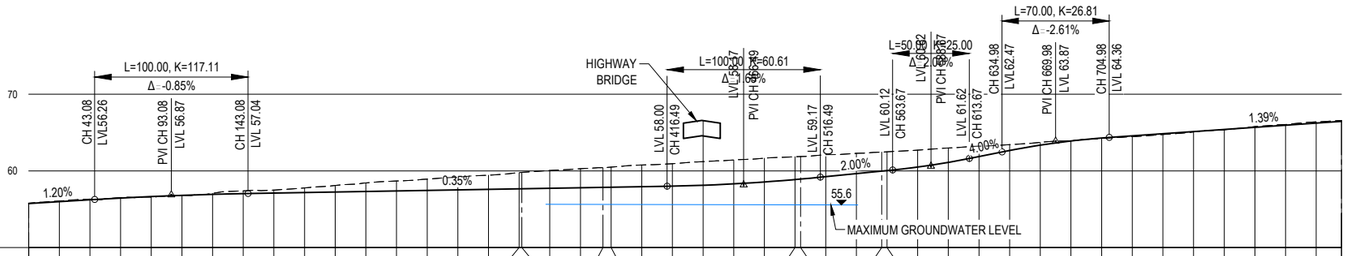
WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

OPTION T1 - TARARUA ROAD
HIGHWAY PARTIALLY BELOW GRADE

Status Stamp **WORKING PLOT**
Date Stamp
Scales AS SHOWN
Drawing No. 310203848-01-001-SK1011
Rev. A



AREA NOT SUBJECT TO MCA



-CUT +FILL	-0.04	-0.06	-0.09	-0.04	+0.08	0.00	-0.13	-0.36	-0.40	-0.61	-0.86	-1.12
FINISHED LEVEL	55.75	55.99	56.23	56.46	56.65	56.81	56.94	57.03	57.10	57.17	57.24	57.31
GROUND LEVEL	55.79	56.04	56.32	56.50	56.57	56.81	57.07	57.39	57.50	57.78	58.10	58.43
CHAINAGE	0.00	20.00	40.00	60.00	80.00	100.00	120.00	140.00	160.00	180.00	200.00	220.00

-CUT +FILL	-1.30	-1.48	-1.64	-1.85	-2.11	-2.13	-2.32	-2.47	-2.56	-2.62	-2.83	-2.93
FINISHED LEVEL	57.38	57.45	57.52	57.59	57.66	57.67	57.73	57.80	57.85	57.87	57.94	58.01
GROUND LEVEL	58.68	58.93	59.16	59.44	59.77	59.80	60.05	60.27	60.41	60.49	60.77	60.94
CHAINAGE	240.00	260.00	280.00	300.00	320.00	321.72	340.00	360.00	374.67	380.00	400.00	420.00

-CUT +FILL	-3.08	-3.12	-3.09	-2.98	-2.94	-2.86	-2.65	-2.48	-2.44	-2.21	-1.88	-1.36
FINISHED LEVEL	58.13	58.31	58.55	58.87	58.93	59.24	59.64	59.97	60.04	60.50	61.11	61.87
GROUND LEVEL	61.21	61.42	61.65	61.85	61.87	62.11	62.29	62.45	62.49	62.70	62.99	63.23
CHAINAGE	440.00	460.00	480.00	500.00	503.62	520.00	540.00	556.55	560.00	580.00	600.00	620.00

-CUT +FILL	-0.76	-0.36	-0.03	+0.05	+0.11	+0.10	+0.04	+0.03	-0.10	-0.09	-0.16	
FINISHED LEVEL	62.67	63.35	63.89	64.28	64.56	64.84	65.12	65.40	65.68	65.95	66.23	66.46
GROUND LEVEL	63.43	63.71	63.92	64.23	64.46	64.74	65.08	65.37	65.77	66.04	66.39	
CHAINAGE	640.00	660.00	680.00	700.00	720.00	740.00	760.00	780.00	800.00	820.00	840.00	856.48

VERTICAL GEOMETRY: L=47.22 1.2% | L=100.00, Δ=-0.85% K=117.11 | L=273.41 0.4% | L=100.00, Δ=1.65% K=60.61 | L=47.18 2.0% | L=50.00, Δ=2.00 K=25.00 | L=21.31 4.0% | L=70.00, Δ=-2.61% K=26.81 | L=202.71 1.4%

HORIZONTAL GEOMETRY: 321.72m 118°58'50" | 52.95m 111°35'01" | 128.94m 124°48'52" | 52.93m 112°09'26" | 299.94m 118°58'50"

LONGITUDINAL SECTION - T2 - Tararua H
SCALES: HOR 1:2000 VERT 1:400

LEGEND

🟥	CUT
🟩	FILL

NOTES / DESIGN ASSUMPTIONS

1. LONGSECTION IS FOR SURFACE OF LOCAL ROAD ONLY.
2. TARARUA ROAD PARTIALLY BELOW GRADE, BUT SHALLOWER THAN ESTIMATED MAX GROUNDWATER.
3. WALKING AND CYCLING (W&C) FACILITIES TO BE PROVIDED ON TARARUA ROAD.
4. SURFACE FLOOD WATERS / FLOW PATHS TO BE MAINTAINED WITH USE OF CULVERTS OR SIPHONS.

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE
A	ISSUED FOR INFORMATION	SS	JP	JP	21.09.21

SURVEYED	
DESIGNED	Melissa Nel
DRAWN	Steve Sutton
CAD REVIEW	
DESIGN CHECK	
DESIGN REVIEW	
APPROVED	
PROF REGISTRATION:	

Stantec

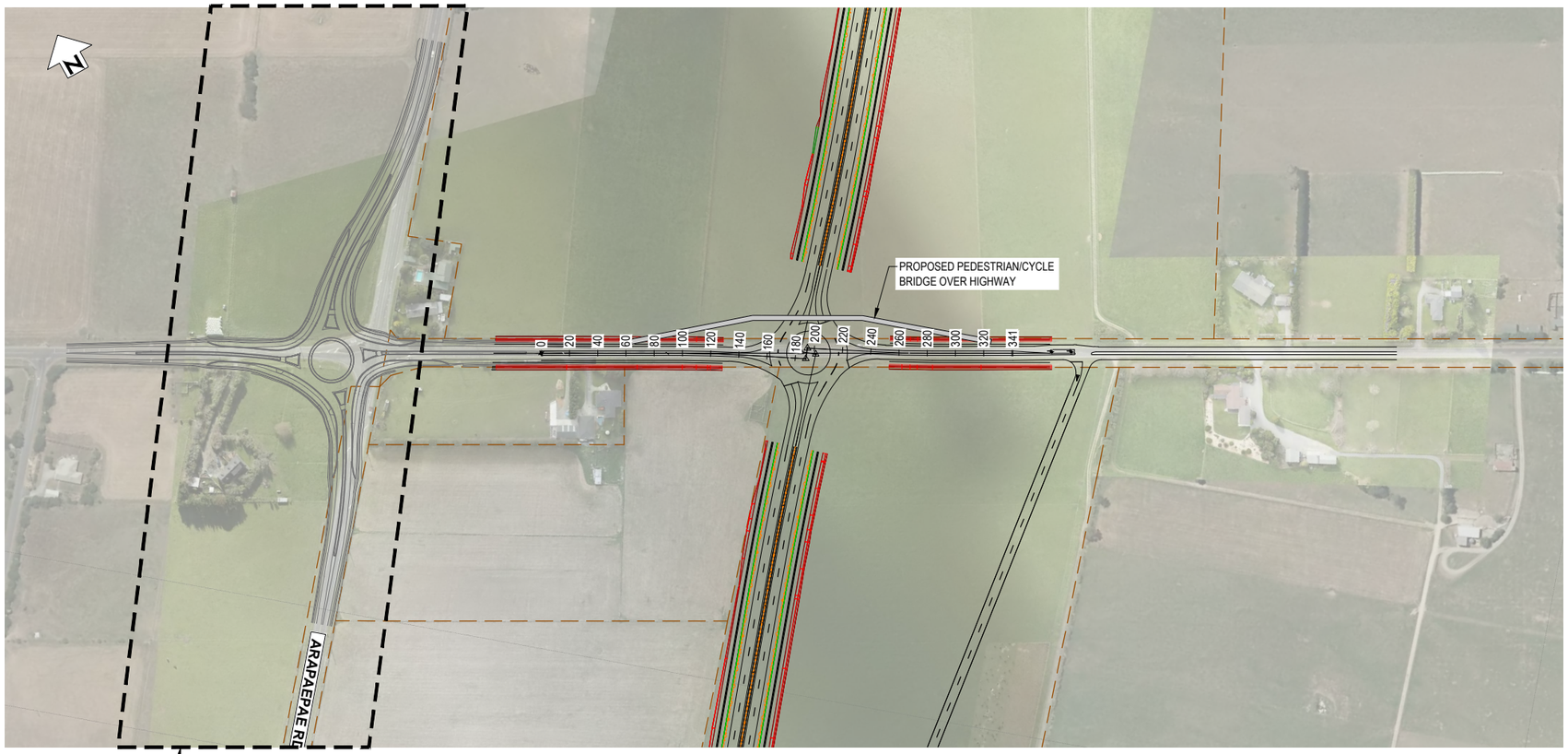
Client:
WAKA KOTAHI NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

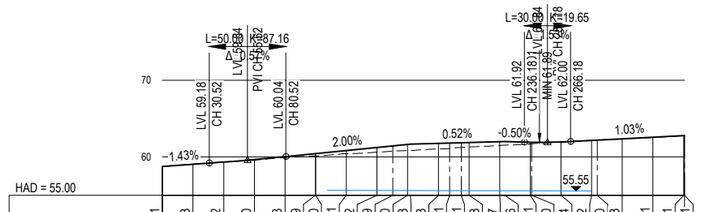
OPTION T2 - TARARUA ROAD
LOCAL ROAD PARTIALLY BELOW GRADE

Status Stamp: WORKING PLOT
Date Stamp
Scales: AS SHOWN
Drawing No.: 310203848-01-001-SK1012
Rev.: A

pw:\\stantec-ap-pw.bentley.com:stantec-ap-pw-01\Documents\New Zealand Clients\NZTA (New Zealand Transport Agency)\310203848 - Otaki to North of Levin DBC\01\Optioneering East Levin MCA\310203848-01-001-SK1000



AREA NOT SUBJECT TO MCA



-CUT +FILL	-0.01	-0.03	-0.02	+0.10	+0.13	+0.29	+0.30	+0.41	+0.62	+0.69	+0.80	+0.83	+0.73	+0.71	+0.61	+0.58	+0.47	+0.46	+0.21	+0.20	+0.04	-0.02	0.00	+0.03	+0.01	-0.01	-0.01
FINISHED LEVEL	58.74	59.03	59.32	59.65	60.03	60.42	60.43	60.83	61.23	61.43	61.63	61.66	61.76	61.80	61.84	61.86	61.97	61.98	61.90	61.90	61.94	62.14	62.18	62.34	62.55	62.75	62.76
GROUND LEVEL	58.75	59.06	59.34	59.55	59.90	60.13	60.13	60.41	60.61	60.74	60.83	60.84	61.03	61.09	61.23	61.28	61.50	61.53	61.69	61.70	61.91	62.15	62.18	62.32	62.54	62.76	62.77
CHAINAGE	0.00	20.00	40.00	60.00	80.00	99.83	100.00	120.00	140.00	150.31	160.00	161.86	180.00	187.43	195.06	200.00	220.00	223.20	240.00	240.84	260.00	280.00	283.72	300.00	320.00	340.00	340.57

VERTICAL GEOMETRY: L=31.8 1.4% | L=50.00, Δ=0.57% K=87.16 | L=81.33 2.0% | L=61.34 0.5% | L | L=30.00, Δ=1.53% K=19.65 | L=78.23 1.0%

HORIZONTAL GEOMETRY: 99.83m 118°58'50" | R 800.00 A 50.48 | 37.12 122°35' | 7.63m 38°03'0 | 45.78m 122°03'07" | R 800.00 A 42.88 | 56.84m 118°58'50"

LONGITUDINAL SECTION - T3 - Tararua H
SCALES: HOR 1:2000 VERT 1:400

LEGEND

🟥	CUT
🟩	FILL

NOTES / DESIGN ASSUMPTIONS

1. LONGSECTION IS FOR SURFACE OF LOCAL ROAD ONLY.
2. SURFACE FLOOD WATERS / FLOW PATHS TO BE MAINTAINED WITH USE OF CULVERTS.
3. WALKING AND CYCLING FACILITIES WOULD BE PROVIDED ON A SEPARATE BRIDGE.

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE
A	ISSUED FOR INFORMATION	SS	JP	JP	21.09.21

SURVEYED
DESIGNED Melissa Nel
DRAWN Steve Sutton
CAD REVIEW
DESIGN CHECK
DESIGN REVIEW
APPROVED
PROF REGISTRATION:

Stantec

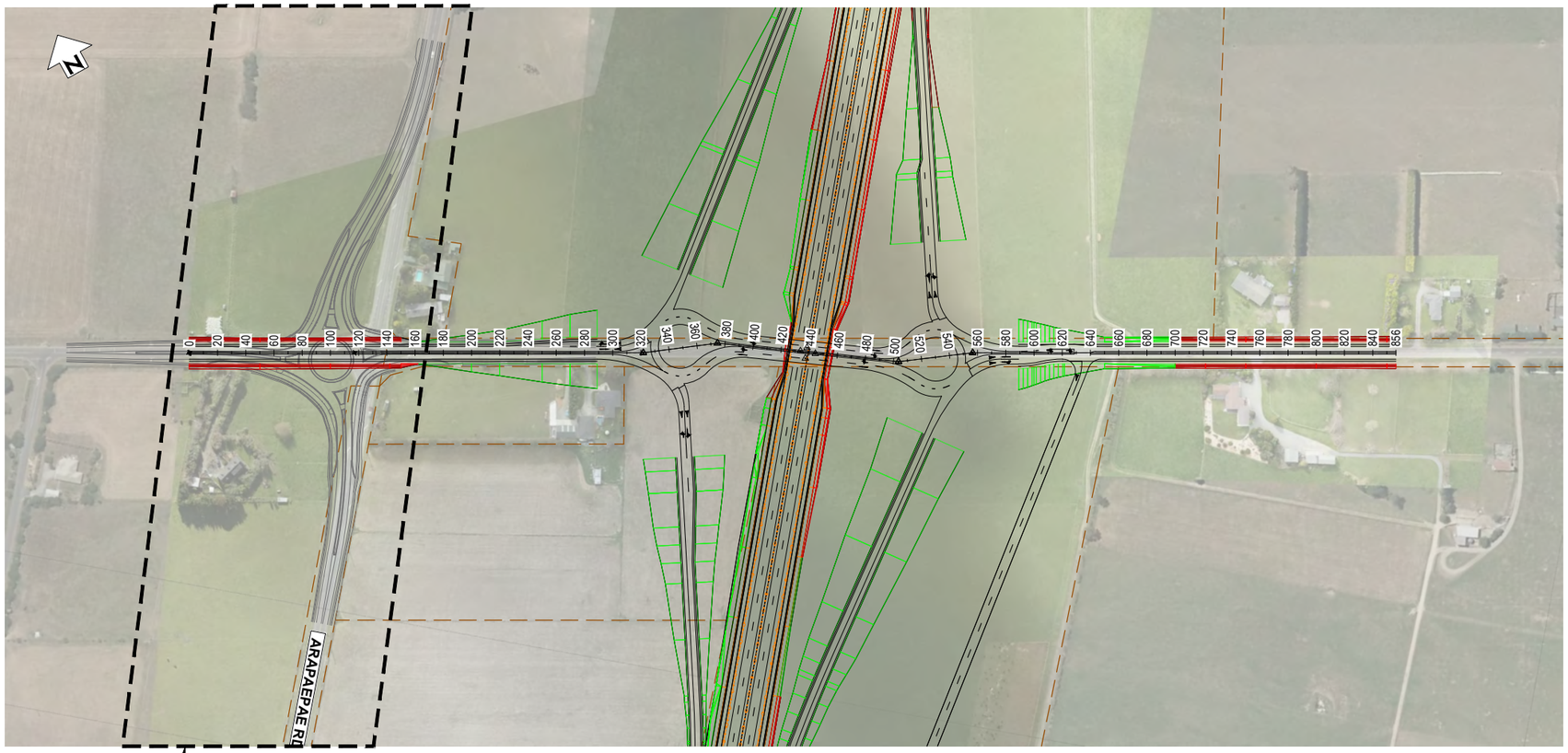
Client:
WAKA KOTAHI NZ TRANSPORT AGENCY

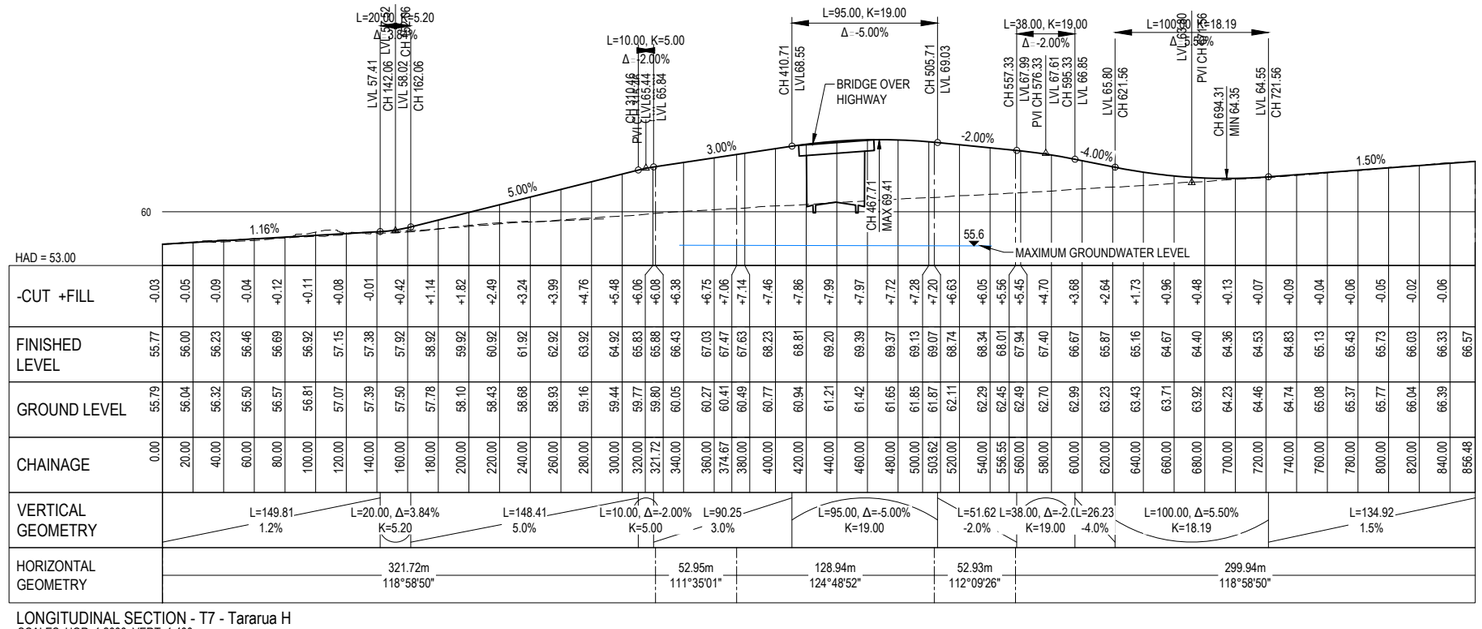
WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

OPTION T3 - TARARUA ROAD
AT-GRADE: ROUNDABOUT

Status Stamp **WORKING PLOT**
Date Stamp
Scales AS SHOWN
Drawing No. 310203848-01-001-SK1013
Rev. A

pw:\\stantec-ap-pw.bentley.com:stantec-ap-pw-01\Documents\New Zealand Clients\NZTA (New Zealand Transport Agency)\310203848 - Otaki to North of Levin DBC\01\Optioneering East Levin MCA\310203848-01-001-SK1000





AREA NOT SUBJECT TO MCA

-CUT +FILL	-0.03	-0.05	-0.09	-0.04	+0.12	+0.11	+0.08	-0.01	+0.42	+1.14	+1.82	+2.49	+3.24	+3.99	+4.76	+5.48
FINISHED LEVEL	55.77	56.00	56.23	56.46	56.69	56.92	57.15	57.38	57.92	58.92	59.92	60.92	61.92	62.92	63.92	64.92
GROUND LEVEL	55.79	56.04	56.32	56.50	56.57	56.81	57.07	57.39	57.50	57.78	58.10	58.43	58.68	58.93	59.16	59.44
CHAINAGE	0.00	20.00	40.00	60.00	80.00	100.00	120.00	140.00	160.00	180.00	200.00	220.00	240.00	260.00	280.00	300.00

-CUT +FILL	+6.06	+6.08	+6.38	+6.75	+7.06	+7.14	+7.46	+7.86	+7.99	+7.97	+7.72	+7.28	+7.20	+6.63	+6.05	+5.56
FINISHED LEVEL	65.83	65.88	66.43	67.03	67.47	67.63	68.23	68.81	69.20	69.39	69.37	69.13	69.07	68.74	68.34	68.01
GROUND LEVEL	59.77	59.80	60.05	60.27	60.41	60.49	60.77	60.94	61.21	61.42	61.65	61.85	61.87	62.11	62.29	62.45
CHAINAGE	320.00	321.72	340.00	360.00	374.67	380.00	400.00	420.00	440.00	460.00	480.00	500.00	503.62	520.00	540.00	556.55

-CUT +FILL	+5.45	+4.70	+3.68	+2.64	+1.73	+0.96	+0.48	+0.13	+0.07	+0.09	+0.04	+0.06	-0.05	-0.02	-0.06	
FINISHED LEVEL	67.94	67.40	66.67	65.87	65.16	64.67	64.40	64.36	64.53	64.83	65.13	65.43	65.73	66.03	66.33	66.57
GROUND LEVEL	62.49	62.70	62.99	63.23	63.43	63.71	63.92	64.23	64.46	64.74	65.08	65.37	65.77	66.04	66.39	
CHAINAGE	560.00	580.00	600.00	620.00	640.00	660.00	680.00	700.00	720.00	740.00	760.00	780.00	800.00	820.00	840.00	856.48

VERTICAL GEOMETRY
L=149.81 1.2%
L=20.00, Δ=3.84% K=5.20
L=148.41 5.0%
L=10.00, Δ=-2.00% K=5.00
L=90.25 3.0%
L=95.00, Δ=-5.00% K=19.00
L=51.62 -2.0%
L=38.00, Δ=-2.(
K=19.00
L=26.23 -4.0%
L=100.00, Δ=5.50% K=18.19
L=134.92 1.5%

HORIZONTAL GEOMETRY
321.72m 118°58'50"
52.95m 111°35'01"
128.94m 124°48'52"
52.93m 112°09'26"
299.94m 118°58'50"

LONGITUDINAL SECTION - T7 - Tararua H
SCALES: HOR 1:2000 VERT 1:400

LEGEND

🟥	CUT
🟩	FILL

NOTES / DESIGN ASSUMPTIONS

1. LONGSECTION IS FOR SURFACE OF LOCAL ROAD ONLY.
2. SURFACE FLOOD WATERS / FLOW PATHS TO BE MAINTAINED WITH USE OF CULVERTS.
3. WALKING AND CYCLING FACILITIES WOULD BE PROVIDED ON TARARUA ROAD.

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE
A	ISSUED FOR INFORMATION	SS	JP	JP	21.09.21

SURVEYED	
DESIGNED	Melissa Nel
DRAWN	Steve Sutton
CAD REVIEW	
DESIGN CHECK	
DESIGN REVIEW	
APPROVED	
PROF REGISTRATION:	

Stantec

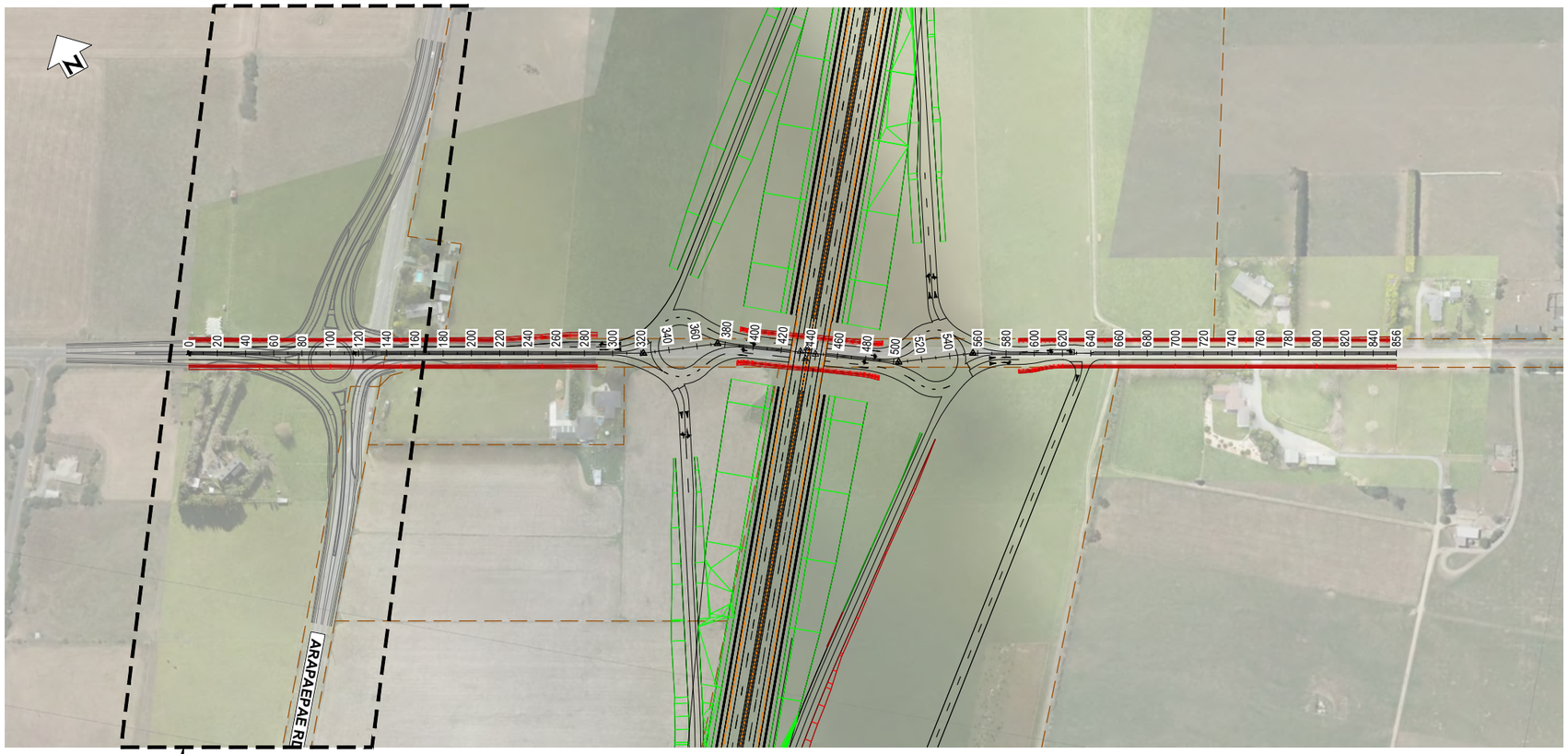
Client:
WAKA KOTAHI
NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

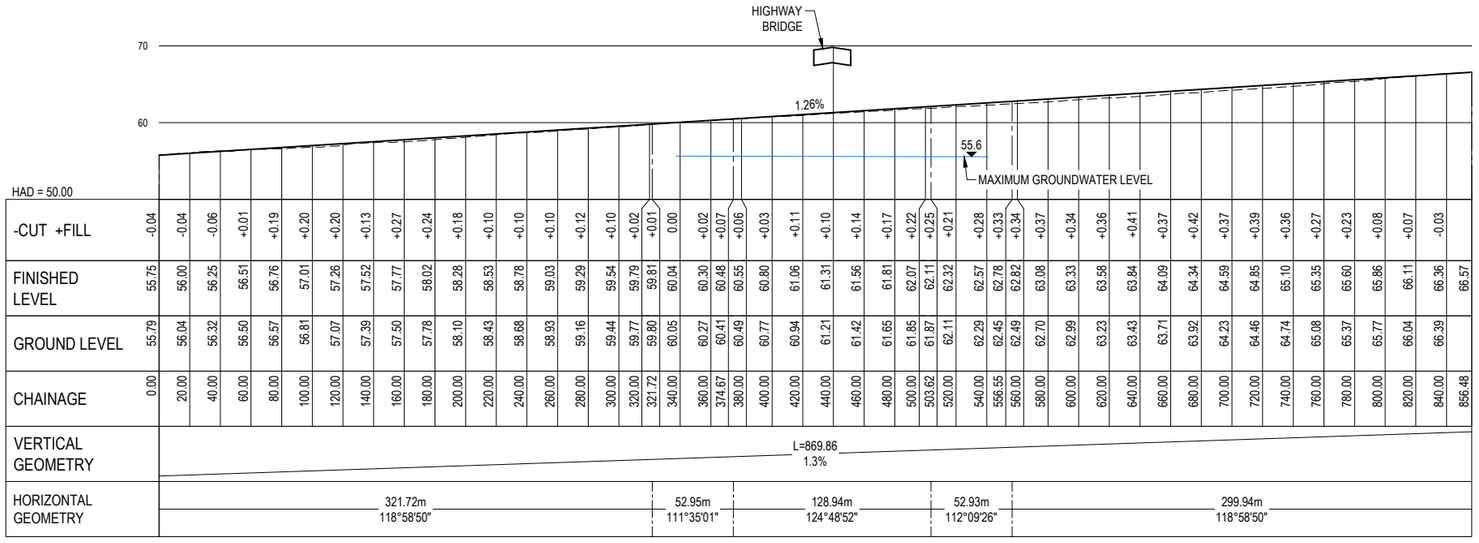
OPTION T7 - TARARUA ROAD
LOCAL ROAD OVER TOP

Status Stamp
WORKING PLOT
Date Stamp
Scales AS SHOWN
Drawing No.
310203848-01-001-SK1015
Rev.
A

pw:\\stantec-ap-pw.bentley.com:stantec-ap-pw-01\Documents\New Zealand Clients\NZTA (New Zealand Transport Agency)\310203848 - Otaki to North of Levin DBC\01\Optioneering East Levin MCA\310203848-01-001-SK1000



AREA NOT SUBJECT TO MCA



LONGITUDINAL SECTION - T6 - Tararua H
SCALES: HOR 1:2000 VERT 1:400

LEGEND

CUT

FILL

NOTES / DESIGN ASSUMPTIONS

1. LONGSECTION IS FOR SURFACE OF LOCAL ROAD ONLY.
2. SURFACE FLOOD WATERS / FLOW PATHS TO BE MAINTAINED WITH USE OF CULVERTS.
3. WALKING AND CYCLING FACILITIES WOULD BE PROVIDED ON TARARUA ROAD.

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE
A	ISSUED FOR INFORMATION	SS	JP	JP	21.09.21

SURVEYED		
DESIGNED	Melissa Nel	
DRAWN	Steve Sutton	
CAD REVIEW		
DESIGN CHECK		
DESIGN REVIEW		
APPROVED		
PROF REGISTRATION:		

Stantec

Client: WAKA KOTAHI NZ TRANSPORT AGENCY

WAKA KOTAHI
OTAKI TO NORTH OF LEVIN

OPTION T6 - TARARUA ROAD
HIGHWAY OVER TOP

Status Stamp: **WORKING PLOT**

Date Stamp:

Scales: AS SHOWN

Drawing No.: 310203848-01-001-SK1014

Rev.: A

pw:\\stantec-ap-pw.bentley.com:stantec-ap-pw-01\Documents\New Zealand Clients\NZTA (New Zealand Transport Agency)\310203848 - Otaki to North of Levin DBC\01\Optioneering East Levin MCA\310203848-01-001-SK1000

B

Appendix B – Summary of survey res

Survey summary – Ōtaki to Levin

Breakdown of responses

- 699 letters sent in total, 100 responses received. Overall response rate of 14%
- 435 letters were sent to households in Levin, and 43 responses were received.
- 166 letters were sent to households in Manakau, and 34 responses were received.
- 46 letters were sent to households in Ōtaki, and 14 responses were received.
- 56 letters were sent to households in Ohau, and 7 responses were received.

100 responses were received in total. As Figures 1 and 2 (below) illustrate, over half of respondents (or their families) have lived in the area for at least a decade, with the majority of people also having lived at their current address for at least 5 years. A significant proportion of households (66%) have at least one household member working from home at least some of the time, in a range of industries including home businesses (office based), horticultural and agricultural work and education.

Figure 2. Length of time spent at current property.

Figure 1. Length of time spent living in area.

Respondents were asked to note which communities they identified with (noting that they could select more than one community. The majority of respondents identified as belonging to the Levin community (see Figure 3), reflecting the larger size of Levin relative to other centres. Of those who identified as being part of another community, most identified with a larger area such as Kapiti Coast or Palmerston North.

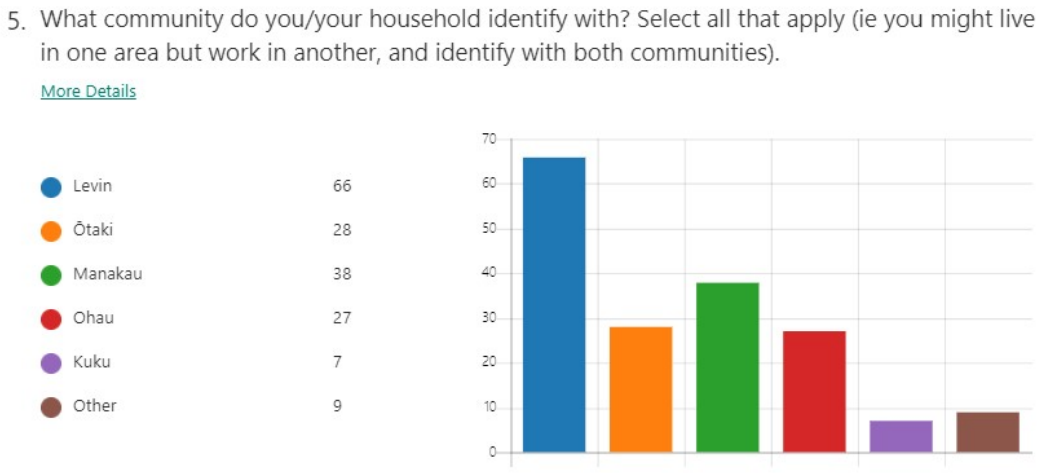


Figure 3. Communities that respondents identify as belonging to.

Access to services:

Levin is home to a wide range of amenities which a vast majority of survey respondents access. Retail (both food retail and other retail shops) and health and medical services are the most popular services in Levin, and the area is also popular for visiting friends and family, as well as parks, beaches and rivers. Around half of all survey respondents have at least one household member who works in Levin.

Ōtaki is also a popular retail centre, although a smaller number of people work in Ōtaki compared to Levin. Many people visit beaches, parks and rivers in and around Ōtaki, as well as visiting family and friends.

People visit Ohau predominantly for social visits or to visit the Ohau River. A smaller number of people visit Ohau for work, retail, and to visit parks and beaches.

The most common reasons for visiting Manakau are social visits, closely followed by food retail and accessing the beach. Parks and rivers are also popular in Manakau, and a smaller number of people attend work, sports and other clubs in the area.

In addition to the these local centres, around half of respondents indicated that at least one member of their household travels outside of the immediate community for work. The majority of these people work in either Wellington or Palmerston North, with a smaller number working in centres such as Porirua, Waikanae and Paraparaumu.

Motor vehicle is by far the most popular method of travel for respondents (see Figure 4), although around 20% of respondents also walk and cycle from place to place. Public transport is not widely used.

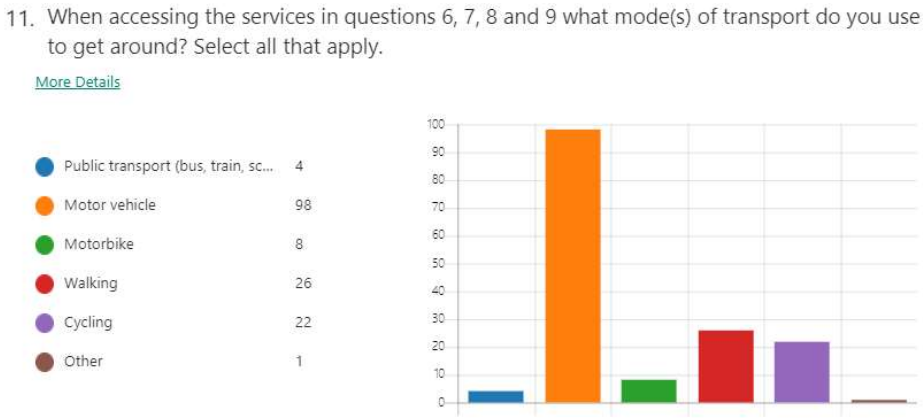


Figure 4. Modes of transport used by respondents.

Community values

Respondents value the rural lifestyle that the Ōtaki – Levin area provides. The community is perceived as being peaceful, quiet, relaxed, safe and private. In addition, people value the proximity to nature that their rural properties offer; including the open space, views of farmland, and abundant bird life. People in the community are perceived as being friendly and helpful, and as looking out for one another.

Access to amenities is also a highly valued quality of the community; respondents noted that parks, beaches and rivers were plentiful in the area, as were amenities like markets, sports clubs, horse riding facilities, quality schools and churches.

Changes to community

When asked to think about changes that they would like to see in their community, most respondents identified changes relating to roading and transport infrastructure. Reducing traffic congestion was a popular request, particularly in town centres and on weekends and public holidays. Safety improvements to rural roads (including installing footpaths) were also commonly identified; it was noted that trucks often drive at speed down roads such as South Manakau Road and Manakau Heights Drive as an informal bypass when SH1 is busy, which makes walking and cycling along these roads difficult for residents.

While residents valued the ease of access to amenities throughout the community, many noted that they would like to see public transport improved throughout the district. In particular, train services connecting through to Palmerston North and Wellington were seen as something which would boost the connectivity of the area, particularly for commuters. In regards to connectivity, some respondents also noted that improved cellphone and internet access across rural areas would allow them to be better connected in both work and personal matters.

Finally, some respondents noted that they would like to see town centres improved, through reduction of traffic congestion (especially trucks) in town centres, the addition of more shopping options, and general town beautification.

Potential impacts of the proposed Ōtaki to Levin highway

A wide range of potential impacts, both positive and negative, were identified by respondents. The majority of respondents identified both positive and negative impacts, with only a small minority expressing predominantly negative sentiments about the proposed highway.

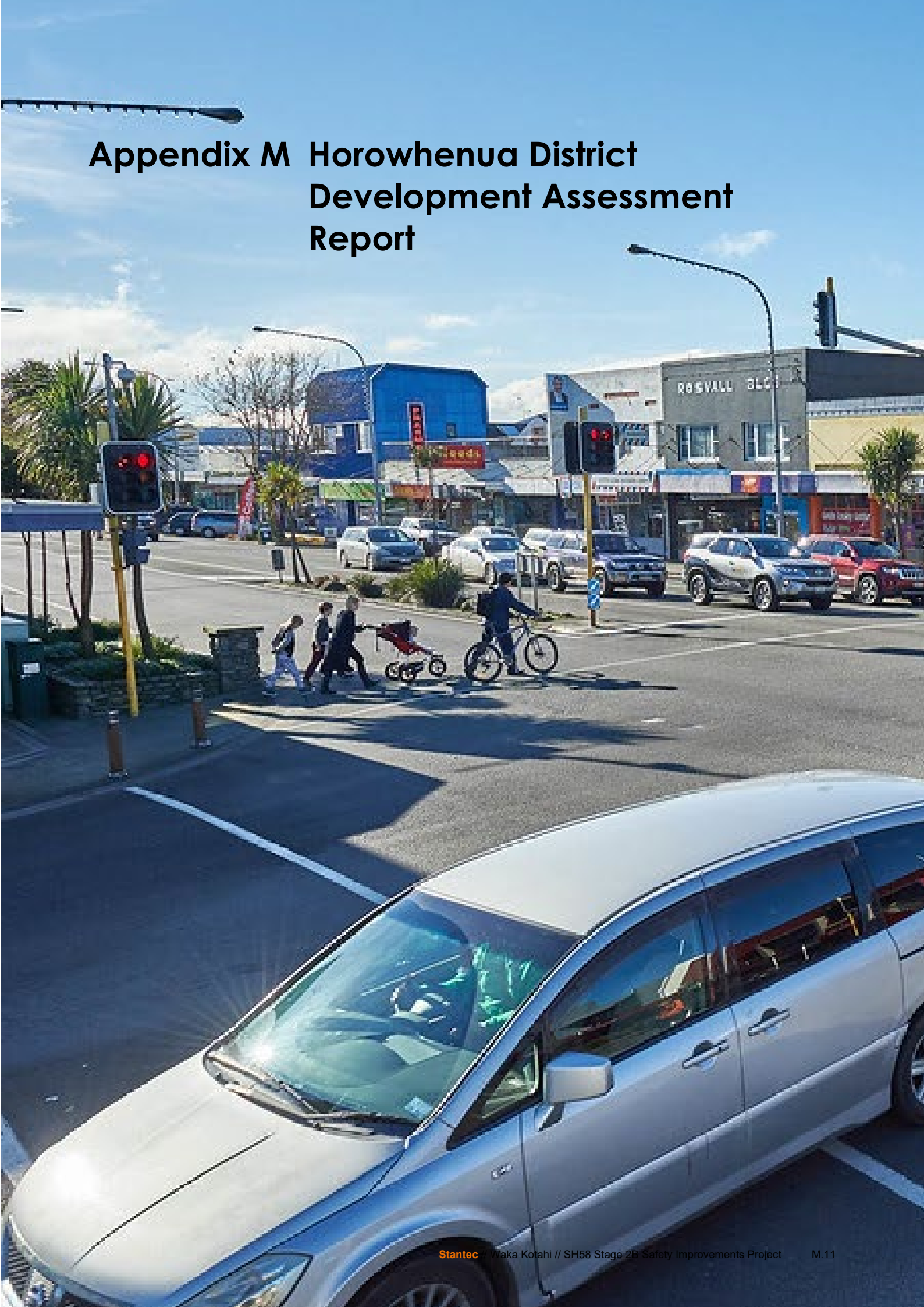
The following **positive** impacts were identified by respondents as being a potential positive impact of the proposed highway:

- Reduced traffic congestion, particularly on weekends and holiday periods.
- Reduced congestion in town centres
- Safer and quieter town centres with more parking available for locals. Currently locals are put off from visiting town centres especially on weekends due to traffic congestion, trucks and traffic noise; town centres could be expected to become more vibrant, pleasant and busy if these negative aspects of the centre are minimised and locals are more likely to visit. This would also have run-on effects for local businesses who could see an increase in patronage.
- Improved access to Wellington: quicker, safer and easier.
- Potential population increase; if the option of commuting to Wellington or Palmerston North from towns like Levin or Ōtaki becomes more viable, more people may move into the area which could boost the local economy and see the development of more housing. The highway could also lead to an increase in property values once the highway is completed, as the improved accessibility to Wellington and Palmerston North could make living in the area more desirable.

The following **negative** impacts were identified by respondents as being a potential negative impact of the proposed highway:

- The qualities of the 'rural lifestyle' that people currently value (such as peace, quiet, tranquillity and proximity to nature) could be damaged by the existence of the highway and the noise, light and visual pollution it will create. Noise impacts will be particularly disruptive for those who will be located between two roads as a result of the highway being built.
- Loss of community connectivity due to the road dividing communities and cutting of existing connections, such as between Ohau and Muhunoa East
- Possible loss of easy access to town centres and schools depending on the location of connections.
- Local centres could see a reduction in visitors and local spending as the number of cars passing through town centres is reduced.
- Sense of loss at the destruction of productive farming land and areas of bush; loss of bird life was emphasised by some respondents.
- Anxiety and stress experienced by property owners due to the uncertainty around where the road will be located and what the impacts on their property will be, if any.
- Potential decrease in property values/difficulty in selling for properties close to the highway
- Disruption to social connectivity as peoples friends, neighbours and family members are potentially displaced.
- Potential that the highway could in fact create *more* traffic by making it easier for people to visit the area (noting that this issue was only raised by several respondents).

Appendix M Horowhenua District Development Assessment Report



Ō2NL Project East of Levin MCA Assessment Memorandum – District Development

ADDENDUM

Revised 06 April 2022

Purpose of Addendum to the Memorandum

This addendum has been prepared by Chris Hansen (CHC Ltd) to provide a recheck of the planning assessment of the options Q4 – Q7 for the proposed Ō2NL Project east of Levin for the District Development criterion to be included in the Multi Criteria Assessment (MCA) currently being undertaken.

Background

An earlier planning assessment of all of the options for the East of Levin section of the Ō2NL Project was provided in a memorandum dated 21 October 2021. That memorandum provides the background to the MCA and outlines:

- The District Development criterion
- The planning instruments the assessment of the East of Levin options is based
- The scope of the MCA and the 6-point MCA scoring scale
- The planning background and the planning assumptions

This addendum needs to be read in conjunction with that memorandum.

MCA Process - Update

The MCA process undertaken in October 2021 identified the following short list of intersection options for further consideration by Waka Kotahi:

- Q4 - At-grade: Close Queen, upgrade Liverpool
- Q5 - At-grade: Queen diverted north
- Q6 - New highway over top
- Q7 - Local road over top

Since identifying the short list of options, Waka Kotahi has undertaken further engagement with HDC and Muaūpoko on the options. It has also undertaken some design refinements to Q5 and Q7. As a result of these processes, Waka Kotahi would now like each MCA assessor to re-check their original evaluations / scores for each of the short-listed options (and update these if deemed appropriate). This process will help Waka Kotahi make final decisions on the preferred intersection option.

The key design changes are as follows:

- Q5 – updated horizontal and vertical geometric design that seeks to better relate to property boundary lines and existing and possible future road network layout (including the Tara-Ika Masterplan). Additional work was also undertaken on the pedestrian and cycle bridge on the existing Queen Street alignment

- Q7 – minor changes to the alignment and the location of the bridge crossing, which is offset northwards from the existing Queen Street alignment
- No (design) changes to Q4
- No (design) changes to Q6

MCA Recheck Assessment Process

The recheck of the preferred 4 options involved:

1. Review of the plans have been provided showing refinements to Options Q5 and Q7
2. Review the refinements against the key objectives and policies (operative HDC District Plan and notified PC4 provisions)
3. Determine whether an amendment to the score given is appropriate

As per the earlier planning assessment, the 6 point MCA scoring scale below has been used:

Table 2: 6-point scoring system to be used by the MCA assessors

Score	Description
1	The option presents few difficulties on the basis of the criterion being evaluated and may provide significant benefits in terms of the attribute
2	The option presents only minor aspects of difficulty on the basis of the criterion being evaluated, and may provide some benefits in terms of the criterion
3	The option presents some aspects of reasonable difficulty in terms of the criterion being evaluated and problems cannot be completely avoided. There are few apparent benefits in terms of the criterion
4	The option includes clear aspects of difficulty in terms of the criterion being evaluated, and very limited perceived benefits
5	The option includes significant difficulties or problems in terms of the criterion being evaluated and no apparent benefits
F	The option will result in completely unacceptable adverse effects that cannot be appropriately avoided, remedied or mitigated (including offsetting)

The table below summarises the recheck of the scores for Options Q4 – Q7 – changes are included as red with the previous score ~~strikethrough~~.

Option	Objective 7.3.1	Policy 7.3.4	PC4 Objective 6A.1	PC4 Policy 6A1.1	PC4 Policy 6A.2.2	Overall Growth Strategy	Overall Score	Comment
Q4	2	1	4	3	3	1	4	Closing Queen St; a raised connection to SH57; highway at grade may not achieve good urban design outcomes relating to amenity/environmental and social aspects (Objective 6A.1); reduced connectivity of northern part of Tara-Ika to Levin; not consistent with northern part of Structure Plan 013
Q5	1	1	~~3~~2	2	2	1	~~3~~2	Highway at grade; a raised deviation of Queen St may not achieve good urban design outcomes relating to amenity/environmental and social aspects (Objective 6A.1); revised Q5 option an improvement on original option as there is better connectivity between Tara-Ika to Levin, and is more consistent with Structure Plan 013
Q6	1	1	3	1	1	1	3	Raising highway may not achieve good urban design outcomes relating to

								amenity/environmental and social aspects (Objective 6A.1) – adverse effects
Q7	1	1	3	1	1	1	3	Highway at grade and raising Queen Street may not achieve good urban design outcomes relating to amenity/environmental and social aspects (Objective 6A.1) – adverse effects

Recheck Planning Assessment

In the assessment of the district development criterion, the approach taken has been to allocate an absolute score for each option, without a comparison between options. That means the 'overall score' is the highest score given for a criterion.

The recheck of Options Q4 and Q6 (no design changes) against the relevant objectives and policies of the District Plan and notified PC4 provisions confirms there are no changes to the MCA scores and the overall scores for those options. Some clarification of the reasons for scores has been made in the comments associated with Option Q4.

The design refinements to Option Q5 include:

- Moving the proposed roundabout connection with Arapaepae Rd (slightly) further south, and
- The realignment of the connection to Queens Street East Rd to the east

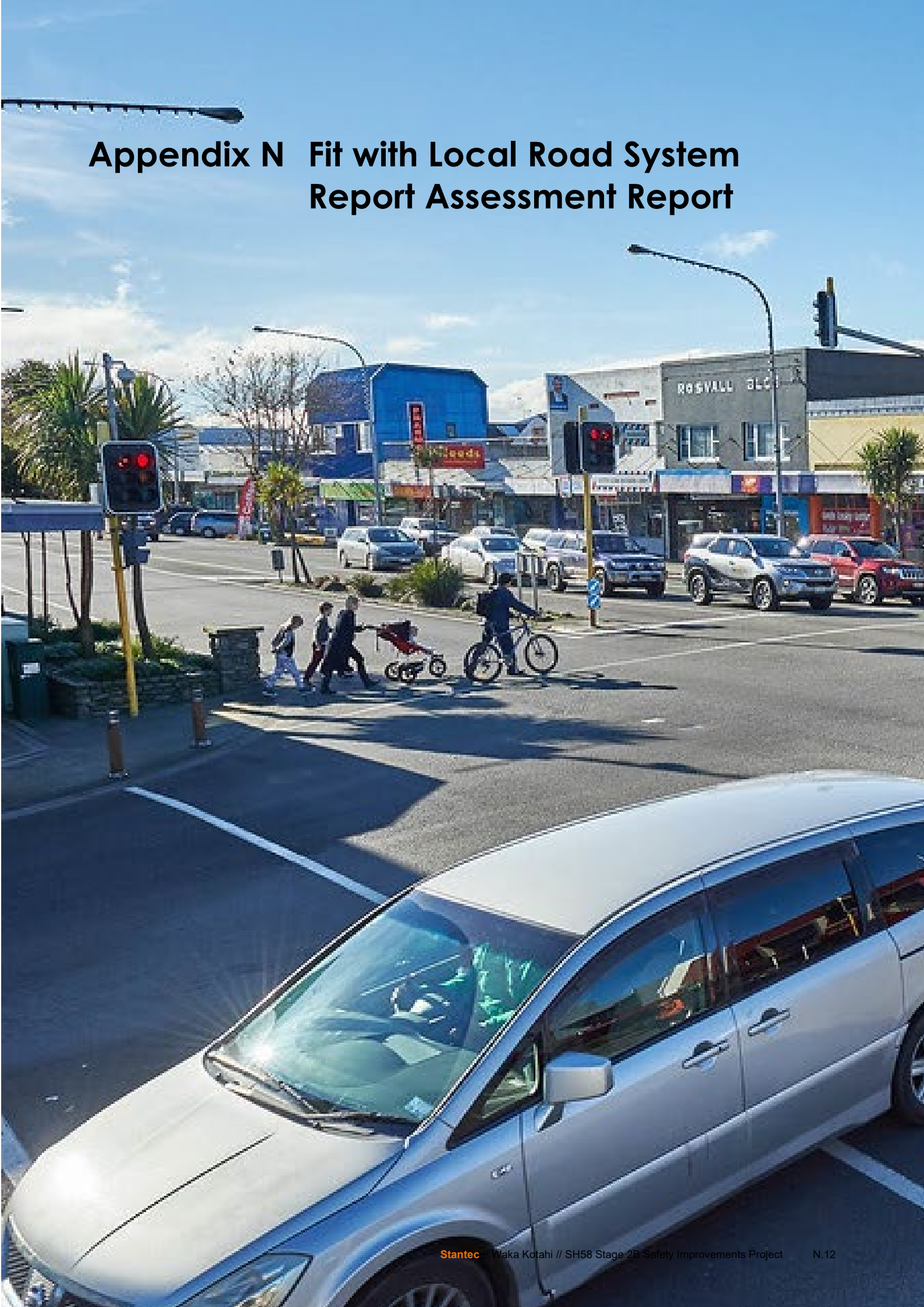
These two refinements improve the connectivity of the northern part of the proposed Tara-Ika development with the norther part of Levin and potentially better urban design outcomes. Collectively these refinements lead to improved consistency with Structure Plan 013 and better implementation of PC4 Objective 6A.1 meaning the overall score for Option Q5 changes to 2.

The design refinements to Option Q7 include:

- Moving the alignment of the Queen Street East Rd overbridge further north
- Retaining the tie-back to the west at the proposed Arapaepae St roundabout
- Moving slightly the diverting of Queen Street East Rd onto the overbridge further west

Overall, it is considered these refinements do not have any additional benefits or disbenefits in relation to implementing the relevant objectives and policies, and therefore there is no change to the scores or overall score for Option Q7.

Appendix N Fit with Local Road System Report Assessment Report



Fit with Local Roads Assessment

Assessment Criteria

This fit with local roads assessment considers the proposed interchange/alignment options proposed by the Ō2NL Team for the East of Levin MCA. It assesses the impacts that the particular option would have on the local road network, both in terms of the future network form and changes to the traffic for all modes within the area.

It has been assumed that none of the proposed options would preclude a future Liverpool Street extension. Should future work conclude that any of the options would preclude the extension being completed then those options would be fatally flawed.

Information Considered

This assessment has relied on:

- Drawings provided by the Ō2NL Project Team for each of the options
- The notified Structure Plan for the Tara-Ika Subdivision
- Transportation modelling outputs from the Ō2NL Project Team
- Draft Network Operating Framework

Scoring System

The scoring system has been provided by the Ō2NL Project Team and is shown below.

Table 2: 6-point scoring system to be used by the MCA assessors

Score	Description
1	The option presents few difficulties on the basis of the criterion being evaluated and may provide significant benefits in terms of the attribute
2	The option presents only minor aspects of difficulty on the basis of the criterion being evaluated, and may provide some benefits in terms of the criterion
3	The option presents some aspects of reasonable difficulty in terms of the criterion being evaluated and problems cannot be completely avoided. There are few apparent benefits in terms of the criterion
4	The option includes clear aspects of difficulty in terms of the criterion being evaluated, and very limited perceived benefits
5	The option includes significant difficulties or problems in terms of the criterion being evaluated and no apparent benefits
F	The option will result in completely unacceptable adverse effects that cannot be appropriately avoided, remedied or mitigated (including offsetting)

Assumptions and Considerations

For the purpose of this assessment, it has been assumed that the base case includes the Tara-Ika subdivision. The implications of who delivers a particular set of infrastructure has not influenced the scores.

The considerations previously considered under this criterion are outlined below:

- Severance (i.e. does the option create severance effects or reduce/improve access for existing social, recreational and economic activities)
- Impact on the safety of current/future transport network i.e. will an option increases traffic through areas of the Transport Network which present higher levels of risk to road users.
- Impact on the accessibility and efficiency of current/future transport network i.e. will an option increases travel time, vehicle operating costs and emissions, either positively or negatively.
- Impact on active transport, in terms of accessibility, severance, safety and level of service.

These have been simplified into three considerations based on the more detailed level of information available for this specific area since the original MCA:

1) Road Network Fit: This considers how the option would fit into the planned road network. Includes the current notified plans and the ability for future expansion of the Levin urban area.
2) Local Traffic Impacts: This considers the impact to the road users, from all perspectives. This includes wider considerations of any options' impact on traffic volumes on existing roads.
3) Active Mode Considerations: This considers the options' impact on the councils current and planned active modes network, including if it makes an option less attractive.

Queen Street Options Assessments

From a fit with local roads perspective, the fact that a direct Ō2NL to Queen Street connection is being considered has influenced the scoring. As the extent of mitigations to manage traffic flows on the existing roads is not known, these scores are provisional.

While there has been no formal weighting system applied, as the road and traffic impacts are expected to create the largest impacts, more consideration has been given to these criteria when formulating the overall score.

Option	Road Network Fit	RNF Score	Local Traffic Impacts	LTI Score	Active Mode Considerations	AM Score	Overall Score
Q0	Maintains Queen Street Connection via an overpass as per the masterplan and HDC expectations.	2	Traffic impacts in line with expectations, no difficulties expected as there are no introduced conflicts due to grade separation with Ō2NL.	1	Shared use path planned in as part of Ō2NL and option maintains east west connectivity.	1	**1**
Q1	Minor elevation change with Queen Street a minor concern, but not enough to consider a change in score.	2	As per Q0	1	As per Q0	1	**1**
Q2	Road impacts the same as Q1 however have a preference to not put the local road belowground.	2	As per Q0	1	Some users will not like a subway style arrangement, otherwise similar to Q0.	2	**2**
Q3	Increases use of O2NL due to the increased connectivity provided by the at-grade roundabout (e.g. to Levin Town Centre). At grade introduces complexity.	2	Reduced traffic on local roads offset by increase in trip times for those using Queen Street. Close proximity of two busy roundabouts may cause issues.	3	Good connectivity provided the grades and exposure of the active modes facility are not unacceptable.	1	**2**
Q4	Severance of Queen Street does not fit in with the planned road network for the Tara-Ika development. Should a Queen Street link not be provided it is unlikely all three connections required for Tara-Ika can be delivered.	5	Diverted trips and additional travel time for users. Additional cars on existing low volume roads..	4	Benefits of active modes in this area offset by additional traffic on local roads elsewhere.	3	**4**

Option	Road Network Fit	RNF Score	Local Traffic Impacts	LTI Score	Active Mode Considerations	AM Score	Overall Score
Q5	Balances a range of positive and negative impacts. Could impacts future road network development north of Tara-Ika.	3	Diversion of traffic away from Queen Street forces additional traffic into existing local roads which are currently low volume roads (i.e. Meadowvale)	3	Active modes facility provided away from vehicles but this is offset by additional traffic on existing roads.	2	**3**
Q6	Maintains Queen Street Connection via an overpass	2	As per Q0	1	Maintains active modes at grade with wider bridge improving visibility.	1	**1**
Q7	Similar to Q6 in terms of connectivity.	2	As per Q0	1	Gradient may provide some difficulties for some active mode users	3	**2**
Q8	Inappropriate for a key route from Tara-Ika to be diverted through this roundabout. Increase in traffic using O2NL offset by increased use of SH57 north of the roundabout. Could impact future road network development north of Tara-Ika .	4	Local trips through a large high speed multilane roundabout has safety and efficiency impacts. The added time also diverts traffic onto the Central Spine Connector and associated suburbs.	5	Active modes facility provided away from vehicles but offset by additional traffic on existing roads to a greater extent than Q5.	2	**4**

Tararua Road Options

From a Fit with Local Roads assessment purposes the Tararua Options are fundamentally minor variations of previously assessed options. All options except for T3 are elevation variations of the service interchange previously assessed, while T3 is the at-grade roundabout previously assessed. The inclusion of the active modes bridge has resulted in a scoring improvement of 1 point for the T3 option compared to the previous assessment. No new information has come to light which would alter the previous scoring for the interchange options which is repeated below. As the assessment is mostly the same, only overall scores and notes have been provided.

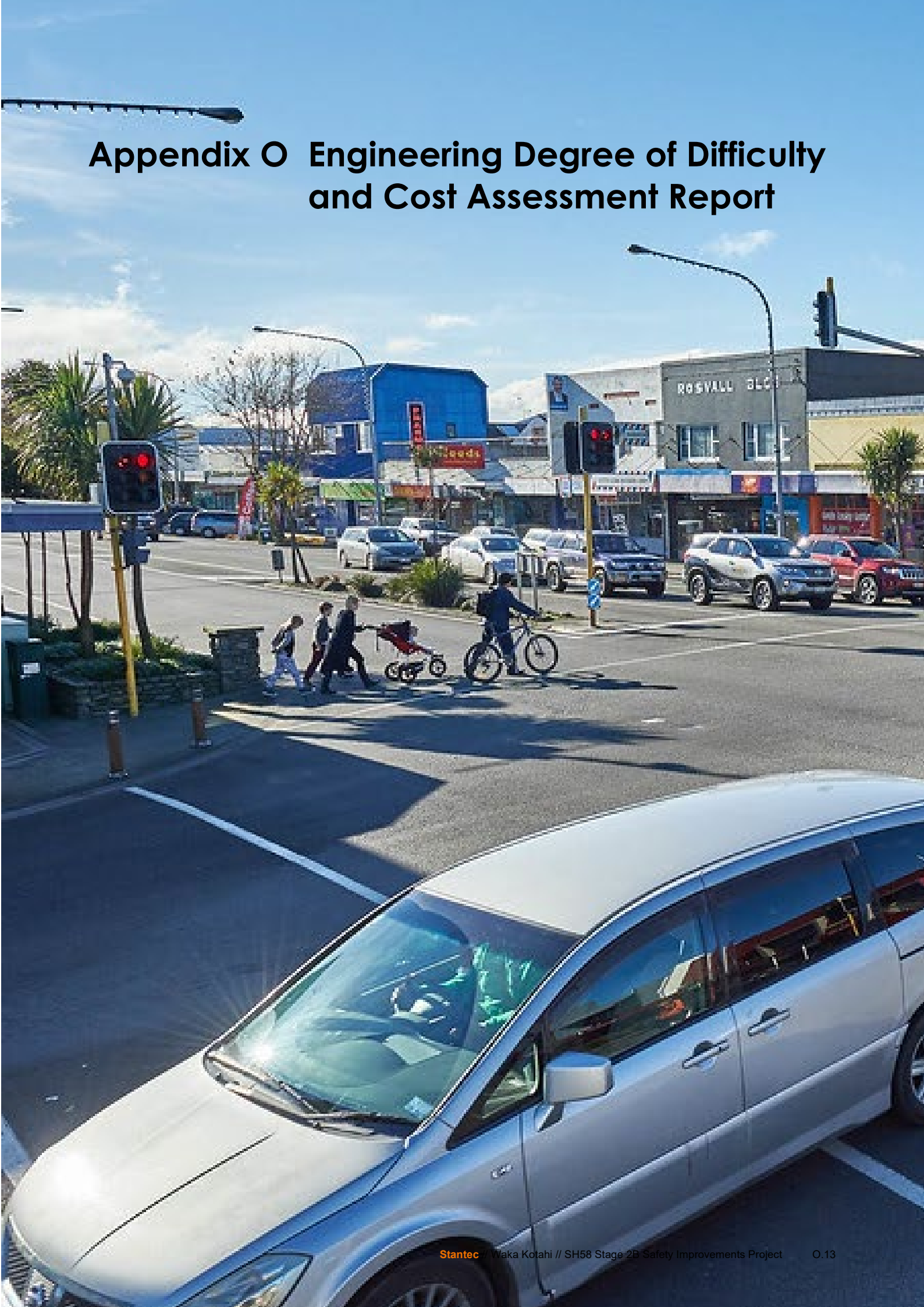
Option	Score	Overall notes
T0	1	It provides strong local connectivity benefits by opening up access into all four corners of this area, providing direct access into Tara-Ika, LS7, Industrial Growth areas and good access into Levin Town Centre.
T1	1	As per T0

Option	Score	Overall notes
T2	1	As per T0
T3	2	All traffic from Tara-Ika has to interact with Ō2NL traffic. Score improved from previously due to improved active modes facility.
T6	1	As per T0
T7	1	As per T0

Midblock Options

The highway being below ground level is preferred from a Fit with Local Roads perspective as it means the Tara-Ika Central Spine Connector and the shared use path bridges will be closer to ground level and will therefore be more attractive. The below grade option scores a 1. Having the new expressway at ground level means these all three planned connections across the expressway corridor will have larger gradients which will make active modes in particular less attractive. As this increases severance and reduces active modes attractiveness, it was assessed as being a reasonable difficulty which cannot be completely avoided and therefore the at grade option scores a 3.

Appendix O Engineering Degree of Difficulty and Cost Assessment Report



Ō2NL Offline Route
Engineering Degree of Difficulty Criteria
East of Levin MCA (October 2021)

1 Introduction

This Engineering Degree of Difficulty (EDOD) report has been prepared to support the development of the Ō2NL Detailed Business Case, and in particular Waka Kotahi's East of Levin Intersection and Midblock Multi Criteria Analysis process.

In September 2021, Waka Kotahi decided to undertake a multi criteria analysis (MCA) to help further inform its decision-making on the intersection designs for the new Ō2NL highway at Queen Street and Tararua Road. In addition, Waka Kotahi requested an MCA of the road vertical alignment above or below ground level between Tararua Road and Queen Street also be undertaken to inform its design decision-making processes. Collectively these MCA processes are referred to as the "East of Levin MCA".

This assessment work has also been undertaken in recognition of the projects core cultural principles:

- Tread Lightly, with the whenua
  - Me tangata te whenua (treat the land as a person)
  - Kia māori te whenua (let it be its natural self)
- Create an Enduring Community Legacy
  - Kia māori te whakaaro (normalise māori values)
  - Me noho tangata whenua ngā mātāpono (embed the principles in all things)
  - Tū ai te tangata, Tū ai te whenua, Tū ai te Wai (elevate the status of the people, land and water

1.1 Assessors

The individuals that have completed this EDOD assessment are:

- Engineering Lead: Jamie Povall, Design Manager (Major Projects), MEng (Civil), MSc (Transportation Eng), CEng (UK), CPEng, CMEngNZ, IntPE
- Geotechnical: Ken Clapcott, Senior Civil/Geotechnical Engineer, BE (Civil), CPEng, CMEngNZ
- Lead project reviewer: Keith Weale, Technical Director Roads and Highways, BSc(Eng), BEng(Hons), MSc(Eng), CPEng, CMEngNZ
- Structures: Jeremy Walters, Chief Bridge Engineer, BEng (Hons) Civil, MEngNZ
- Flooding & Drainage: Andrew Craig, Flood Risk Practice Lead, BSc(Eng) Civil, C.WEM, MCIWEM.

These assessors are all part of the project design team.

1.2 Process

The methodology used to complete the process was in line with the previous MCA approaches.

The previous approach to the MCAs considered a number of sub-criteria which included for example; effect on watercourses, flooding/drainage, complexity of local road connections, geotech/structural, constructability, etc.

The small assessment team (made up from members of the larger design team) discussed and agreed the most appropriate individual factors to be considered in this MCA, and then subsequently how each option should be scored.

2 Engineering Degree of Difficulty Considerations

2.1 Introduction

In earlier MCA processes for the Ō2NL Project, members of the project design team considered the key factors that may constitute engineering difficulty as follows:

- **Structures**: multiple watercourse crossings and other structures, including complexity of the structure
- **Local Roads**: complexity of connecting
- **Earthworks**: volumes & major / complex cuts, cut/fill balance
- **Ground conditions**: requirements for ground improvement and groundwater proximity
- **Watercourses / flooding**: effects on existing watercourses and ability to drain
- **Temporary works**: temporary roads, bridges, haul roads, mass haul
- **Utilities**: temporary or permanent relocations

As some of these items were not yet known or there was very little difference between options at this stage of design, they were not considered further, and the EDOD team (referred in Section 1.1) agreed the following should be used to assess the EDOD criteria at this stage:

- **Geotechnical & Structures:** complexity with ground conditions and geo/structural design
- **Local Roads:** complexity of connecting to local network
- **Flood & drainage:** effect on existing overland flow paths and road stormwater
- **Constructability:** ease of the build activity / temporary works / traffic effects

2.2 Criteria considerations

A description of the sub-criteria and approach taken is provided below:

Sub-criteria	Description & Assumptions
Geotechnical & Structures	• Proximity to maximum modelled groundwater (based on monitoring to date and preliminary 1D modelling) and influence on option • Groundwater effects on structural foundation and anchoring requirements • Geotechnical complexity of options, including ground improvements • Structural requirements for options including number of structures and expected complexity
Local Roads	• Complexity of the local road alignment geometry to connect to adjacent local roads • Works required to existing local road to accommodate new connection
Flood & Drainage	• Effect on existing flow paths crossing the alignment and requirements to maintain passage of flow (culverts / inverted siphons) • Complexity of the road stormwater drainage of the option
Constructability	• Temporary works such as sheet piling, dewatering and temporary roads to maintain access • Complexity of keeping existing traffic running • Maintaining access during construction

2.3 MCA Exclusions

The following items are not considered in the EDOD assessment, but the team noted that they should be factored into the decision-making processes outside of the MCA:

- **Cost**: Likely to be major differences between options (e.g. Q1 to Q3)
- **Affordability**: Whether options fit within overall funding envelope
- **Earthworks volumes**: Effect on EW balance / sourcing / costs
- **Network fit / legibility**: How do options work together or in series? Impact on wider district? Likely considered by other MCA assessors?
- **Design suitability**: Is design an optimal solution? Does it provide flexibility for future undefined upgrades?

3 MCA Scoring

The MCA scoring from the team followed the five-point scoring scale provided to assessors, with the four sub-criteria for each option scored using this scale. The options were not compared against the existing environment or a base case as this is not suitable given EDOD is not an effect. This is consistent with how EDOD was assessed in previous MCAs for this project.

The scores for each of the sub-criteria were then combined and averaged to give a total option score out of 5. A weighting system was also used, which is described later in this report.

3.1 Queen Street Options

3.1.1 Q0

Q0 scored as a Fatal Flaw because, as shown in the concept design, the option is achieved using a standard earthworks cutting below ground level to around 6.5 m depth. Maximum modelled groundwater is periodically higher than this by a number of metres and therefore this is not a feasible technical option as shown.

The team did note that an option with a similar expressway profile as shown would be possible if enclosed within a watertight trough structure (similar to the Q1 option, but with the surface of the expressway being deeper below existing ground level than shown in Q1 and over a longer extent). However, this would be materially different from that shown in the Q0/DBC option.

3.1.2 Q1

This option scored very poorly in all sub-criteria other than local road fit. The team noted this was a complex and difficult design solution with a watertight trough structure needed for at least a few hundred metres given the options would intercept high groundwater. It was debated whether constructability could warrant a Fatal Flaw score, but a score of 5 (for constructability) was settled upon. Draining existing East-West flow paths was considered highly complex, along with challenges of draining road stormwater from with the trough low point below groundwater level.

3.1.3 Q2

This option has some similar challenges to Q1, but often on a lesser scale, due to the trough structure being smaller in scale and running generally with the directional flow of groundwater and overland flow paths. On this basis, the geotechnical and structures scoring and the flood/drainage scores were moderately improved to scores of 4. The scoring for constructability and local roads remain the same as Q1.

3.1.4 Q3

This option scored well against all sub-criteria. The team did note that a smaller structure was still required (for walking and cycling) and there would be some minor challenges in constructing an online roundabout on Queen Street.

3.1.5 Q4

The option presented few difficulties; however the team did note that the fit with local roads was contingent upon the timing and delivery of the wider Tara-Ika local road network otherwise this option would have no road network to connect into on the eastern side of the expressway. The requirement for two structures (including a walking and cycling connection at Queen Street) was noted.

3.1.6 Q5

The team noted a number of moderate items that affected scoring on this option; such as the proximity of the works to higher groundwater, the need for two structures and the constructability of a new online roundabout on Arapaepae Road; though none of these issues was considered significantly adverse.

3.1.7 Q6

This option includes a 70 m three-span bridge, and the team noted this, together with a large embankment in close proximity to shallow maximum groundwater. Related to this was the potential need for ground improvements for the bridge abutments and piers given this groundwater proximity. No other issues were noted for this option.

3.1.8 Q7

This option includes a moderate vertical crest curve and associated downhill grade for road users travelling in an East-West direction towards central Levin. It does not fit well with connecting the new bridge to the new SH57/Queen Street roundabout currently being constructed. Constructability challenges would be minimal with Queen Street shifted partially off line.

3.1.9 Q8

This option scored poorly on local road fit, due to the number of accesses and intersections on Arapaepae Road and the assumption that additional works would be required if this were to remain as state highway. The option includes two structures. There would be limited constructability challenges as most construction would be off line.

3.2 Tararua Road Options

3.2.1 T0

This option would have some challenges across geotechnical/structural, flood/drainage and constructability categories due to the (long) deep cutting and the proximity to maximum groundwater level, drainage across and within the cutting, and the challenges of maintaining local road traffic with the cutting excavation.

3.2.2 T1

This shallower cutting option scores better than T0 in all categories other than the local road fit criterion, which is equal. Engineering complexity still exists but is lessened for structures/geotechnical, flood/drainage and constructability. Constructability would not be overly challenging.

3.2.3 T2

With the local road in cutting, this option scores mostly the same as T1, other than for flood/drainage, which has no complexity concerns as positive gravity drainage can be achieved for overland flow paths and road drainage from east to west due to the natural fall of the terrain.

3.2.4 T3

This option presented few difficulties. The constructability of building the online roundabout was noted together with a new walking and cycling bridge, but this was not a concern.

3.2.5 T6

This option includes a new structure, but the team noted a large offset to groundwater levels and much of the construction would be kept on existing ground level. Constructability is likely to be straightforward in terms of keeping local traffic moving.

3.2.6 T7

T7 is considered to have broadly the same constructability challenges as T1 (minor). There would be the inclusion of a structure and some grading issues down to Arapaepae Road, but these would not be significant.

3.3 Mid-block Section

3.3.1 Mid-block at-grade

The team did not identify any areas of complexity with this option. The team also noted that, dependent upon ground conditions, topsoil stripping depth, vertical geometry and drainage, there may be very little difference between the at-grade and below grade mid-block options.

3.3.2 Mid-block below grade

The team did not identify any areas of complexity with this option. The team also noted that, dependent upon ground conditions, topsoil stripping depth, vertical geometry and drainage, there may be very little difference between the at-grade and below grade mid-block options.

3.4 Final Scoring (Unweighted sub-components)

Scoring of each attribute within the sub-component category was completed by the EDOD team as follows:

Table 1 – Unweighted Scoring: Queen Street

Option Number	Description	EDOD Category Score				UNWEIGHTED SCORES	
		Geotech & Structural	Flood / drainage	Local road interface	Construct-ability	Overall Score	Non-weighted Rounded
Q0	Expressway fully below grade (DBC)	FF				FF	
Q1	Expressway partially below grade	5	5	2	5	4.25	**4**
Q2	Local road partially below grade	4	4	2	5	3.75	**4**
Q3	At-grade: Roundabout	1.5	1	1	2	1.375	**1**
Q4	At-grade: Close Queen, upgrade Liverpool	2	1	3	1	1.75	**2**
Q5	At-grade: Queen diverted north	2.5	1	2	2	1.875	**2**
Q6	Expressway over top	3	1	1	1	1.5	**2**
Q7	Local road over top	2	1	4.5	1.5	2.25	**2**
Q8	At-grade: 5-arm, shift SH57 connection South	2.5	1	5	2	2.625	**3**

Table 2 – Unweighted Scoring: Tararua Road

Option Number	Description	EDOD Category Score				UNWEIGHTED SCORES	
		Geotech & Structural	Flood / drainage	Local road interface	Construct-ability	Overall Score	Non-weighted Rounded
T0	Expressway fully below grade (DBC)	3	3	1	3	2.5	**3**
T1	Expressway partially below grade	2.5	2	1	2	1.875	**2**
T2	Local road partially below grade	2.5	1	1	2	1.625	**2**
T3	At-grade: Roundabout	1.5	1	1	2	1.375	**1**
T6	Expressway over top	2	1	1	1.5	1.375	**1**
T7	Local road over top	2	1	1.5	2	1.625	**2**

Table 3 – Unweighted Scoring: Mid-block

Option Number	Description	EDOD Category Score				UNWEIGHTED SCORES	
		Geotech & Structural	Flood / drainage	Local road interface	Construct-ability	Overall Score	Non-weighted Rounded
	Mid-block at-grade	1	1	1	1	1	1
	Mid-block below grade	1	2	1	1	1.25	1

3.5 Weighting

The EDOD team discussed whether a weighting system was necessary for this MCA and agreed that some weighting was appropriate as not all of these elements were likely to result in equal levels of engineering complexity.

The weighting system used for the final EDOD scoring is as follows:

Geotechnical & Structures: 30%
Local Roads: 10%
Flood & drainage: 30%
Constructability: 30%

This weighting was selected because the fit with local roads was not considered to generate the same level of engineering complexity for the overarching EDOD scoring as the three other sub-criteria, which would each be more challenging.

3.6 Final Scoring

The scoring, with the agreed weighting system applied is as follows:

Table 4 – Final Scoring: Queen Street

Option Number	Description	WEIGHTED FINAL SCORES	
		Weighted, 10% local road, other 30%	Weighted Rounded
Q0	Expressway fully below grade (DBC)		FF
Q1	Expressway partially below grade	4.7	5
Q2	Local road partially below grade	4.1	4
Q3	At-grade: Roundabout	1.45	1
Q4	At-grade: Close Queen, upgrade Liverpool	1.5	2
Q5	At-grade: Queen diverted north	1.85	2
Q6	Expressway over top	1.6	2
Q7	Local road over top	1.8	2
Q8	At-grade: 5-arm, shift SH57 connection South	2.15	2

Table 5 – Final Scoring: Tararua Road

Option Number	Description	WEIGHTED FINAL SCORES	
		Weighted, 10% local road, other 30%	Weighted Rounded
T0	Expressway fully below grade (DBC)	2.8	3
T1	Expressway partially below grade	2.05	2
T2	Local road partially below grade	1.75	2
T3	At-grade: Roundabout	1.45	1

T6	Expressway over top	1.45	1
T7	Local road over top	1.65	2

Table 6 – Final Scoring: Mid-block

Option Number	Description	WEIGHTED FINAL SCORES	
		Weighted, 10% local road, other 30%	Weighted Rounded
	Mid-block at-grade	1	1
	Mid-block below grade	1.3	1

As can be seen by comparing Tables 1-6, the weighting has affected only the following two scores:

- Q1 has been upgraded from a score of 4 to a final score of 5
- Q8 has been downgraded from a score of 3 to a final score of 2

4 Limitations

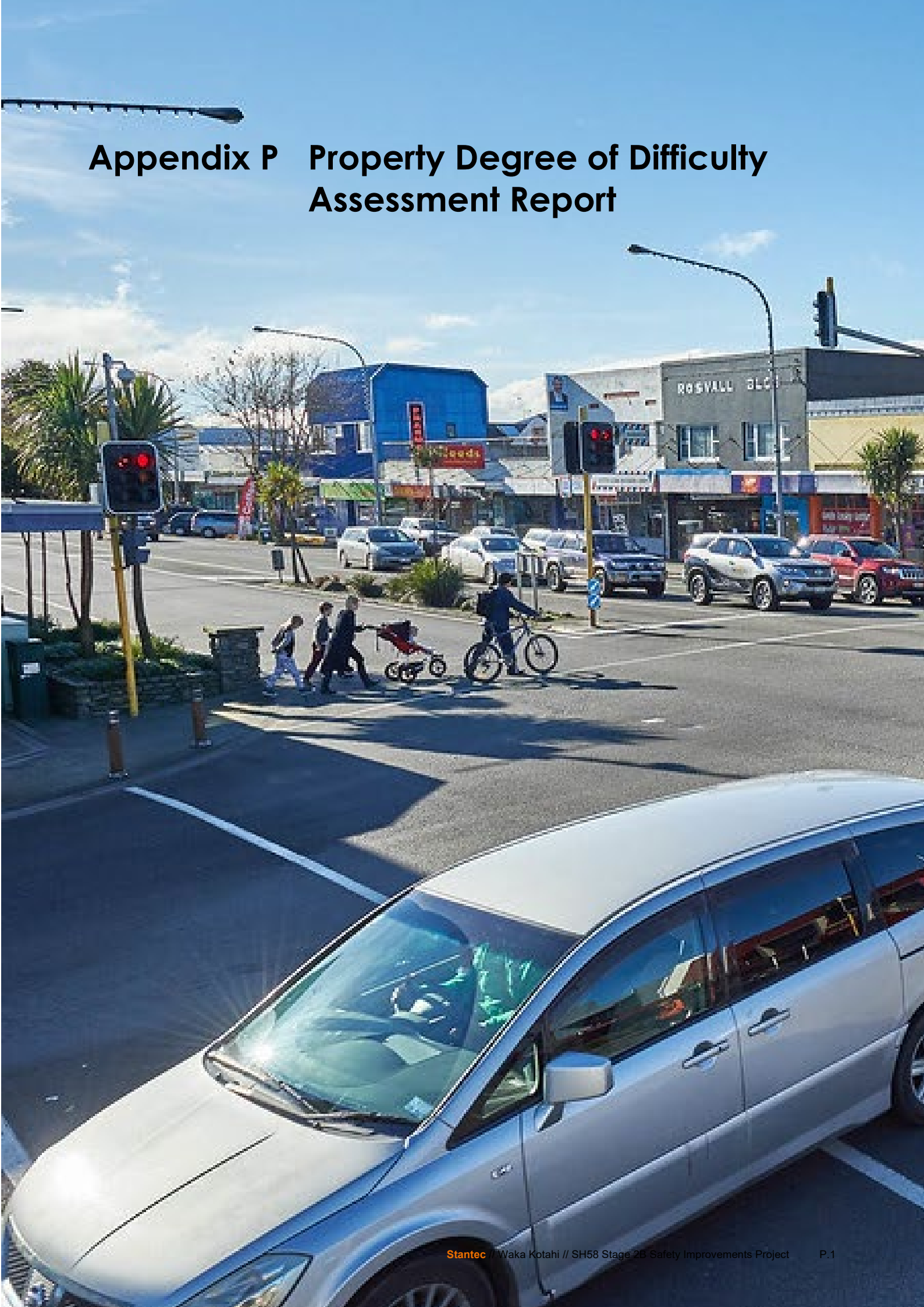
The assessment has been completed on the information available at the time of assessment and has necessarily relied upon individual's professional judgement. The team has relied upon senior individuals within their technical fields to undertake this work.

The reader is also referred to Section 2.3 for limiting assumptions.

As further information becomes available and more detailed work is completed, it is possible that some of the work completed for this EDOD assessment may need to be revisited.

Rev. No.	Date	Description	Prepared By	Checked By	Reviewed By	Approved By
0	21/10/21	First Draft	Jamie Povall	Ken Clapcott, Jeremy Walters Keith Weale, Andrew Craig	Selwyn Blackmore	Phil Peet

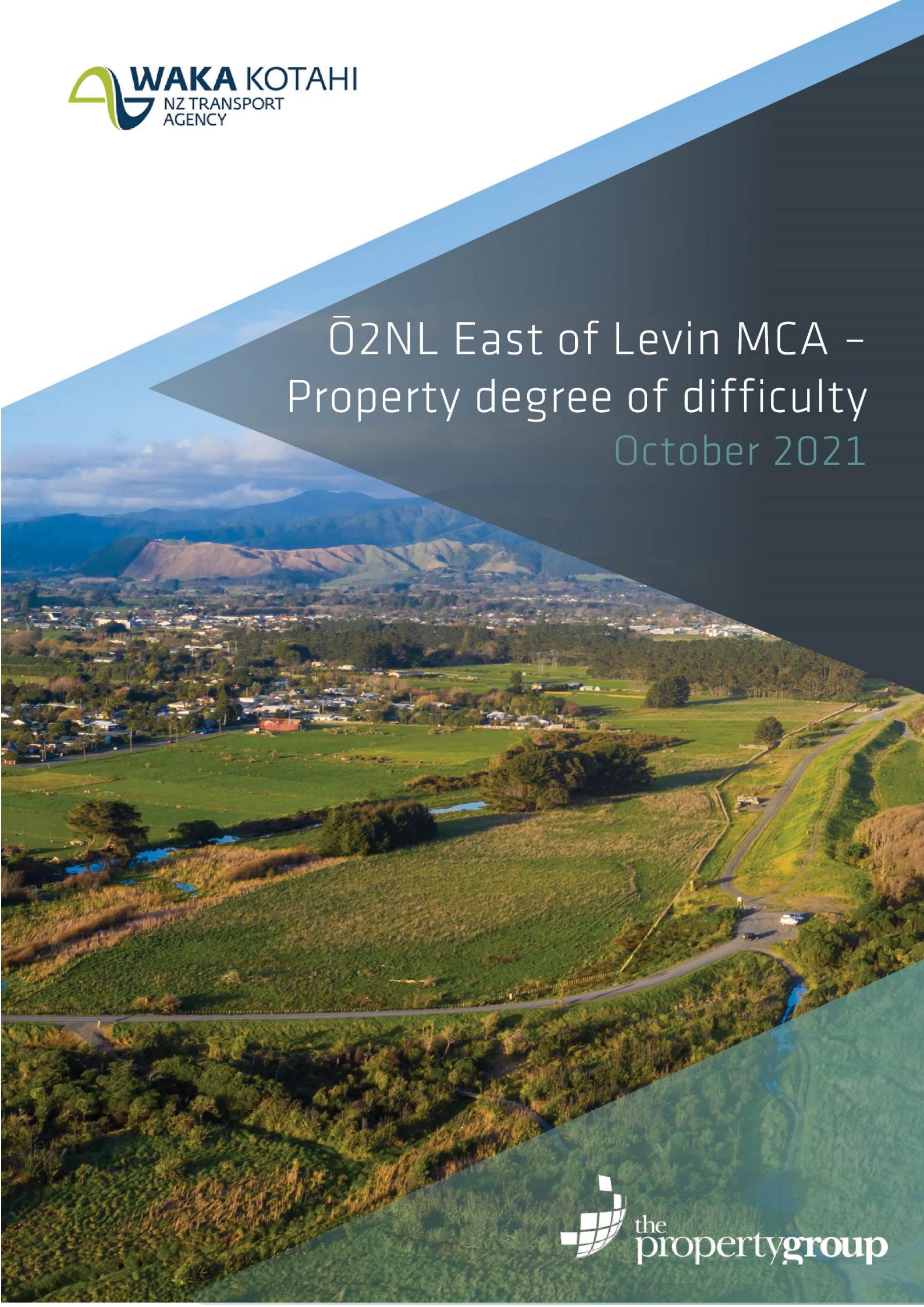
Appendix P Property Degree of Difficulty Assessment Report



WAKA KOTAHI
NZ TRANSPORT AGENCY

Ō2NL East of Levin MCA – Property degree of difficulty

October 2021



the propertygroup

Ō2NL East of Levin MCA – Property degree of difficulty

Waka Kotahi NZ Transport Agency (Waka Kotahi) has requested The Property Group Limited (TPG) to provide an evaluation of the property issues and risks relating to the Section of the SH1 North Otaki to North of Levin Project (Ō2NL) between Taraua Road and Queen Street. This report is to support the development of the Ō2NL Detailed Business Case, and in particular Waka Kotahi's East of Levin Intersection and Midblock Multi Criteria Analysis process.

In September 2021, Waka Kotahi decided to undertake a multi criteria analysis (MCA) process to help further inform its decision-making on the intersection designs for the new Ō2NL highway at Queen Street and Tararua Road. In addition, Waka Kotahi requested an MCA evaluation of the road grade level between Tararua Road and Queen Street be also undertaken to inform its design decision-making processes. Collectively these MCA processes are referred to as the "East of Levin MCA".

TPG has considered the latest options set out in the Stantec briefing to the MCA assessors dated 4 October 2021.

Proposed Ō2NL East of Levin MCA Options

A five-point scoring system has been adopted to enable numeric evaluations and application of different weighting systems for the MCA evaluation. The scoring scale is as follows:

Score	Description
1.	The option presents few difficulties based on the criterion being evaluated and may provide significant benefits in terms of the attribute.
2.	The option presents only minor aspects of difficulties based on the criterion being evaluated and may provide some benefits in terms of the attribute.
3.	The option presents some aspects of reasonable difficulty in terms of the criterion being evaluated and problems cannot be completely avoided. There are a few apparent benefits in terms of the criterion.
4.	The option includes clear aspects of difficulty in terms of the criterion being evaluated, and very limited perceived benefits.
5.	The option includes significant difficulty in terms of the criterion being evaluated, and no apparent benefits.

We have undertaken further analysis and comment on property issues and risks associated with the various options and these are detailed Appendix I below.

Refer Appendix II for TPG's scoring assessment summary.

Factors Considered When Determining the Property Degree of difficulty

The degree of difficulty assessment for each of the options identified in the in the Stantec briefing have been considered at a high level based on several factors which follow:

- Effects on horticultural holdings and any severance issues
- Effects on lifestyle holdings and residential holdings including access, severance and other issues
- Additional properties which were previously unaffected which are now affected
- Any significant land tenure issues

We have not identified any Māori land or commercial businesses that might be affected by the various options.

General Property Comments

Where owners were previously unaffected and could now be affected by some of these options, this could result in potential reputational risks and result in a communications issue.

In relation to MCA 3 Queen Street Mid-block Evaluation Option 2, it is unclear as to the indirect effects that the below ground option might have on the general hydrology of the area. Mitigations of these effects, the structures and other required measures to address the hydrological effects could affect the property degree of difficulty due to potential impacts on further properties outside of the corridor.

Prepared by:

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Date: 26 October 2021

Reviewed by:

Dave Hoffmann

Senior Property Consultant, The Property Group Limited

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Attachments

Appendix I: Scoring for East of Levin MCA Options - Property Degree of Difficulty (including Plans)

Appendix II: Summary Scoring Table

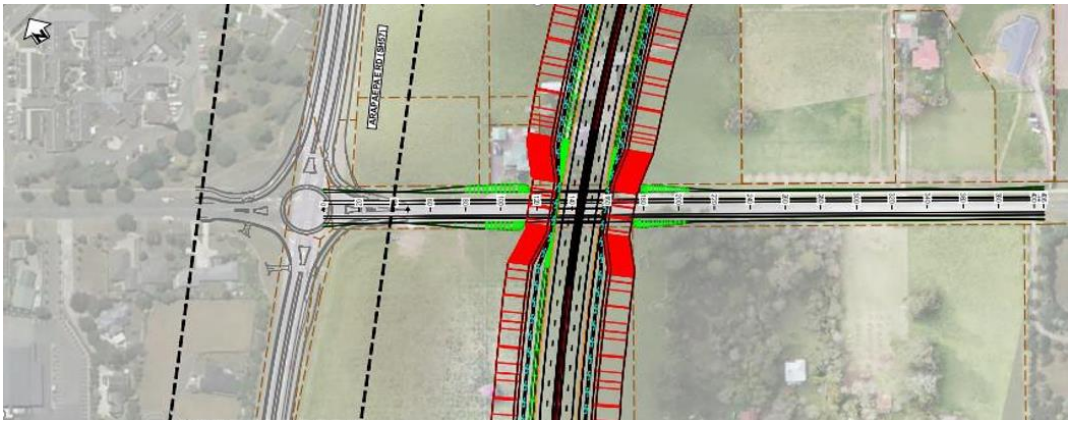
Appendix I: Scoring for East of Levin MCA Options

1. MCA Queen Street Intersection - Options Q0-Q8

Option Q0 (Base Case Option)

Score 2

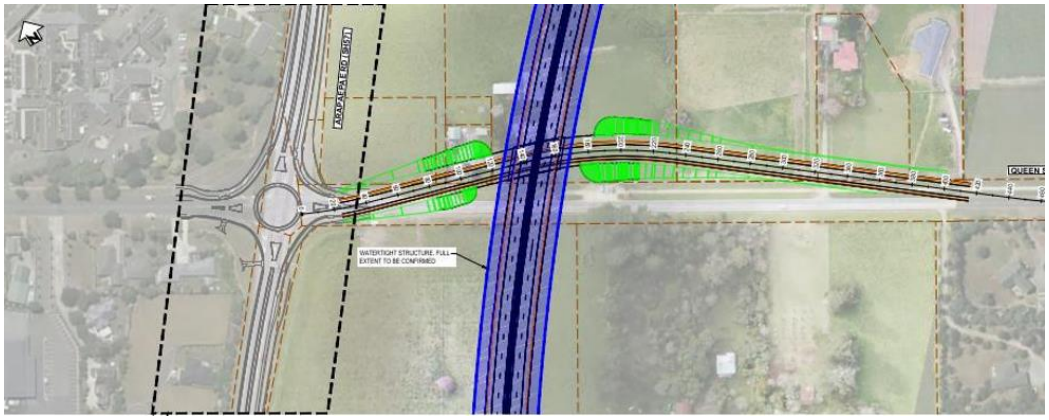
- Highway beneath Queen Street.
- No new properties affected.
- Score similar to the earlier MCA alignment ranking for Zone G (Tararua to Queen Street) and Part Zone H (north of Queen Street).



Option Q1

Score 2

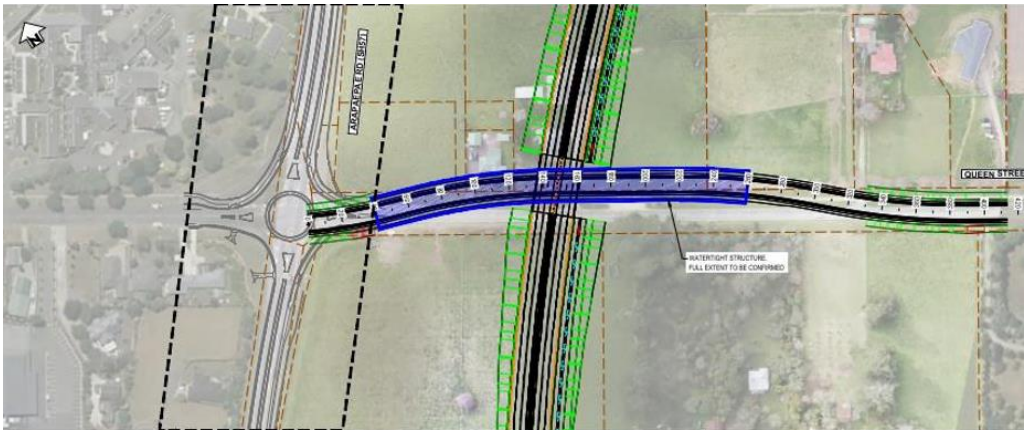
- Highway partially submerged.
- To the east of the alignment this option affects the driveway of one new residential site and one improved lifestyle property which is already partially affected.
- Assumes private driveways can be retained and be regraded.
- Visual impact of embankment and Queen overbridge and noise impacts to properties immediately to the east.



Option Q2

Score 2

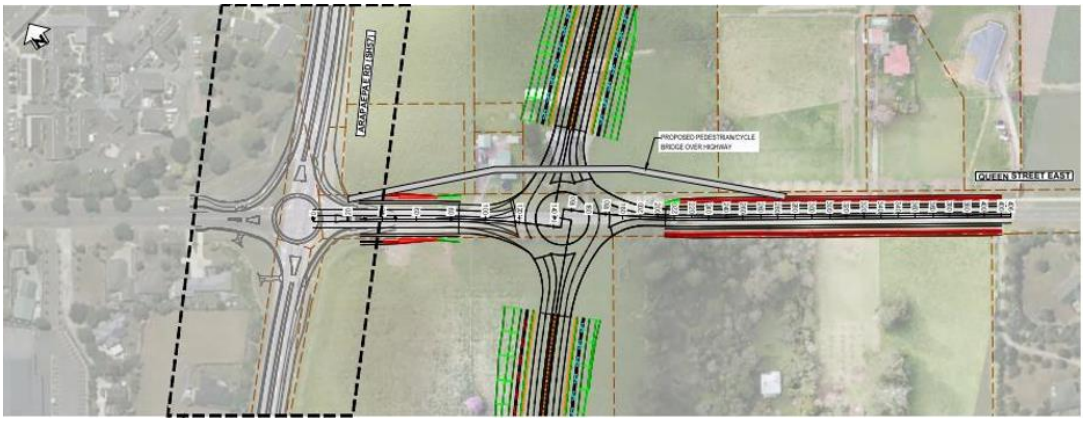
- Highway partially raised.
- Similar to Q1 but property impacts less because Queen Street is closer to its current alignment. Appears to avoid the two properties impacted by Q1.
- Assumes Queen Street to eastern end stays within the existing road reserve and private driveways can be retained and be regraded.
- New highway on an elevated bridge resulting in increased effects.



Option Q3

Score 2

- Highway at or close to grade.
- Similar to Option Q2 in terms of property difficulty.
- Roundabout affects same properties already impacted by the expressway alignment.
- Noise arising from breaking and acceleration at the roundabout.



Option Q4 – Liverpool Street connection

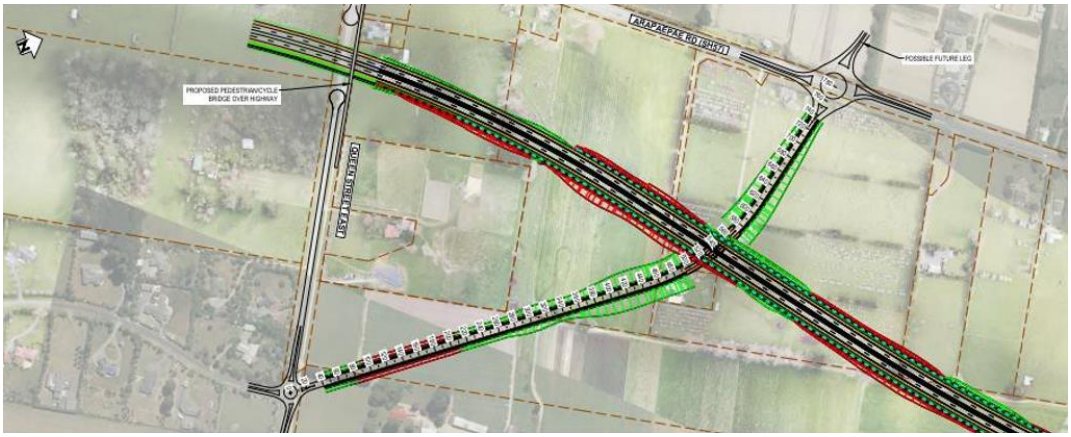
Score 5

- Highway at or close to grade.
- Three new properties affected. One residential, one improved lifestyle property and common property that forms part of a multi-unit title property/retirement community for over 50-year-olds.
- The common property which appears to be owned by 70 different owners will be difficult to acquire and presents a significant land tenure issue. The required land appears to be a recreational vehicle parking space.
- Due to the multiple owners involved there could be a higher risk of objection from an RMA perspective.

Option Q5

Score 3

- Highway at or close to grade.
- One new property affected by the proposed roundabout.
- Plan shows a possible future leg to the west. While the Crown could acquire the land required for the roundabout it could not acquire the future leg except by voluntary agreement with the affected owner i.e. land cannot be compulsorily acquired for a future requirement.
- Increases severance issues in relation to two blocks that form a large horticultural holding.



Option Q6

Score 2

- Score similar to the original alignment. No new properties affected.
- New highway on an elevated bridge/embankment resulting in increased visual and noise effects.

Option Q7

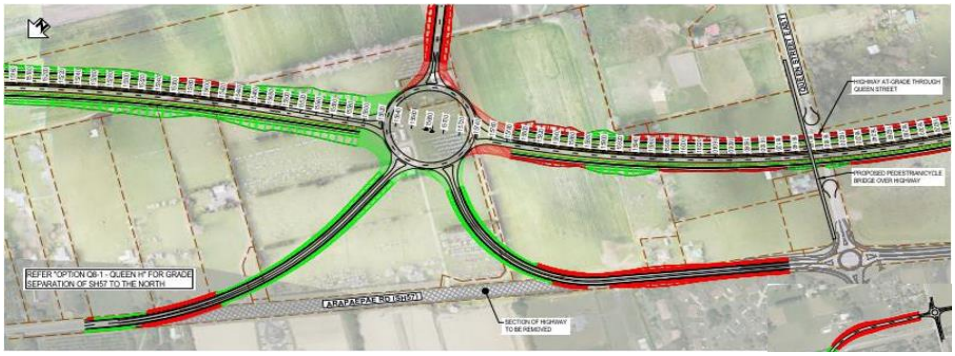
Score 3

- Highway at or close to grade.
- Similar to Option Q1 but higher in terms of property difficulty as driveways more likely to be affected.
- To the east of the alignment this option affects one new residential site and one improved lifestyle property which is already partially affected. Assumes at least one driveway will be affected.
- Visual impact of embankment and Queen Street overbridge and noise impacts two properties immediately to the east.

Option Q8

Score 3

- Highway at or close to grade.
- Appears four new properties will be affected.
- Roundabout located on a property already acquired by the Crown.
- Increases severance issues in relation to two blocks which form a large horticultural holding.
- Assumed SH 57 link confined to existing SH road reserve north of Queen Street and private driveways can be retained and regraded.

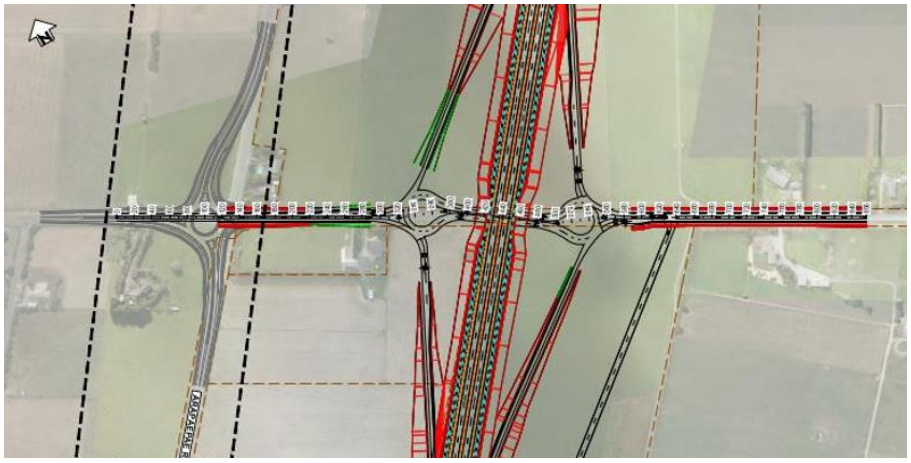


2. MCA Tararua Road Intersection Options

Option T0 (Base Case Option)

Score 2

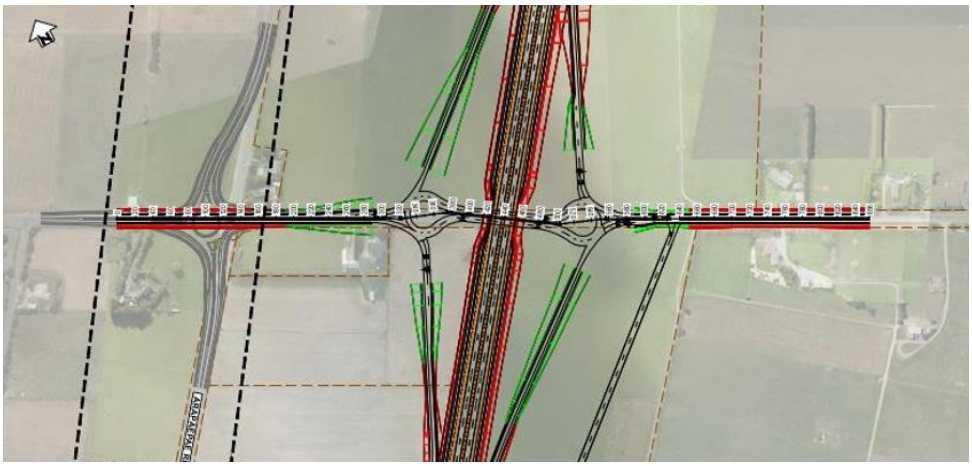
- Highway beneath Tararua Road.
- Similar to the previous MCA Interchange score assessed in August last year.
- Assumes no additional properties required i.e. Tararua Road stays within the existing road reserve and private driveways can be retained and regraded.



Option T1

Score 2

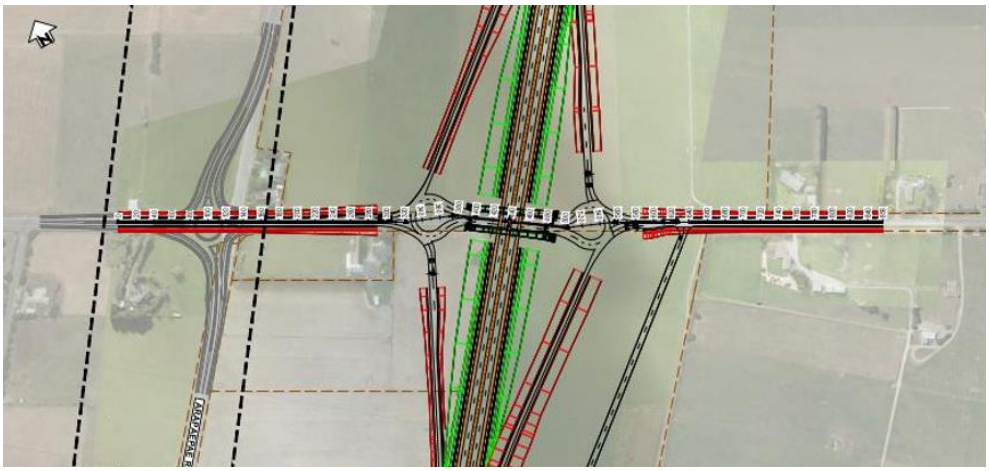
- Highway partially submerged.
- Appears that one additional residential property is impacted by local road embankment and may result in a full purchase.
- Assumes balance of Tararua Road stays within the existing road reserve and private driveways can be retained and regraded.



Option T2

Score 2

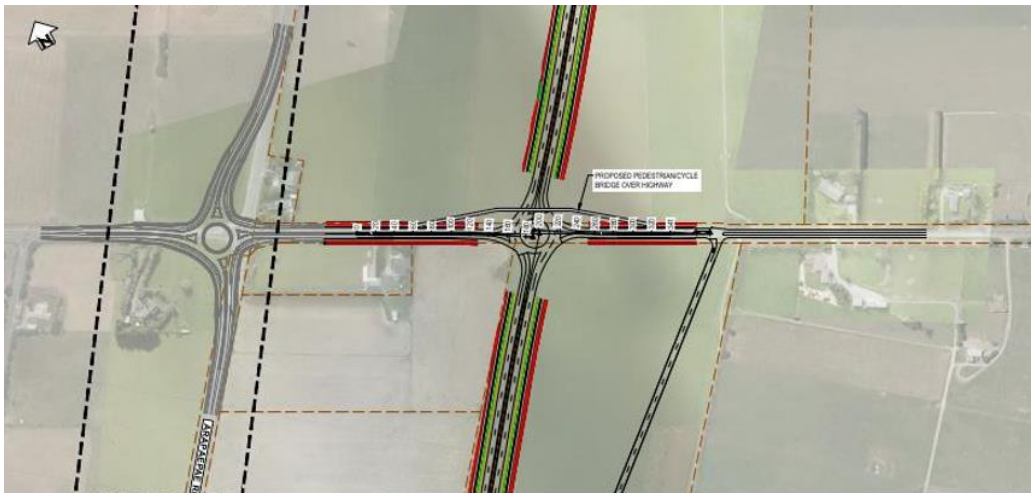
- Half and half option. Local road partially submerged and highway partially raised.
- Similar to Option T0 in terms of property difficulty although new highway is on a bridge over the local road resulting in increased visual effects when compared to at ground level.
- Assumes no additional properties required i.e. Tararua Road stays within the existing road reserve and private driveways can be retained and regraded.



Option T3

Score 2

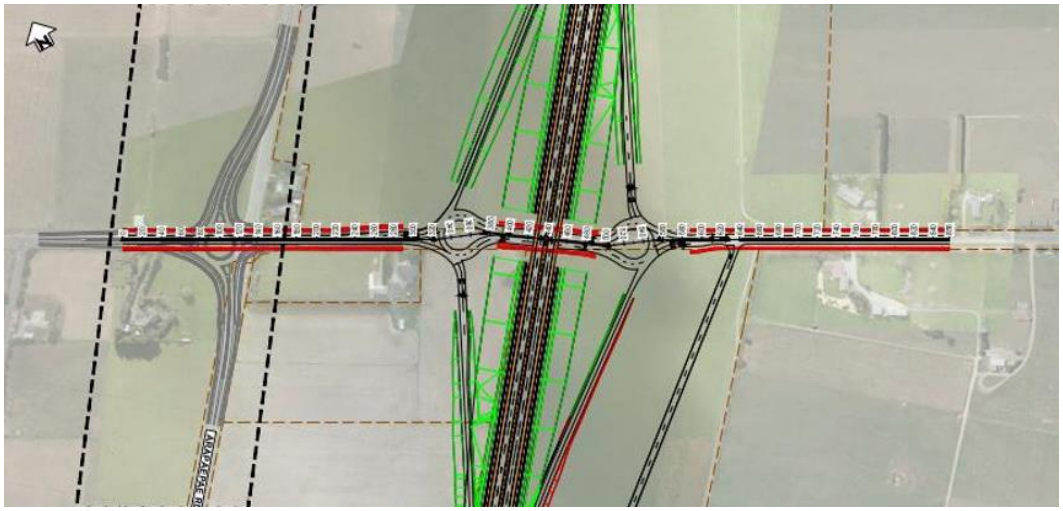
- Highway at or close to grade.
- Single roundabout within existing corridor. From a property perspective T3 has the least impact in terms of the Tararua Road options.
- Assumes no additional properties required i.e. Tararua Road stays within the existing road reserve and private driveways can be retained and regraded.
- Noise arising from breaking and acceleration at the roundabout.



Option T6

Score 2

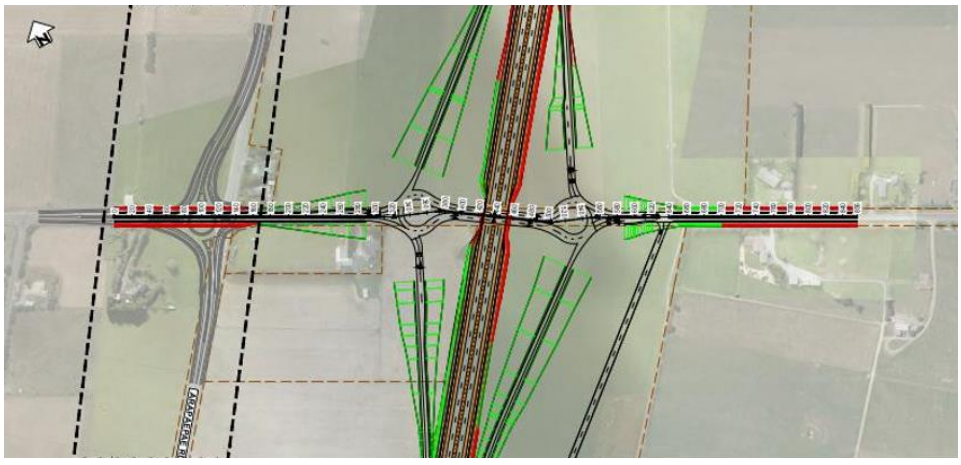
- Roundabouts and Tararua Road at grade.
- Similar to Option T2 in terms of property difficulty although new highway on a bridge is more elevated resulting in increased visual and noise effects.
- This option appears to have the greatest visual impact in terms of the Tararua Road options.
- Assumes no additional properties required i.e. Tararua Road stays within the existing road reserve and private driveways can be retained and regraded.



Option T7

Score 2

- Highway at grade.
- Similar to Option T1 in terms of property difficulty.
- Appears one additional residential property impacted by local road embankment which may result in a full purchase.
- Assumes balance of Tararua Road stays within the existing road reserve and private driveways can be retained and regraded.



3. MCA Queen Street Mid-Block Evaluation

Option 1: Ground Level

Score 3

- On existing alignment. Score is consistent with earlier MCA alignment ranking for Zone G Tararua to Queen Street) and Part Zone H (north of Queen Street).

Option 2: Below Ground Level

Score 3

- Assumed similar footprint to Option 1.
- Unclear as to the indirect effects on the general hydrology of the area. This could affect the property degree of difficulty due to potential impacts on further properties outside of the corridor.

In terms of both Options 1 and 2 the degree of property difficulty is not affected by the Tara-Ika development because the valuation approaches for properties in that area of the expressway were likely to be valued using the hypothetical subdivisional approach. The only difference is that if the zoning change was in place the subdivision potential is more intensive.

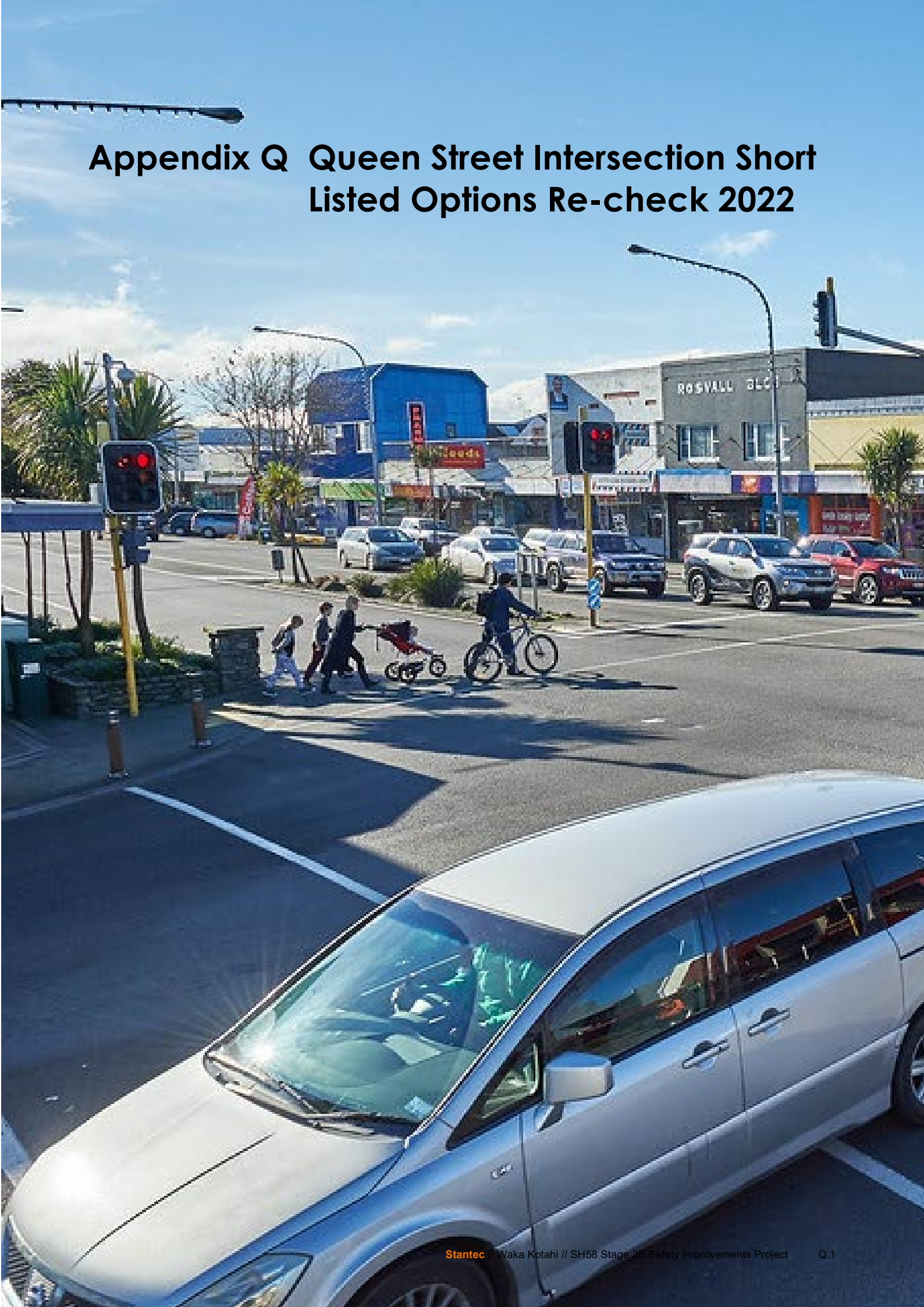
Appendix II: Summary Scoring Table

MCA 1 - Queen Street Intersection	
Option	Score
Q0	2
Q1	2
Q2	2
Q3	2
Q4	5
Q5	3
Q6	2
Q7	3
Q8	3

MCA 2 - Tararua Road Intersection	
Option	Score
T0	2
T1	2
T2	2
T3	2
T6	2
T7	2

MCA 3 – Queen Street Mid-block	
Option	Score
Ground Level-1	3
Above Ground Level-2	3

Appendix Q Queen Street Intersection Short Listed Options Re-check 2022



Stantec

Memo

To:	Phil Peet Wellington	From:	Selwyn Blackmore Wellington
Project/File:	**East of Levin MCA Recheck**	Date:	18 May 2022 (updated on 15 August)

Purpose
The purpose of this memo is to summarise the outcomes of the East of Levin Multi Criteria Analysis (MCA) re-check process of the short-listed Queen Street intersection options that were identified in the East of Levin Multi Criteria Analysis Report November 2021 (referred to as the "*East of Levin MCA November 2021 (Version 2) Report".* This report can be found on the project SharePoint: East of Levin MCA V2.

Background
Waka Kotahi undertook an East of Levin MCA in November 2021. In summary, this MCA assessed various intersection options for Queen Street and Tararua Road as well as options for the Ōtaki to North of Levin (Ō2NL) new highway's "midblock" alignment between these two intersections.

With regards to the Queen Street intersection options, the MCA process ultimately identified the following short list of options for further consideration by Waka Kotahi:

- Q4 - At-grade: Close Queen, upgrade Liverpool
- Q5 - At-grade: Queen diverted north
- Q6 - New highway over top
- Q7 - Local road over top

In terms of identifying option preferences, the East of Levin MCA November 2021 (Version 2) Report ultimately concluded the following:

"For the Queen Street intersection options, Options Q5, Q6, Q4 and Q7 were identified as the three best performing options. However, it is noted Option Q5 was the best overall performing option under both the unweighted and weighting scenario assessment processes."

Following completion of the report, Waka Kotahi undertook additional engagement with Horowhenua District Council (HDC) and the Muaūpoko Tribal Authority on the above short-listed options. It also undertook additional design refinements to Q5 and Q7. As a result of these processes, Waka Kotahi asked the East of Levin MCA assessors to re-check their original evaluations / scores for each short-listed option and to update these if deemed appropriate.

Key design changes
The key design changes are as follows:

- Q5 – updated horizontal and vertical geometric design that seeks to better relate to property boundary lines and existing and possible future road network layout (including the Tara-Ika Masterplan). Additional work was also undertaken on the pedestrian and cycle bridge on the existing Queen Street alignment
- Q7 – minor changes to the alignment and the location of the bridge crossing, which is offset northwards from the existing Queen Street alignment

- No (design) changes to Q4
- No (design) changes to Q6

Attachment 1 provides a high-level layout of the short-listed options, including providing a comparison between the original and "refined" Q5 and Q7 Options.

MCA assessment methodology
A briefing on the MCA re-check process for the MCA assessors was held on 4 April 2022. At this briefing, the Design Team outlined the key design refinements to Q5 and Q7. In addition, the MCA assessors were instructed to:

- Re-check their original evaluations / scores for Q5 (refined only), Q7 (refined only) as well as for Q4 and Q6
- Undertake the re-check process in accordance with the original East of Levin MCA instructions and their previous (individual) assessment methodologies, and
- Report back if there were changes or no changes to the original evaluations / scores for the short-listed options.

MCA re-check updates
This section summarises the outcomes of the re-check process (all of the individual MCA assessor reports / emails on the re-check process are held on Stantec's project files).

Table 1 below summarises the key comments made by the MCA assessors who did not change their original option evaluation scores. Table 2 below summarises the re-check outcomes for the MCA assessors who did change their original evaluations / scores.

No evaluation / score changes

Table 1 summarises the comments made by the MCA assessors who did not change their original evaluation scores.

Table 1: No changes to MCA assessors' original evaluation scores

Assessment Criteria	Summary of Comments
Theme: Fit with Project Objectives	
1. Enhance the safety of the State highway network by delivering a four lane State highway between Ōtaki and North of Levin	There were no changes to the original intersection option scores. The MCA assessor did make the following comments on the refined options: • Q5: Compared to the original Q5 option, the refined Q5 option removes a roundabout from Queen Street and introduces a low volume priority-controlled intersection keeping larger traffic volumes along Queen Street as a priority. The other material consideration is the gradients which are expected to remain reasonable at around 7 per cent • Q7: From a gradient perspective this option is similar to the original Q7, with around 8 per cent grades. It is noted that the original Q7 has the highway in a cut where this does not appear to be the case for the refined option as the bridge is slightly further north, so

Assessment Criteria	Summary of Comments
	therefore there is a slightly longer distance to reach the required height. The visibility at the crest which combines both vertical and horizontal curves will need to be checked and managed during detailed design, but this is not expected to be an issue. This will also help control speed of vehicles approaching SH57. On balance, this option is probably better than the existing Q7 Q7 continues to be considered marginally less safe than Option Q5 due to the higher grades, more abrupt vertical curve and shorter distance between the crest of the vertical curve and the roundabout intersection. The scores of 1 for Q5 and 2 for Q7 have been retained. For avoidance of doubt, no specific comments (or scoring changes) were made on Q4 or Q6.
2. Improve the resilience of the State highway network	There were no changes to the original intersection option scores. The MCA assessor did make the following comment on the refined options: • Both would not introduce any resilience concerns For avoidance of doubt, no specific comments (or scoring changes) were made on Q4 or Q6.
3. Provide integration between the State highway network and the local road network including supporting access to multi-modal connections and Levin	There were no changes to the original intersection option scores. The MCA assessor did make the following comment on the refined options: • Both would retain the grade separation of the highway and a roundabout with Arapaepae Road which is appropriate For avoidance of doubt, no specific comments (or scoring changes) were made on Q4 or Q6.
4. Enable mode choice for journeys between local communities by providing a walking and cycling facility	There were no changes to the original intersection option scores. The MCA assessor did make the following comments on the refined options: • Q5: The score is 1 on the basis that the new facility for active modes at the existing Queen Street would have an appropriate gradient, and have safe and appropriate crossings of Arapaepae Road. Active modes would also be able to use the new road bridge, but no dedicated cycle facilities would be provided on that structure • Q7: There is no change to the score of 2 compared to the previous Q7 as there is no substantive change in the gradient compared to the previous Q7 option or separate provision of facilities for walking and cycling shown It is noted that, for all short listed options, an opportunity exists to design separate adjacent walking and cycling facilities that would have much more cycle friendly gradients. If such facilities were made available then the scores for Q4 and Q7 could be reduced from 2 to 1.

Assessment Criteria	Summary of Comments
5. Support intra and inter-regional economic growth and productivity through improved movement of people and freight	This criterion primarily covers effects on inter-regional traffic on the state highway network and therefore there were no changes to the original intersection option scores. The MCA assessor did make the following comments on the refined options: • Q5: The option remains grade separated. It is noted that this option will serve the Tara-Ika residents better than the original Q5 option, as it will only contain one additional roundabout • Q7: There are no material changes from an enhanced movement perspective For avoidance of doubt, no specific comments (or scoring changes) were made on Q4 or Q6.
Theme: Environmental / Social impacts	
Iwi Cultural Values (Muaūpoko)	Muaūpoko concluded that the minor changes to Options Q5 and Q7 did not alter its original scoring. Muaūpoko did comment that its scoring of Q5, and the installation of a pedestrian / cycle bridge was premised with a "pause point" or lookout and cultural expression installation at the top of the cycle/pedestrian bridge. This pause point would enable connections with Punahau / Lake Horowhenua and Tararua Ranges to be protected and enhanced.
Terrestrial Ecology	No evaluation or scoring changes to any of the options were proposed by the expert assessor.
Freshwater / Wetland Ecology	
Heritage	There were no changes to the original intersection option scores. The MCA assessor did make the following comment on refined Q7: • The bridge would be sufficiently far away from the Prouse's homestead to not be visible (from the homestead) For avoidance of doubt, no specific comments (or scoring changes) were made on Q4 or Q6.
Noise / Vibration	No evaluation or scoring changes to any of the options were proposed by the expert assessors.
Productive Land Values	
Social / Community / Recreation	
Theme: Implementability impacts	
Fit with Local Road System	There were no changes to the original intersection option scores. The MCA assessor did make the following comments on the refined options:

Assessment Criteria	Summary of Comments
	• Q5: Avoiding the need for a roundabout at Redwood Grove is a better outcome due to there being no intensification along this road as part of Tara Ika • Q7: Would result in a slightly worst fit with the local road network due to its curve (when compared to the original Q7) For avoidance of doubt, no specific comments (or scoring changes) were made on Q4 or Q6.
Engineering Degree of Difficulty	There were no changes to the original intersection option scores. The MCA assessor did make the following comment on refined Q7: • The refined option was considered moderately better than the original option in the local road interface sub-attribute. This was because the refined option had marginally improved vertical geometry that matched with the curves in the new horizontal layout and provided a more consistent slower speed layout better suited for a future urban environment For avoidance of doubt, no specific comments (or scoring changes) were made on Q4 or Q6.
Property Degree of Difficulty	No evaluation or scoring changes to any of the options. For avoidance of doubt, no specific comments (or scoring changes) were made on Q4 or Q6.

Evaluation / score changes

The following MCA assessors updated their original evaluations and scores for the Queen Street intersection options:

- Landscape / Visual / Urban Design
- Archaeology, and
- Horowhenua District Development

Table 2 below summarises the re-check outcomes for the above assessors (the scoring changes are highlighted in red).

Table 2: Changes to MCA assessors' original evaluations / scores

Option	Original score	Re-check score (April 2022)	Status	Comments
Visual / Landscape / Urban Amenity (Theme: Environmental / Social impacts)				
Q4	2	3	Change	On reflection the original score of 2 gave insufficient weight to the importance of the Queen Street access and overly weights the benefits for the future Tara-Ika development at the expense of adverse effects on the existing Queen Street East. This option would undermine Queen Street East as an important element of Levin's urban form and result in a circuitous and poorly legible connection for the existing Queen Street Area. A score of 3 better reflects a balance weighting between the existing Queen Street East axis and the future planned Tara-Ika.
Q5	4	5	Change	This option originally scored a 4 due to the moderate adverse visual effects of the bridge and significant adverse effects on connectivity and legibility on Queen Street East. There would be significant adverse effects on legibility and landscape connectivity compared to the existing environment. On reflection, a score of 5 more clearly reflects these effects. The refined option does not alter the original concerns with Q5 (and therefore the score would remain as a 5). While the revised alignment has a better fit to the cadastral pattern (i.e. in terms of the bridge and its approaches), it diverts Queen Street East to leave a section "marooned" as a side road.
Q6	3	3	No change	Whilst there is no scoring change to Q6, the MCA assessor did comment on the visual / landscape effects on the Prouse Homestead and the viewshafts between Levin and the Tararua ranges as follows: • Q6 would have fewer effects on Prouse when compared to Q7 because the Q6 bridge(s) and approaches would be to one side of the property (whereas Q7 would be in front of the property). It would also retain the relationship of the property frontage with Queen Street East, including the relationship between the property and Levin and its historic urban form • From the centre of Levin the view shaft of the Tararua Ranges would be relatively unaffected. Further east (e.g. Bartholomew Road), the highway structure is likely to be noticed, but its effect would be insignificant
Q7	3	4	Change	This option originally scored a 3 because of its moderate to high visual effects and moderate connectivity and legibility effects when compared to the existing environment. On reflection a score of 4 better reflects

Reference: East of Levin MCA Re-check

Option	Original score	Re-check score (April 2022)	Status	Comments
				these effects. The refined options introduce a more pronounced deviation of Queen Street East's straight alignment, but the vertical alignment will be symmetrical which will look more elegant than the original design (this "benefit" is not sufficient to change the new score of 4).
Archaeology (Theme: Environmental / Social impacts)				
Q4	1	1	No change	No score changes or comments
Q5	1	1	No change	
Q6	1	1	No change	
Q7	2	1	Change	The refined Q7 option is re-scored as a 1 as it would have a reduced effect on the Prouse Homestead's frontage (and therefore curtilage)
Horowhenua District Development (Theme: Environmental / Social impacts)				
Q4	4	4	No change	There were no changes to the original intersection option scores. The MCA assessor made the following comment on Q4: • Closing Queen Street, a raised connection to SH57 and a highway at grade may not achieve good urban design outcomes relating to amenity / environmental and social aspects (Objective 6A.1). Reduced connectivity of northern part of Tara-Ika to Levin. Not consistent with northern part of Structure Plan 013
Q5	3	2	Change	This option was re-scored a 2 (from a 3). The MCA assessor made the following comment in support of this score change: • Highway at grade and a raised deviation of Queen Street may not achieve good urban design outcomes relating to amenity / environmental and social aspects (Objective 6A.1). Refined Q5 is an improvement on the original option as there is better connectivity between Tara-Ika to Levin, and is more consistent with Structure Plan 013 (hence the 1-point scoring change)
Q6	3	3	No change	There were no changes to the original intersection option scores. The MCA assessor made the following comment on Q6:

Option	Original score	Re-check score (April 2022)	Status	Comments
				• Raising highway may not achieve good urban design outcomes relating to amenity / environmental and social aspects (Objective 6A.1) – adverse effects
Q7	3	3	No Change	There were no changes to the original intersection option scores. The MCA assessor made the following comment on Q7: • Highway at grade and raising Queen Street may not achieve good urban design outcomes relating to amenity / environmental and social aspects (Objective 6A.1) – adverse effects

Updated equally weighted scores (previously referred to as unweighted scores)
Table 3 below sets out the updated equally weighted scores for the short listed Queen Street intersection options. The updated scores are shown in red.

Table 3: Updated unweighted (equally weighted) scores

ption	Enhanced movement	Safety	Resilience	Mode Choice	Connections	Iwi Muaūpoko	Landscape / visual	Ecological - Terrestrial	Ecological - Freshwater & Wetlands	Heritage	Archaeology	Noise and vibration	Productive land values	Social/community/recreation	Horowhenua District development	Fit with local road system	Engineering degree of difficulty	Property degree of difficulty	Updated total Score (equally weighted) April 2022	Original Total Score (equally weighted) November 2021
Q4 - At-grade: Close Queen, upgrade Liverpool	1	1	1	2	2	2	**3**	1	1	2	1	3	2	4	4	4	2	5	**40**	**39**
Q5 - At-grade: Queen diverted north	1	1	1	1	1	1	**5**	1	1	2	1	3	3	3	**2**	3	2	3	**35**	**35**
Q6 - New highway over top	1	1	1	1	1	3	3	2	2	3	1	3	2	4	3	1	2	2	**36**	**36**
Q7 - Local road over top	1	2	1	2	1	3	**4**	2	2	3	**1**	3	2	3	3	2	2	3	**40**	**40**

Summary of equally weighted results

Despite the changes to the original Visual / Landscape, Archaeology and Horowhenua District Development equally weighted scores, there has been no material change in total scores or the overall option rankings from the November 2021 MCA Report. Put simply the "increased" Visual / Landscape assessment scores have been "neutralised" by the "score reductions" in the Archaeology and Horowhenua District Development assessments. Accordingly, there is no change to the equally weighted short-listed preferences from the MCA in November 2021.

For completeness, Appendix 2 sets out the updated scores for all nine Queen Street intersection options.

Weighting scenario assessments

For the East of Levin MCA November Report, a weighting assessment process was undertaken to test the various sensitivities of the equally weighted scores to matters considered, under various weightings, to be more important. To recap, the weighted scenarios examined in the East of Levin MCA November Report were as follows:[1]

- Workshop weighting scenario
- RMA Section 6 matters scenario, and
- Quadruple bottom line scenario (which was assessed separately as social, economic, cultural and environment scenarios).

The above weighted scenarios were re-checked based on the updated equally weighted scores (as set out above in Table 3).

Updated weighting scenario scores and rankings

Table 4 below sets out the weighted scores for the short-listed Queen Street intersection options (these scores were calculated[2] in accordance with the numerical values assign to each assessment criteria as set out in the East of Levin MCA November (Version 2) Report[3]). For ease of reference, Table 5 below provides an overall ranking for each weighting scenario (i.e. these are the "colour coded" rankings identified in Table 5).

In addition to examining the weighted scores for each individual weighting scenario assessment, both Table 4 and Table 5 also provide overall combined average scores and rankings as an alternative means of interpreting the weighting scenario assessment process as follows:

- The left hand light pink column in Table 4 provides the average score for all of the six weighting scenarios (i.e. all scenario scores are added up and then divided by six) with the lowest average score ranked first and highest score ranked last (as identified in the right hand light pink column), and
- The left hand light pink column in Table 5 provides a total score for all of the weighting scenario rankings (i.e. all of the rankings are added up) with the lowest overall score ranked first and highest score ranked last (as identified in the right hand light pink column).

The change in weighted scenario scores from the East of Levin MCA November 2021 Report are highlighted in red in the tables below.

[1] Further information on the weighted scenarios can be found in Section 6.2.1 of the East of Levin MCA November Report
[2] To calculate the weighted score, each MCA assessor's score has been multiplied by the assigned weight to the relevant criteria which is then summed and divided by the sum of all the weightings
[3] Table 9, page 51, East of Levin MCA Report, November 2021

Table 4: Average scores for the short listed Queen Street intersection weighting scenarios

Queen Street Options	Workshop Weighting	RMA Sec 6	Social	Environment	Cultural	Economic	Average Score	Overall Average Score Ranking
Q4 - At-grade: Close Queen, upgrade Liverpool	**2.21**	**1.89**	**2.18**	**1.61**	**1.78**	**2.25**	**1.98**	**3**
Q5 - At-grade: Queen diverted north	1.88	**1.72**	**1.77**	**1.51**	**1.51**	**1.73**	**1.69**	**1**
Q6 - New highway over top	**1.88**	**1.93**	**1.97**	**2.00**	**2.06**	1.60	**1.91**	**2**
Q7 - Local road over top	**2.13**	**2.12**	**2.14**	**2.16**	**2.11**	1.86	**2.09**	**4**

Table 5: Weighting scenario ranking orders for the scores identified in Table 4

Queen Street Options	Workshop Weighting	RMA Sec 6	Social	Environment	Cultural	Economic	Total Ranking Score	Overall Ranking
Q4 - At-grade: Close Queen, upgrade Liverpool	4	2	4	2	3	7	22	**3**
Q5 - At-grade: Queen diverted north	1	1	1	1	1	2	7	**1**
Q6 - New highway over top	1	3	2	5	5	1	17	**2**
Q7 - Local road over top	3	**5**	3	6	6	3	**26**	**4**

Weighting scenario assessment conclusions

Overall, there are no weighting scenario option ranking changes from the East of Levin MCA November 2021 Report. That is, Options Q5, Q6, Q4 and Q7 remained ranked one to four respectively. As set out in Appendix 3, there was however a minor ranking change for Option Q7 for the RMA Section 6 weighting scenario. That is, this option is now ranked fifth (compared to its original ranking of fourth)[4]. Overall, Option Q7 still remains fourth overall.

[4] Option 3 (At-grade roundabout) is now ranked fourth for the RMA Section 6 weighting scenario (it was originally ranked fifth)

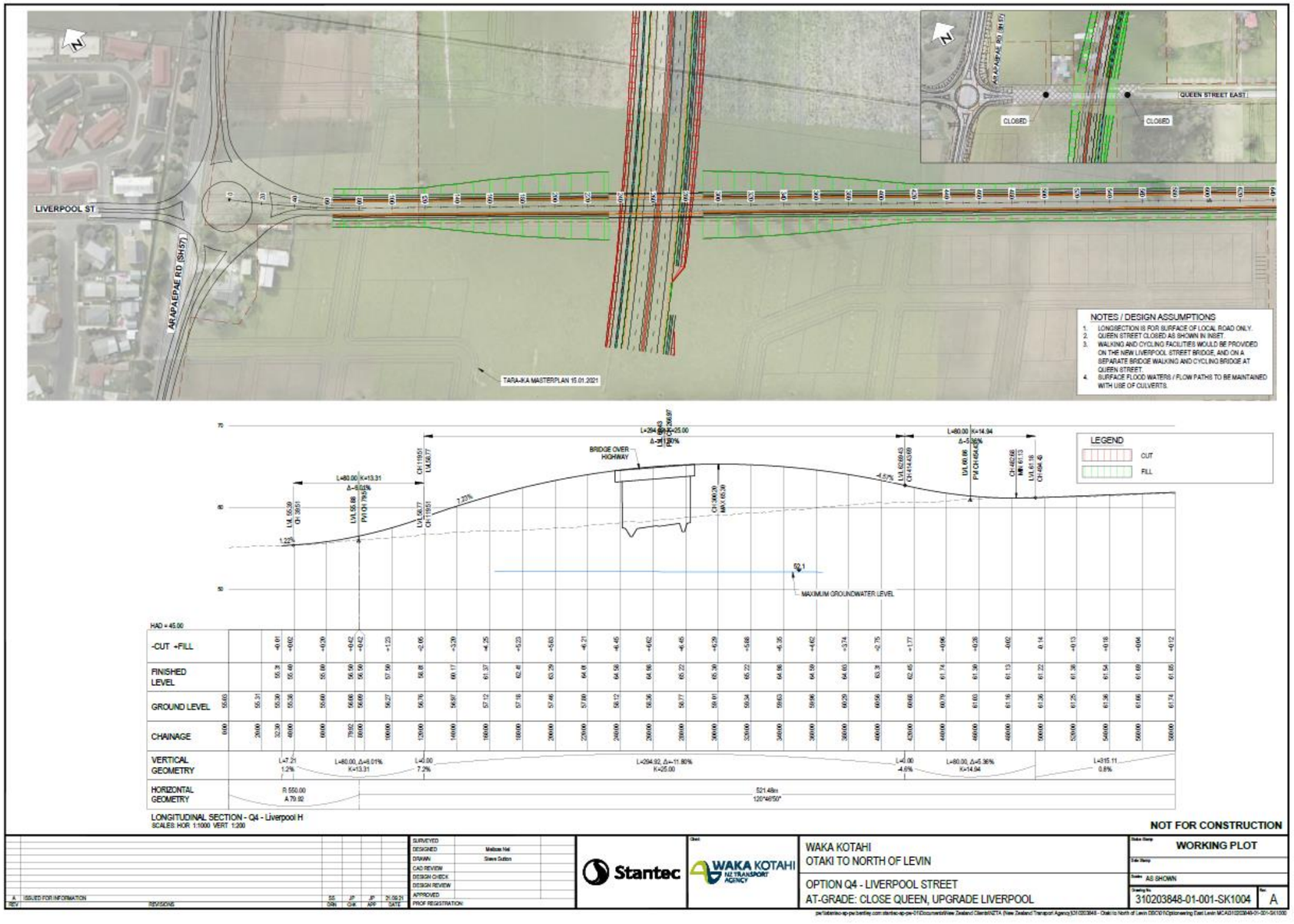
Conclusion

Overall, there is no material change in the equally weighted or weighting scenario option rankings, and therefore there is no change to the original East of Levin MCA November Report's recommendations for the short listed intersection options for Queen Street.

Accordingly, Option Q5 remains the best overall performing option under both MCA assessment processes (followed by Option Q6).

Appendix 1: Short listed Queen Street Intersection Options

Option Q4: Liverpool Street At-grade: Close Queen, Upgrade Liverpool (no design changes)

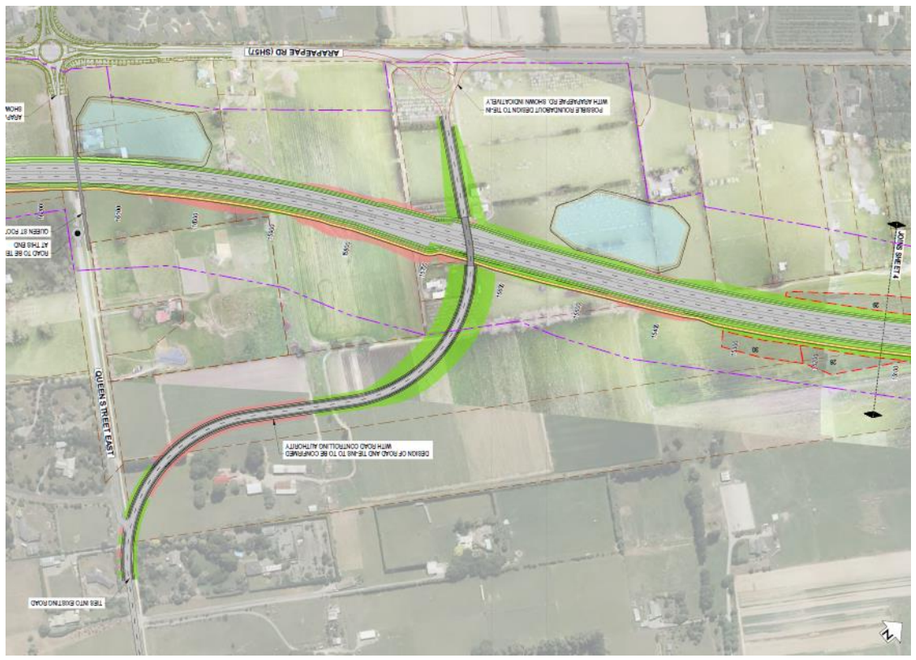


Reference: **East of Levin MCA Re-check**

Option Q5: At-grade: Queen diverted north

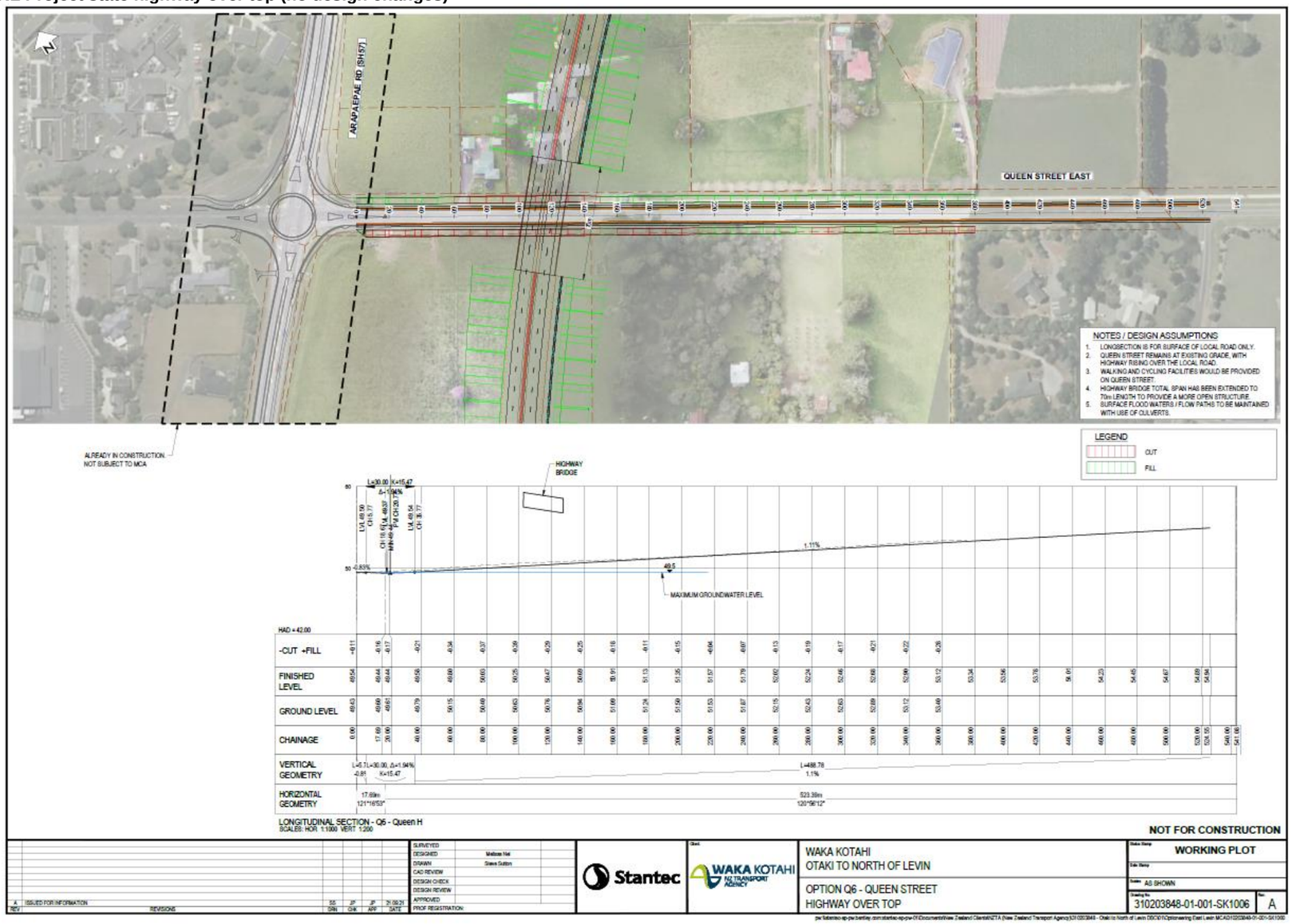
Original Q5 (November 2021)

Refined Q5 (March 2022)



Reference: **East of Levin MCA Re-check**

Option Q6: Proposed Ō2NL Project state highway over top (no design changes)

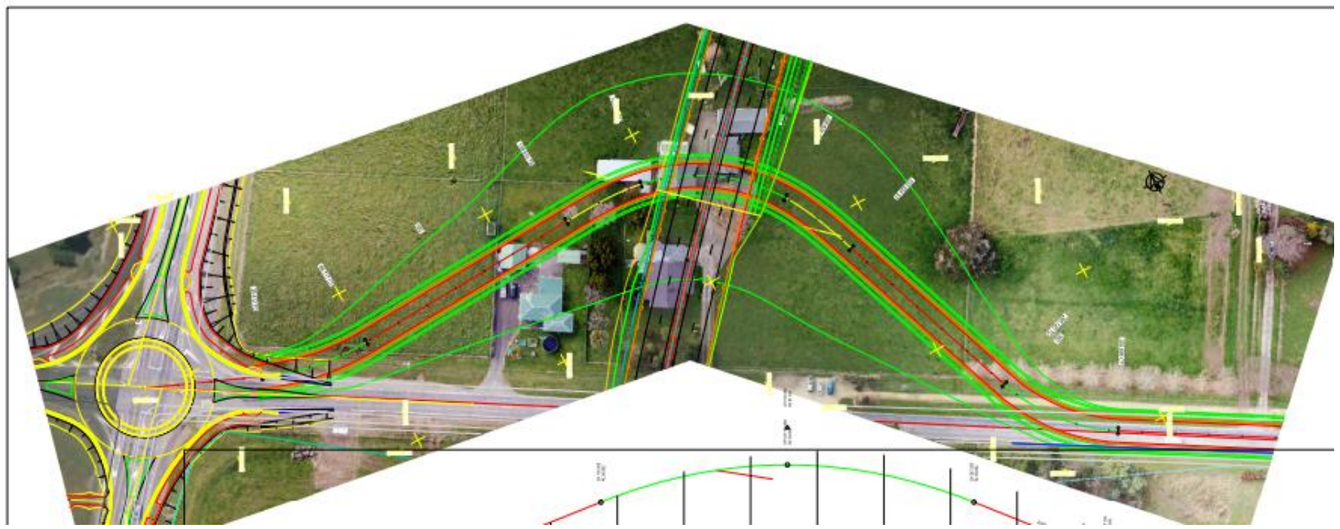


Reference: East of Levin MCA Re-check

Option Q7: Local road over top

Original Q7 (November 2021)

Refined Q7 (March 2022)



Appendix 2: Updated Equally Weighted Scores for all nine Queen Street Intersection Options (red denotes a score change from 2021)

Options	Enhanced movement	Safety	Resilience	Mode Choice	Connections	Iwi Muaūpoko	Landscape / visual	Ecological - Terrestrial	Ecological - Freshwater & Wetlands	Heritage	Archaeology	Noise and vibration	Productive land values	Social/community/recreation	Horowhenua District development	Fit with local road system	Engineering degree of difficulty	Property degree of difficulty	Updated total Score (equally weighted) April 2022	Original Total Score (equally weighted) November 2021
Q0 - New highway fully below grade (DBC)	1	1	2	1	1	**F**	2	**F**	5	1	1	3	4	2	1	1	**F**	2	**58**	58
Q1 - New highway partially below grade	1	1	1	1	1	**F**	3	**F**	5	2	1	3	3	2	2	1	5	2	**54**	54
Q2 - Local road partially below grade	1	1	1	1	1	**F**	4	**F**	5	2	1	3	2	3	3	2	4	2	**56**	56
Q3 - At-grade: Roundabout	2	3	2	1	3	2	3	2	2	3	1	5	2	3	3	2	1	2	**42**	42
Q4 - At-grade: Close Queen, upgrade Liverpool	1	1	1	2	2	2	**3**	1	1	2	1	3	2	4	4	4	2	5	**40**	39
Q5 - At-grade: Queen diverted north	1	1	1	1	1	1	**5**	1	1	2	1	3	3	3	**2**	3	2	3	**35**	35
Q6 - New highway over top	1	1	1	1	1	3	3	2	2	3	1	3	2	4	3	1	2	2	**36**	36
Q7 - Local road over top	1	2	1	2	1	3	**4**	2	2	3	**1**	3	2	3	3	2	2	3	**40**	40
Q8 - At-grade: 5-arm, shift SH57 connection South	3	3	2	1	3	2	4	1	1	2	1	5	4	3	3	4	2	3	**47**	47

Appendix 3: Updated Weighted Scenario Scores for all nine Queen Street Intersection Options Options (red denotes a score / ranking change from 2021)

Average scores for Queen Street intersection weighting scenarios

Queen Street Options	Workshop Weighting	RMA Sec 6	Social	Environment	Cultural	Economic	Average Score	Overall Average Score Ranking
Q0 - New highway fully below grade (DBC)	3.03	3.17	2.61	4.43	3.82	2.71	3.30	8
Q1 - New highway partially below grade	2.78	3.19	2.58	4.57	3.96	2.02	3.18	7
Q2 - Local road partially below grade	2.94	3.36	2.75	4.72	4.17	2.02	3.33	9
Q3 - At-grade: Roundabout	2.26	2.10	2.28	1.92	1.89	2.19	2.11	5
Q4 - At-grade: Close Queen, upgrade Liverpool	2.21	1.89	2.18	1.61	1.78	2.25	1.98	3
Q5 - At-grade: Queen diverted north	1.88	1.72	1.77	1.51	1.51	1.73	1.69	1
Q6 - New highway over top	1.88	1.93	1.97	2.00	2.06	1.60	1.91	2
Q7 - Local road over top	2.13	2.12	2.14	2.16	2.11	1.86	2.09	4
Q8 - At-grade: 5-arm, shift SH57 connection South	2.62	2.14	2.43	1.64	1.69	2.79	2.22	6

Reference: **East of Levin MCA Re-check**

Weighting scenario ranking orders for the scores in the table above

Queen Street Options	Workshop Weighting	RMA Sec 6	Social	Environment	Cultural	Economic	Total combined Ranking Score	Overall Ranking
Q0 - New highway fully below grade (DBC)	9	7	8	7	7	8	46	**8**
Q1 - New highway partially below grade	7	8	7	8	8	4	42	**7**
Q2 - Local road partially below grade	8	9	9	9	9	4	48	**9**
Q3 - At-grade: Roundabout	5	**4**	5	4	4	6	**28**	**5**
Q4 - At-grade: Close Queen, upgrade Liverpool	4	2	4	2	3	7	22	**3**
Q5 - At-grade: Queen diverted north	1	1	1	1	1	2	7	**1**
Q6 - New highway over top	1	3	2	5	5	1	17	**2**
Q7 - Local road over top	3	**5**	3	6	6	3	**26**	**4**
Q8 - At-grade: 5-arm, shift SH57 connection South	6	6	6	3	2	9	32	**6**

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