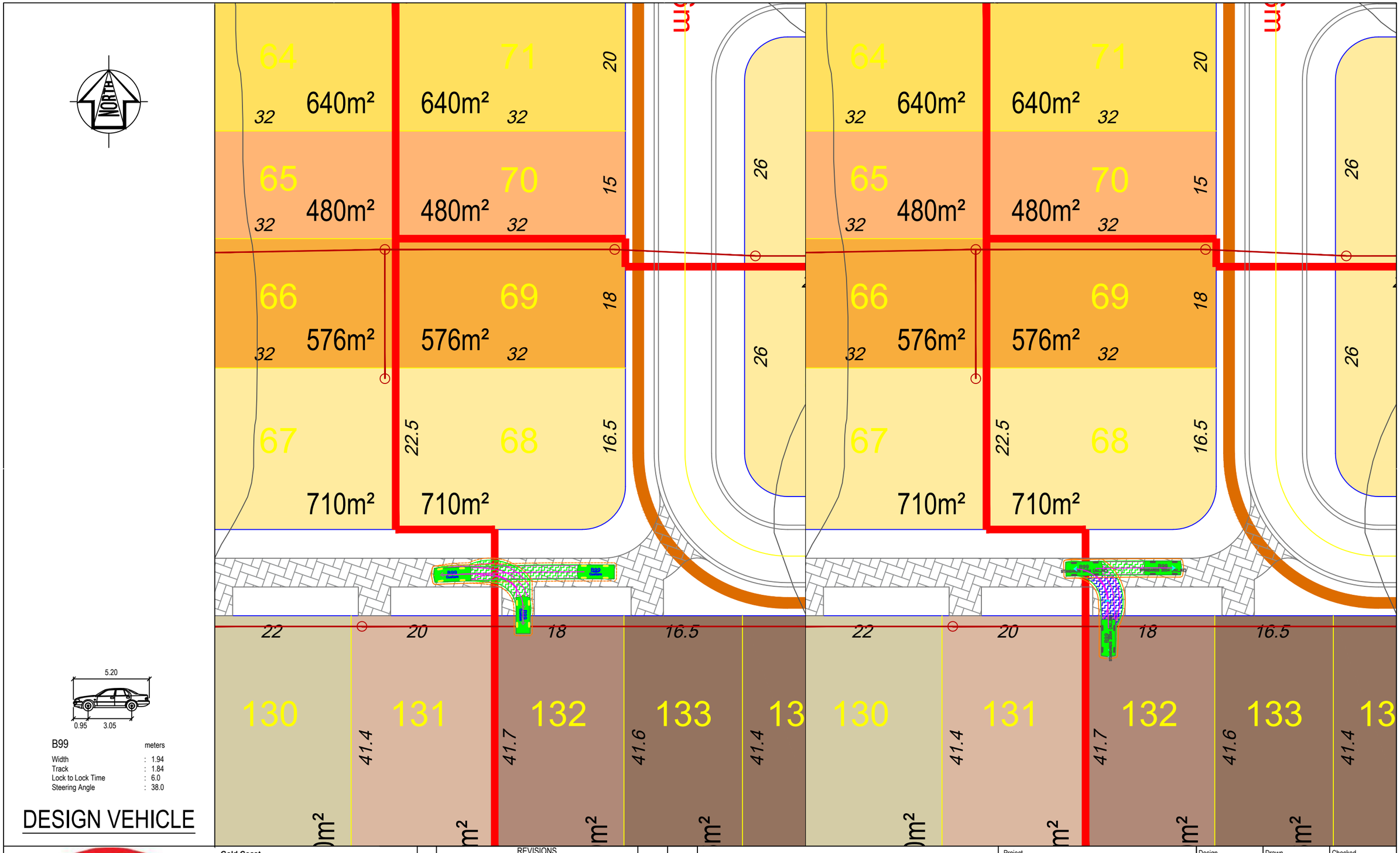


B99	meters
Width	: 1.94
Track	: 1.84
Lock to Lock Time	: 6.0
Steering Angle	: 38.0

DESIGN VEHICLE

Gold Coast
Suite 26, 58 Riverwalk Avenue, Robina QLD 4226
P: (07) 5562-5377
W: www.bitziosconsulting.com.au
Brisbane
Level 2, 428 Upper Edward Street, Spring Hill 4000
P: (07) 3831-4442
E: admin@bitziosconsulting.com.au
Sydney
Studio 203, 3 Gladstone Street, Newtown NSW 2042
P: (02) 9557 6202

Issue	REVISIONS Revisions/Descriptions	Drawn	Date
001	Swept Paths Assessment	R.TU	23.08.2023
002	Swept Paths Assessment	B.C	19.07.2024

Scale @ A3 — 0 5 10 15 20 25 — 1:500

ENGINEERING CERTIFICATION (RPEQ)

Name	Signature	No.	Date

Project: Mount Low Precinct TIAs

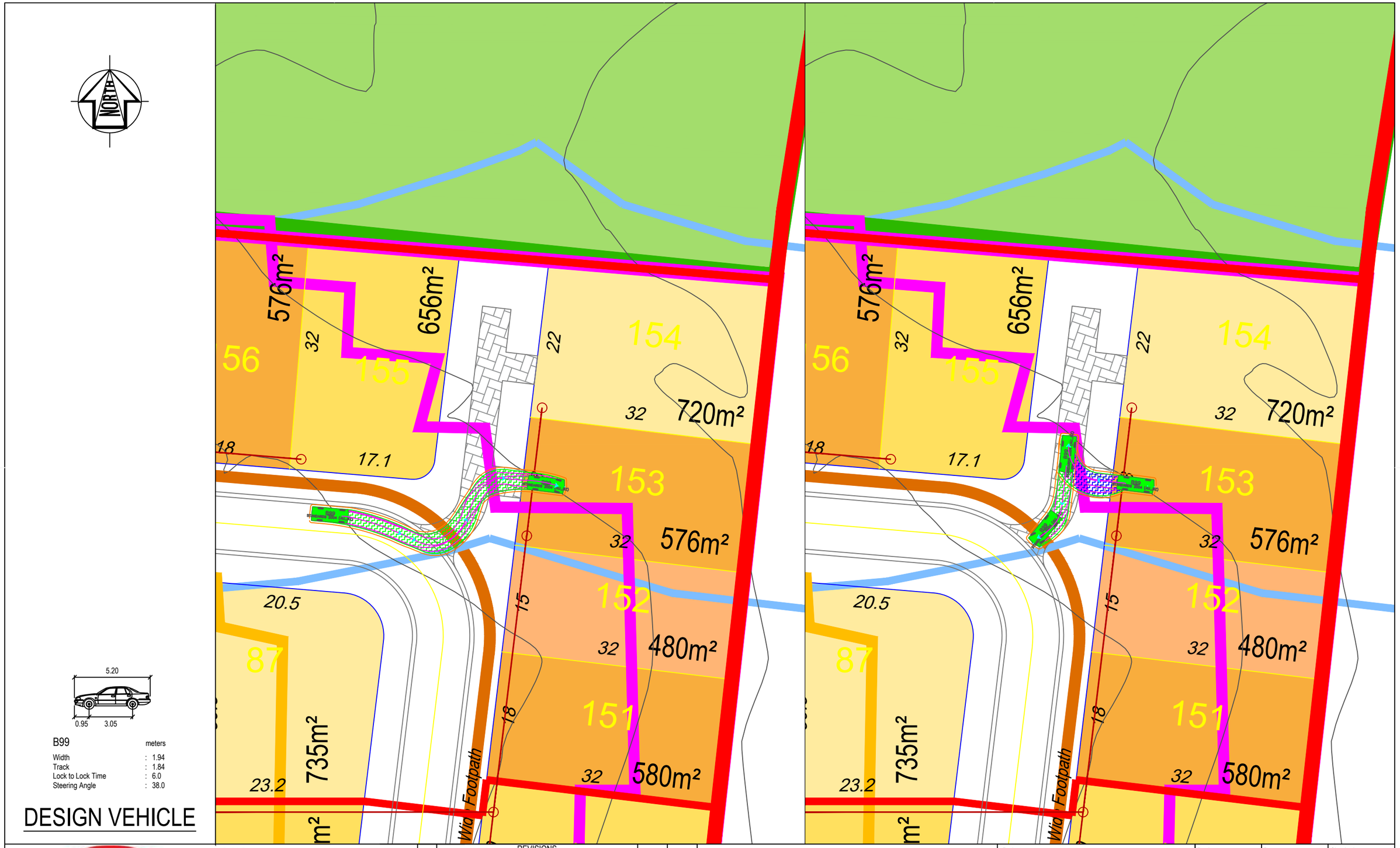
Title: B99 Ingress & Egress
Lot 132

Design	Drawn	Checked
B.C	B.C	E.S

CONCEPT ONLY

Date: 19.07.2024

Project Number	Sheet Number	Issue
P6519	8	002



B99	meters
Width	: 1.94
Track	: 1.84
Lock to Lock Time	: 6.0
Steering Angle	: 38.0

DESIGN VEHICLE

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Sydney
Studio 203, 3 Gladstone Street, Newtown NSW 2042
P: (02) 9557 6202

Issue	REVISIONS Revisions/Descriptions	Drawn	Date
001	Swept Paths Assessment	R.TU	23.08.2023
002	Swept Paths Assessment	B.C	19.07.2024

Scale @ A3 0 5 10 15 20 25 1:500

ENGINEERING CERTIFICATION (RPEQ)

Name	Signature	No.	Date

Project: Mount Low Precinct TIAs

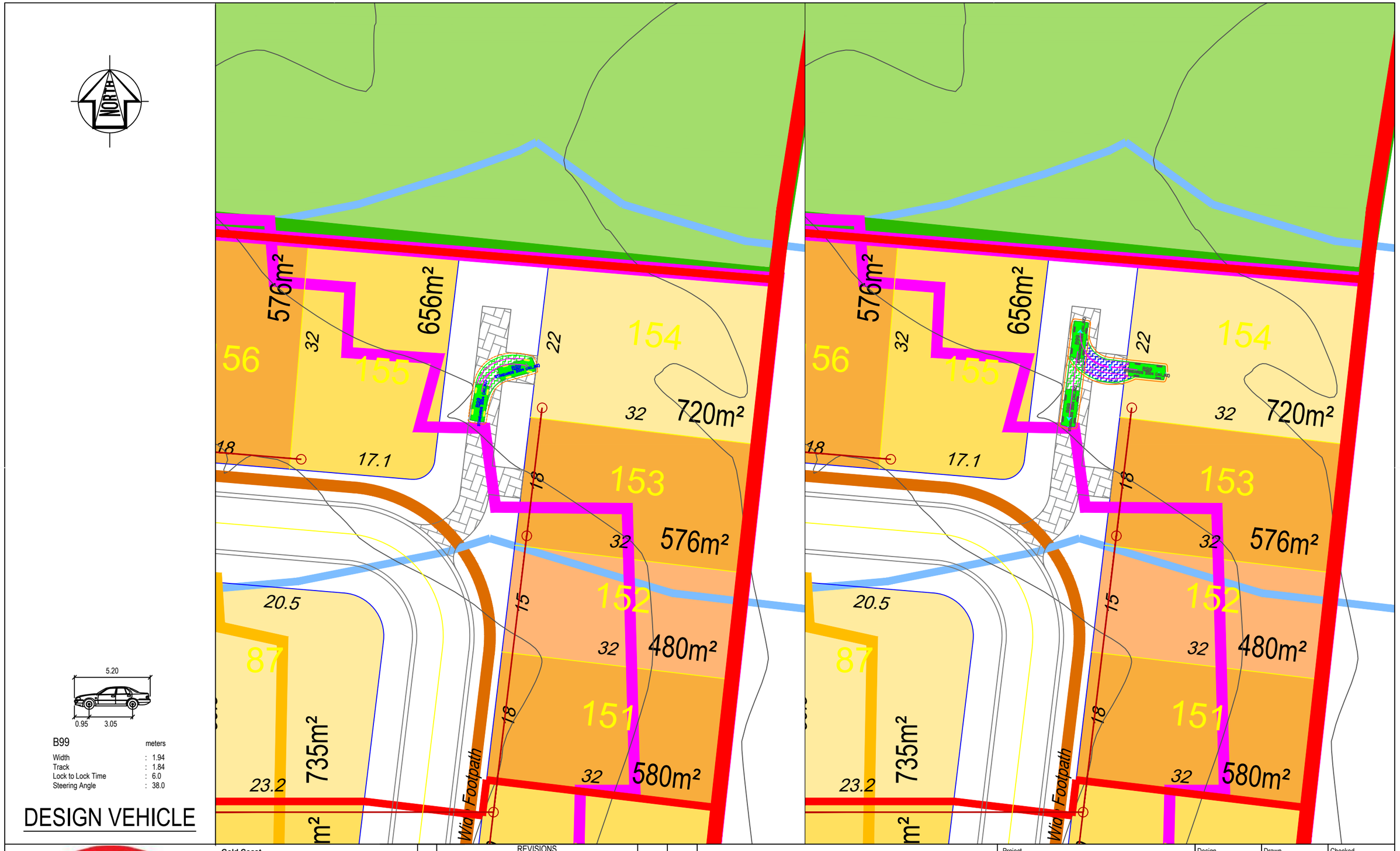
Title: B99 Ingress & Egress
Lot 153

Design	Drawn	Checked
B.C	B.C	E.S

CONCEPT ONLY

Date: 19.07.2024

Project Number	Sheet Number	Issue
P6519	9	002



B99	meters
Width	: 1.94
Track	: 1.84
Lock to Lock Time	: 6.0
Steering Angle	: 38.0

DESIGN VEHICLE

Gold Coast
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Brisbane
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E: admin@bitziosconsulting.com.au
Sydney
Studio 203, 3 Gladstone Street, Newtown NSW 2042
P: (02) 9557 6202

Issue	REVISIONS Revisions/Descriptions	Drawn	Date
001	Swept Paths Assessment	R.TU	23.08.2023
002	Swept Paths Assessment	B.C	19.07.2024

Scale @ A3 — 0 5 10 15 20 25 — 1:500

ENGINEERING CERTIFICATION (RPEQ)

Name	Signature	No.	Date

Project: Mount Low Precinct TIAs

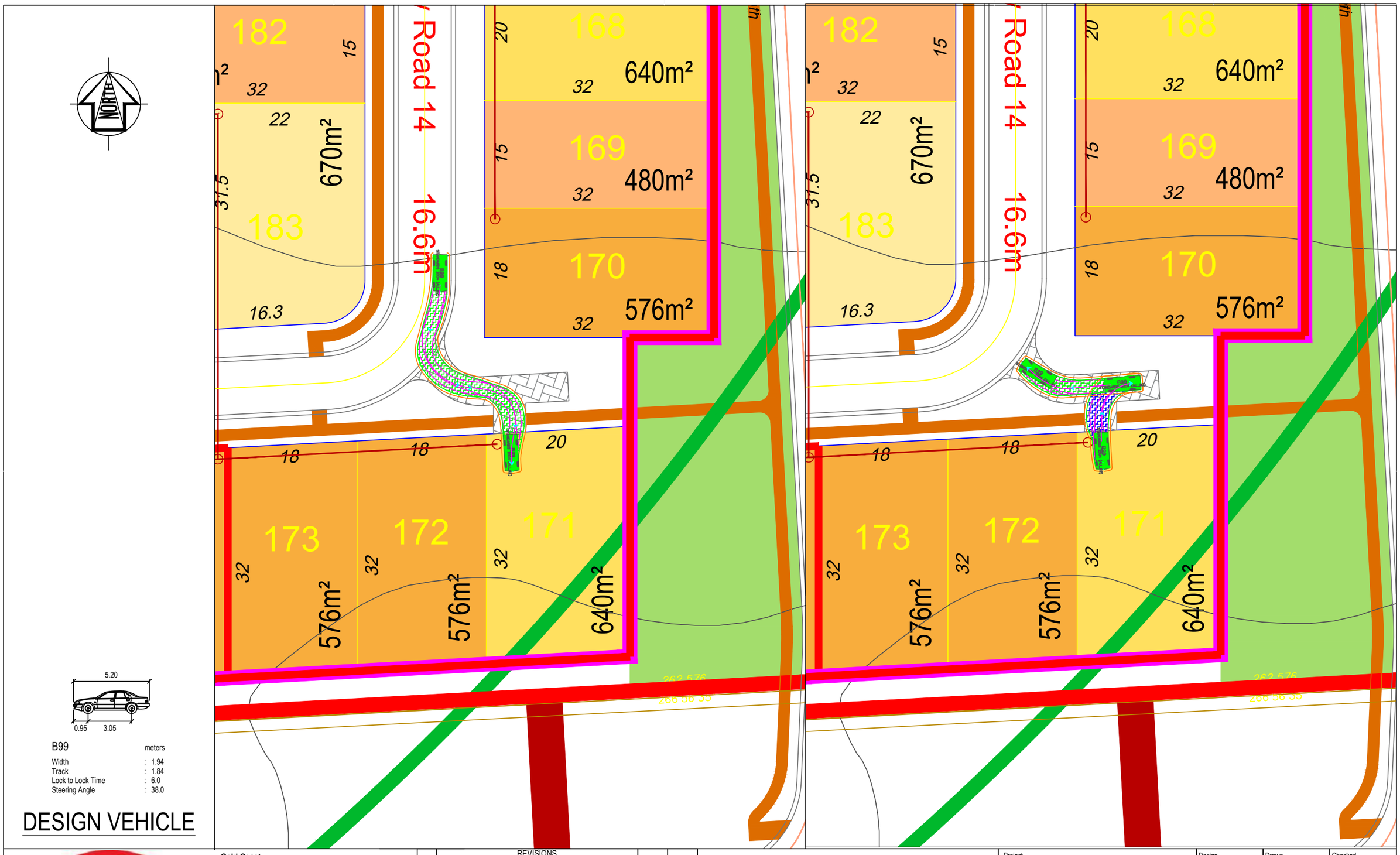
Title: B99 Ingress & Egress
Lot 154

Design	Drawn	Checked
B.C	B.C	E.S

CONCEPT ONLY

Date: 19.07.2024

Project Number	Sheet Number	Issue
P6519	10	002



B99 meters

Width	:	1.94
Track	:	1.84
Lock to Lock Time	:	6.0
Steering Angle	:	38.0

DESIGN VEHICLE

Gold Coast
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Sydney
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P: (02) 9557 6202

Issue	REVISIONS Revisions/Descriptions	Drawn	Date
001	Swept Paths Assessment	R.TU	23.08.2023
002	Swept Paths Assessment	B.C	19.07.2024

Scale @ A3 0 5 10 15 20 25 1:500

ENGINEERING CERTIFICATION (RPEQ)

Name	Signature	No.	Date

Project: Mount Low Precinct TIAs

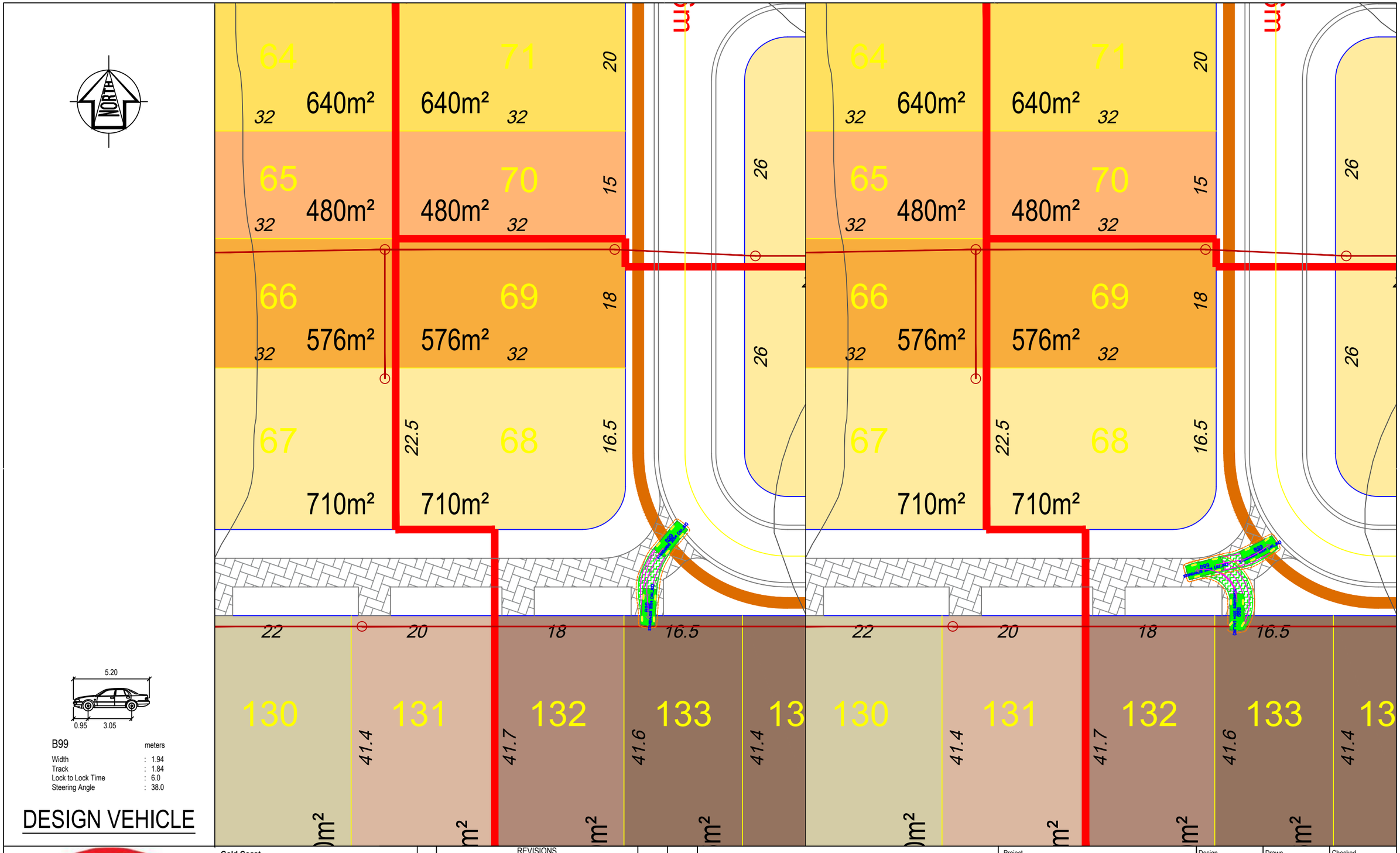
Title: B99 Ingress & Egress
Lot 171

Design	Drawn	Checked
B.C	B.C	E.S

CONCEPT ONLY

Date: 19.07.2024

Project Number	Sheet Number	Issue
P6519	11	002



B99 meters

Width	:	1.94
Track	:	1.84
Lock to Lock Time	:	6.0
Steering Angle	:	38.0

DESIGN VEHICLE

Gold Coast
Suite 26, 58 Riverwalk Avenue, Robina QLD 4226
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Studio 203, 3 Gladstone Street, Newtown NSW 2042
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Issue	REVISIONS Revisions/Descriptions	Drawn	Date
001	Swept Paths Assessment	R.TU	23.08.2023
002	Swept Paths Assessment	B.C	19.07.2024

Scale @ A3 0 5 10 15 20 25 1:500

ENGINEERING CERTIFICATION (RPEQ)

Name	Signature	No.	Date

Project: Mount Low Precinct TIAs

Title: B99 Ingress & Egress
Lot 133

Design	Drawn	Checked
B.C	B.C	E.S

CONCEPT ONLY

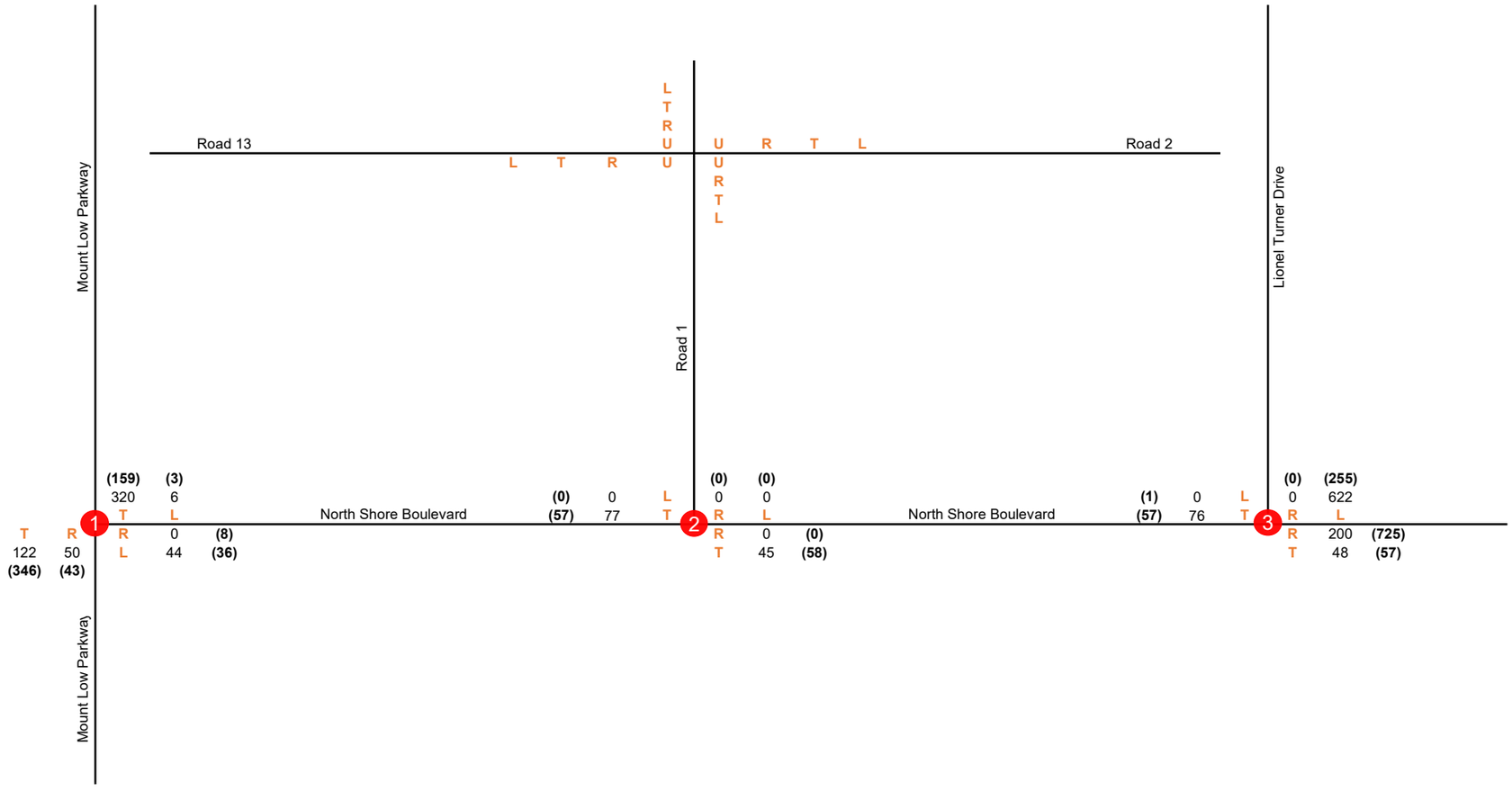
Date: 19.07.2024

Project Number	Sheet Number	Issue
P6519	12	002

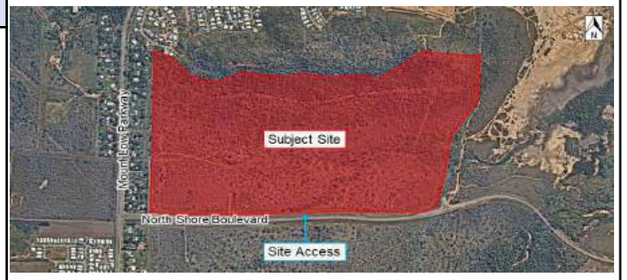
Appendix D: Network Volume Diagrams

TRAFFIC GENERATION

Aimsun BASE Model



LOCALITY PLAN



INTERSECTION VOLUMES

		#1	#2	#3
Aimsun BASE Model	AM	542	122	946
	PM	(595)	(115)	(1095)

DETAILS

Survey Year		
Peak Period	AM	PM
Base Year		
Growth Rate		
Growth Factor		

DOCUMENT CONTROL

Job Number:	P6159
Prepared By:	RTU
Reviewed By:	ES
Job Name:	Mount Low Northern Precincts TIAs
Prepared Date:	26/09/2023
Reviewed Date:	26/09/2023
File Path:	P:\P6159 Mount Low Northern Precinct TIAs\Technical\Traffic Generation\

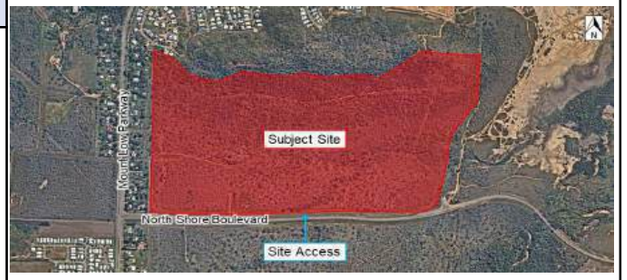
LEGEND

##	AM Peak Period
(##)	PM Peak Period
L	Left Turn Movement
T	Through Turn Movement
R	Right Turn Movement
1	Intersection ID

TRAFFIC GENERATION

Aimsun Model_Project (Interim)

LOCALITY PLAN



INTERSECTION VOLUMES

		#1	#2	#3
Aimsun Model_Project (Interim)	AM	1233	531	1131
	PM	(1075)	(592)	(1269)

DETAILS

Survey Year		
Peak Period	AM	PM
Base Year		
Growth Rate		
Growth Factor		

DOCUMENT CONTROL

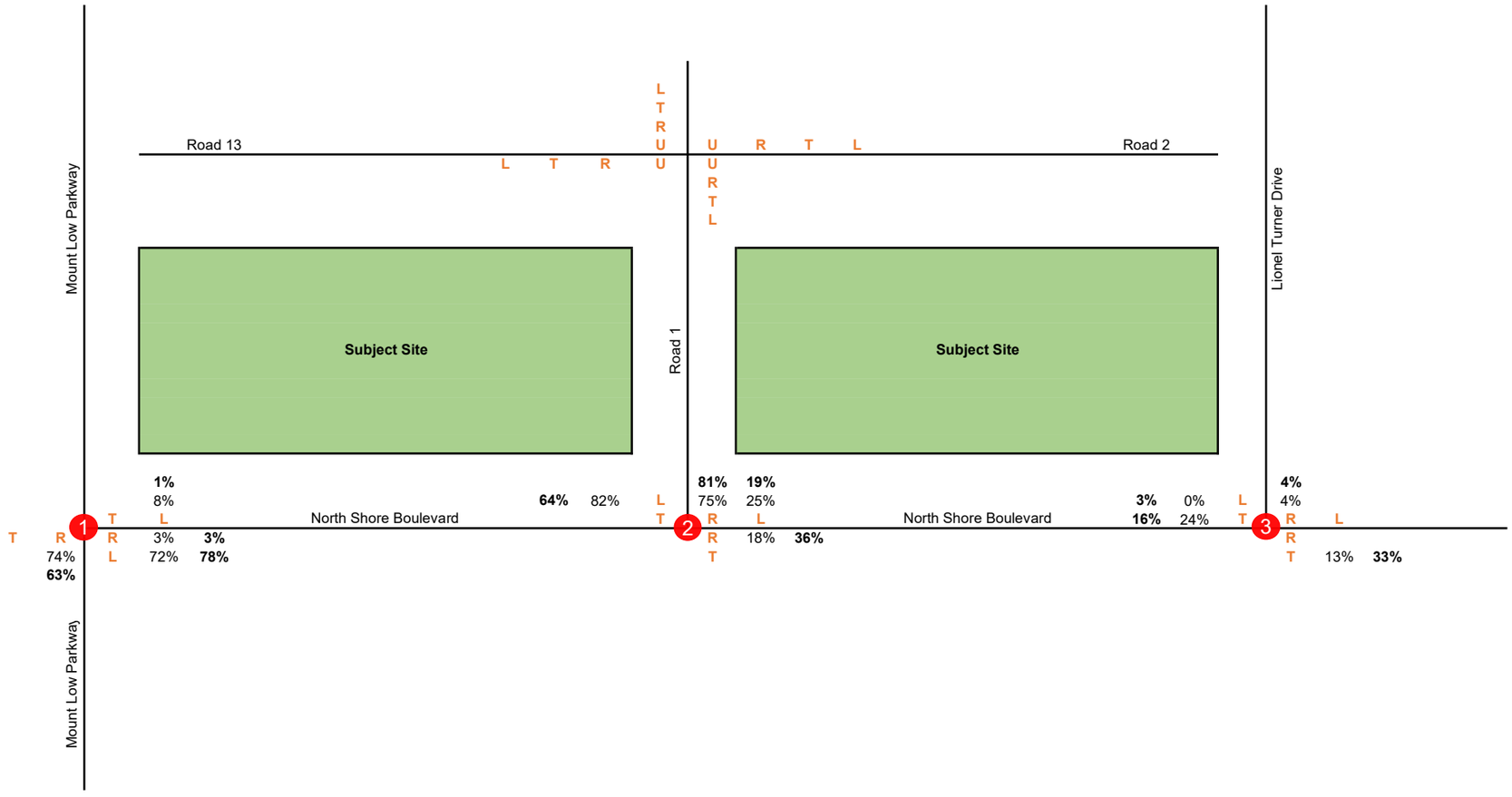
Job Number:	P6159
Prepared By:	RTU
Reviewed By:	ES
Job Name:	Mount Low Northern Precincts TIAs
Prepared Date:	26/09/2023
Reviewed Date:	26/09/2023
File Path:	P:\P6159 Mount Low Northern Precinct TIAs\Technical\Traffic Generation\

LEGEND

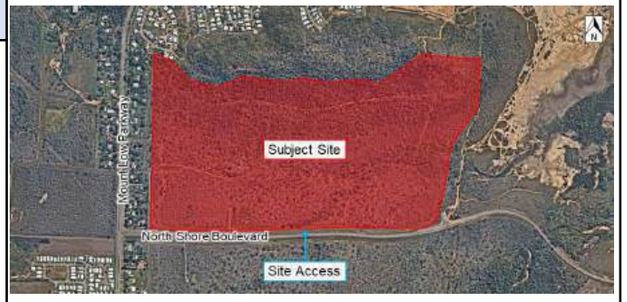
##	AM Peak Period
(##)	PM Peak Period
L	Left Turn Movement
T	Through Turn Movement
R	Right Turn Movement
1	Intersection ID

TRAFFIC GENERATION

Development Distribution "Project (INT)-BG" Dist



LOCALITY PLAN



INTERSECTION VOLUMES

		#1	#2	#3
Development Distribution "Project (INT)-BG" Dist	AM	2	2	0
	PM	(1)	(2)	(1)

DETAILS

Survey Year		
Peak Period	AM	PM
Base Year		
Growth Rate		
Growth Factor		

DOCUMENT CONTROL

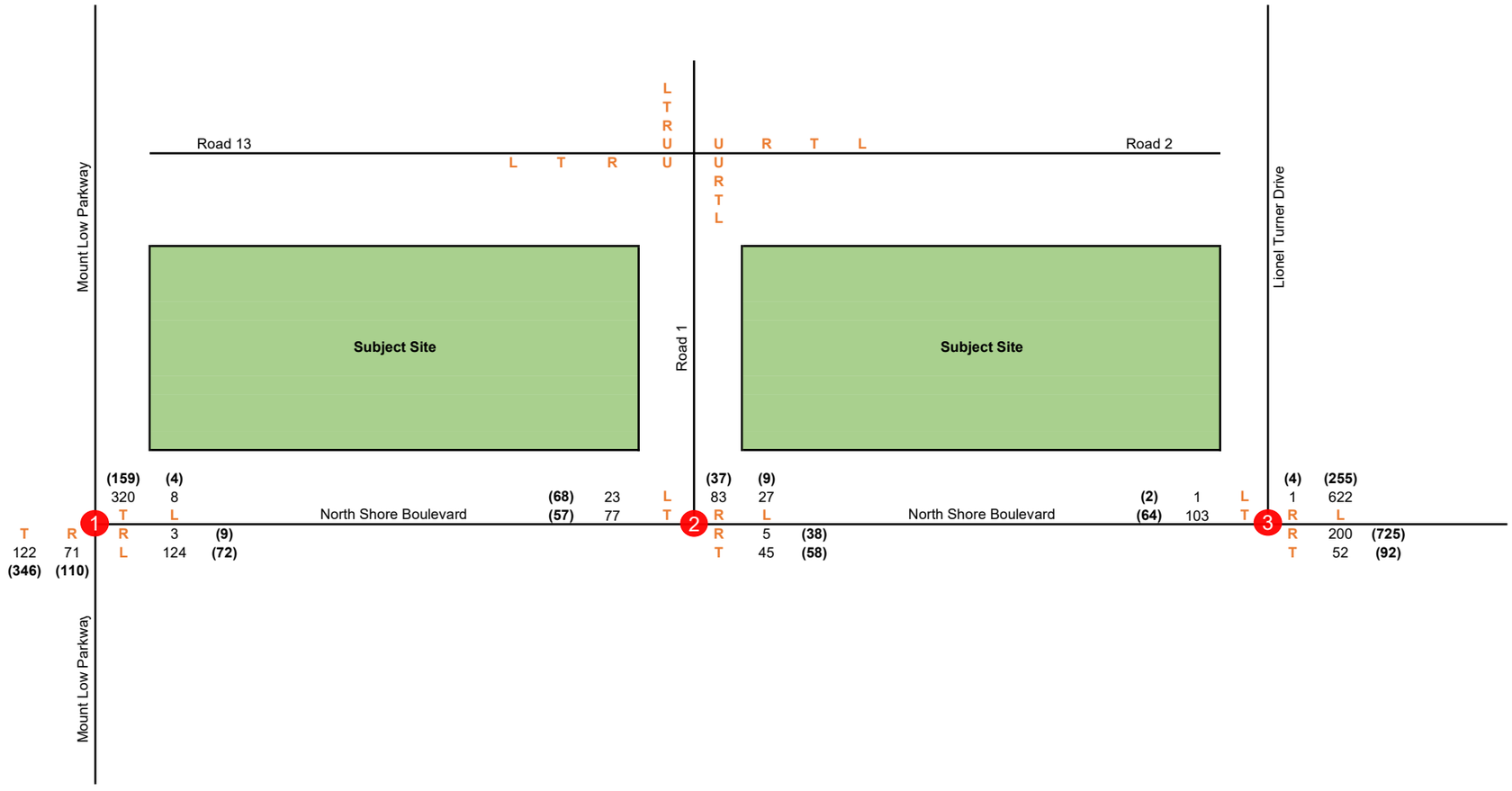
Job Number:	P6159
Prepared By:	RTU
Reviewed By:	ES
Job Name:	Mount Low Northern Precincts TIAs
Prepared Date:	26/09/2023
Reviewed Date:	26/09/2023
File Path:	P:\P6159 Mount Low Northern Precinct TIAs\Technical\Traffic Generation\

LEGEND

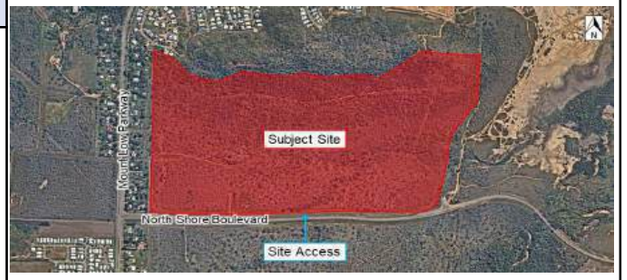
##	AM Peak Period
(##)	PM Peak Period
L	Left Turn Movement
T	Through Turn Movement
R	Right Turn Movement
1	Intersection ID

TRAFFIC GENERATION

Design Traffic Volumes (2027)



LOCALITY PLAN



INTERSECTION VOLUMES

		#1	#2	#3
Design Traffic Volumes (2027)	AM	648	260	978
	PM	(700)	(267)	(1142)

DETAILS

Survey Year		
Peak Period	AM	PM
Base Year		
Growth Rate		
Growth Factor		

DOCUMENT CONTROL

Job Number:	P6159
Prepared By:	RTU
Reviewed By:	ES
Job Name:	Mount Low Northern Precincts TIAs
Prepared Date:	26/09/2023
Reviewed Date:	26/09/2023
File Path:	P:\P6159 Mount Low Northern Precinct TIAs\Technical\Traffic Generation\

LEGEND

##	AM Peak Period
(##)	PM Peak Period
L	Left Turn Movement
T	Through Turn Movement
R	Right Turn Movement
1	Intersection ID

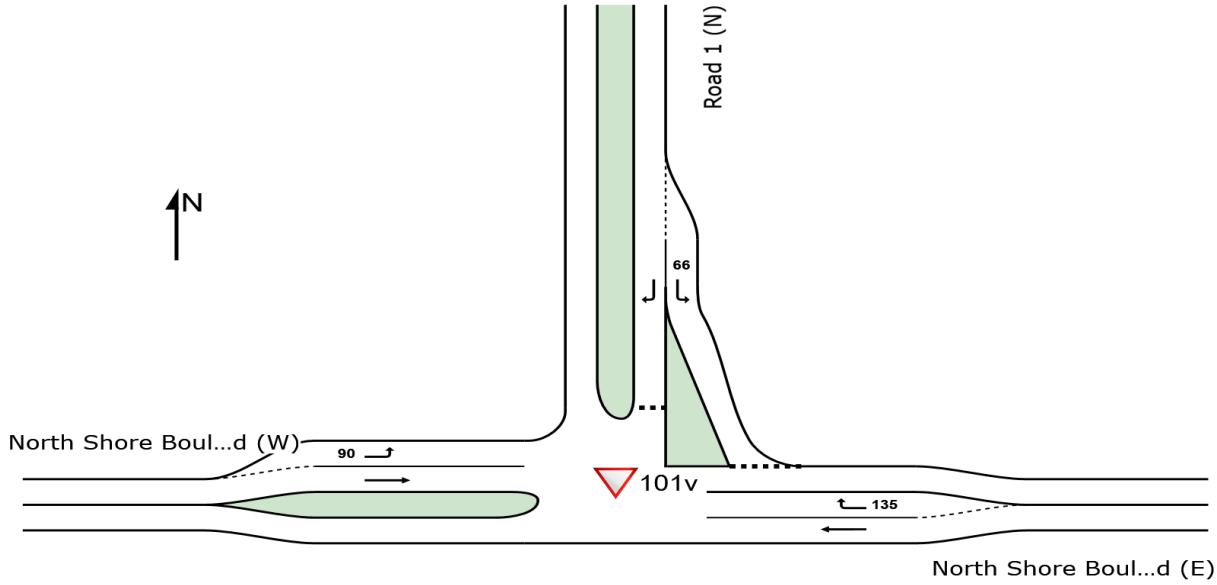
Appendix E: SIDRA Results

SITE LAYOUT

Site: 101v [2027DES AM - CHR/AUL (Site Folder: Priority Controlled Layout)]

P6159
Mount Low Northern Precinct TIAs
North Shore Boulevard / Road 1
Site Category: (None)
Give-Way (Two-Way)

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Organisation: BITZIOS CONSULTING | Licence: PLUS / FLOATING | Created: Thursday, 30 May 2024 4:20:49 PM
Project: P:\P6159 Mount Low Northern Precinct TIAs\Technical\Models\SIDRA\P6159.002S North Shore Boulevard & Road 1 Intersection.sip9

MOVEMENT SUMMARY

Site: 101v [2027DES AM - CHR/AUL (Site Folder: Priority Controlled Layout)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

P6159
Mount Low Northern Precinct TIAs
North Shore Boulevard / Road 1
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: North Shore Boulevard (E)															
5	T1	All MCs	45	5.0	45	5.0	0.024	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	80.0
6	R2	All MCs	5	5.0	5	5.0	0.004	7.5	LOS A	0.0	0.1	0.20	0.57	0.20	57.6
Approach			50	5.0	50	5.0	0.024	0.8	NA	0.0	0.1	0.02	0.06	0.02	77.8
North: Road 1 (N)															
7	L2	All MCs	27	5.0	27	5.0	0.022	4.8	LOS A	0.1	0.6	0.17	0.47	0.17	44.0
9	R2	All MCs	83	5.0	83	5.0	0.093	5.6	LOS A	0.4	2.7	0.29	0.53	0.29	43.5
Approach			110	5.0	110	5.0	0.093	5.4	LOS A	0.4	2.7	0.26	0.51	0.26	43.6
West: North Shore Boulevard (W)															
10	L2	All MCs	23	5.0	23	5.0	0.013	7.0	LOS A	0.0	0.0	0.00	0.63	0.00	58.7
11	T1	All MCs	77	5.0	77	5.0	0.040	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	80.0
Approach			100	5.0	100	5.0	0.040	1.6	NA	0.0	0.0	0.00	0.14	0.00	75.3
All Vehicles			260	5.0	260	5.0	0.093	3.1	NA	0.4	2.7	0.11	0.28	0.11	60.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101v [2027DES PM - CHR/AUL (Site Folder: Priority Controlled Layout)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

P6159
Mount Low Northern Precinct TIAs
North Shore Boulevard / Road 1
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: North Shore Boulevard (E)															
5	T1	All MCs	58	5.0	58	5.0	0.030	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	80.0
6	R2	All MCs	38	5.0	38	5.0	0.031	7.6	LOS A	0.1	0.9	0.23	0.58	0.23	57.4
Approach			96	5.0	96	5.0	0.031	3.0	NA	0.1	0.9	0.09	0.23	0.09	71.3
North: Road 1 (N)															
7	L2	All MCs	9	5.0	9	5.0	0.007	4.7	LOS A	0.0	0.2	0.14	0.47	0.14	44.1
9	R2	All MCs	37	5.0	37	5.0	0.044	5.9	LOS A	0.2	1.2	0.33	0.54	0.33	43.3
Approach			46	5.0	46	5.0	0.044	5.7	LOS A	0.2	1.2	0.29	0.52	0.29	43.5
West: North Shore Boulevard (W)															
10	L2	All MCs	68	5.0	68	5.0	0.038	7.0	LOS A	0.0	0.0	0.00	0.63	0.00	58.7
11	T1	All MCs	57	5.0	57	5.0	0.030	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	80.0
Approach			125	5.0	125	5.0	0.038	3.8	NA	0.0	0.0	0.00	0.34	0.00	68.8
All Vehicles			267	5.0	267	5.0	0.044	3.9	NA	0.2	1.2	0.08	0.33	0.08	64.2

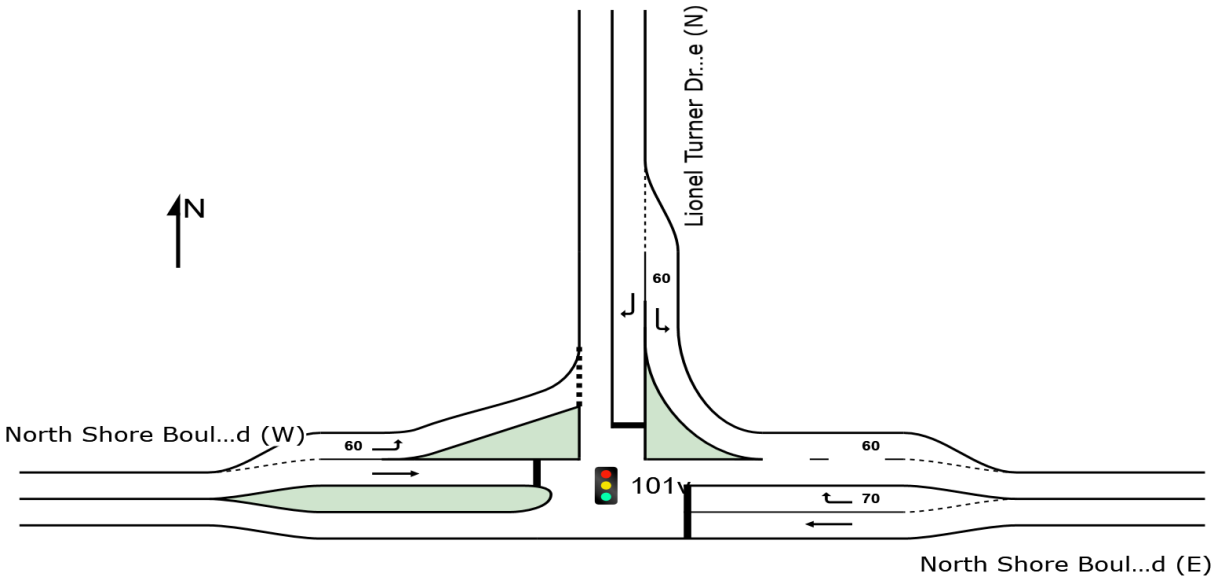
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

SITE LAYOUT

Site: 101v [2027DES AM_CHR - Conversion (Site Folder: Priority Controlled Layout)]

P6159
Mount Low Northern Precinct TIAs
North Shore Boulevard / Lionel Turner Drive
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Organisation: BITZIOS CONSULTING | Licence: PLUS / FLOATING | Created: Friday, 31 May 2024 10:03:52 AM
Project: P:\P6159 Mount Low Northern Precinct TIAs\Technical\Models\SIDRA\P6159.002S North Shore Boulevard & Lionel Turner Drive Intersection.sip9

MOVEMENT SUMMARY

Site: 101v [2027DES AM_Signals (Site Folder: Priority Controlled Layout)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

P6159
Mount Low Northern Precinct TIAs
North Shore Boulevard / Lionel Turner Drive
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 40 seconds (Site Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: North Shore Boulevard (E)															
5	T1	All MCs	52	5.0	52	5.0	0.050	4.5	LOS A	0.5	3.4	0.48	0.37	0.48	55.9
6	R2	All MCs	200	5.0	200	5.0	* 0.442	20.1	LOS C	3.5	25.5	0.89	0.79	0.89	42.6
Approach			252	5.0	252	5.0	0.442	16.9	LOS B	3.5	25.5	0.80	0.70	0.80	45.0
North: Lionel Turner Drive (N)															
7	L2	All MCs	622	5.0	622	5.0	0.343	6.0	LOS A	0.0	0.0	0.00	0.53	0.00	52.7
9	R2	All MCs	1	5.0	1	5.0	* 0.004	21.6	LOS C	0.0	0.1	0.87	0.58	0.87	41.8
Approach			623	5.0	623	5.0	0.343	6.0	LOS A	0.0	0.1	0.00	0.53	0.00	52.6
West: North Shore Boulevard (W)															
10	L2	All MCs	1	5.0	1	5.0	0.001	7.2	LOS A	0.0	0.0	0.38	0.57	0.38	51.1
11	T1	All MCs	103	5.0	103	5.0	* 0.360	17.8	LOS B	2.0	14.3	0.94	0.73	0.94	46.4
Approach			104	5.0	104	5.0	0.360	17.7	LOS B	2.0	14.3	0.93	0.72	0.93	46.4
All Vehicles			979	5.0	979	5.0	0.442	10.1	LOS B	3.5	25.5	0.31	0.59	0.31	49.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

MOVEMENT SUMMARY

Site: 101v [2027DES PM_Signals (Site Folder: Priority Controlled Layout)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

P6159
Mount Low Northern Precinct TIAs
North Shore Boulevard / Lionel Turner Drive
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 60 seconds (Site Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: North Shore Boulevard (E)															
5	T1	All MCs	92	5.0	92	5.0	0.069	3.6	LOS A	0.8	6.1	0.33	0.26	0.33	57.2
6	R2	All MCs	725	5.0	725	5.0	* 0.806	23.8	LOS C	20.4	148.7	0.90	0.92	1.02	41.0
Approach			817	5.0	817	5.0	0.806	21.5	LOS C	20.4	148.7	0.84	0.84	0.94	42.1
North: Lionel Turner Drive (N)															
7	L2	All MCs	255	5.0	255	5.0	0.141	5.8	LOS A	0.0	0.0	0.00	0.53	0.00	52.7
9	R2	All MCs	4	5.0	4	5.0	* 0.022	33.0	LOS C	0.1	0.8	0.92	0.63	0.92	36.7
Approach			259	5.0	259	5.0	0.141	6.2	LOS A	0.1	0.8	0.01	0.53	0.01	52.4
West: North Shore Boulevard (W)															
10	L2	All MCs	2	5.0	2	5.0	0.003	12.0	LOS B	0.0	0.2	0.55	0.59	0.55	47.7
11	T1	All MCs	64	5.0	64	5.0	* 0.335	29.2	LOS C	1.9	13.7	0.97	0.73	0.97	40.6
Approach			66	5.0	66	5.0	0.335	28.6	LOS C	1.9	13.7	0.96	0.72	0.96	40.7
All Vehicles			1142	5.0	1142	5.0	0.806	18.5	LOS B	20.4	148.7	0.66	0.76	0.73	44.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

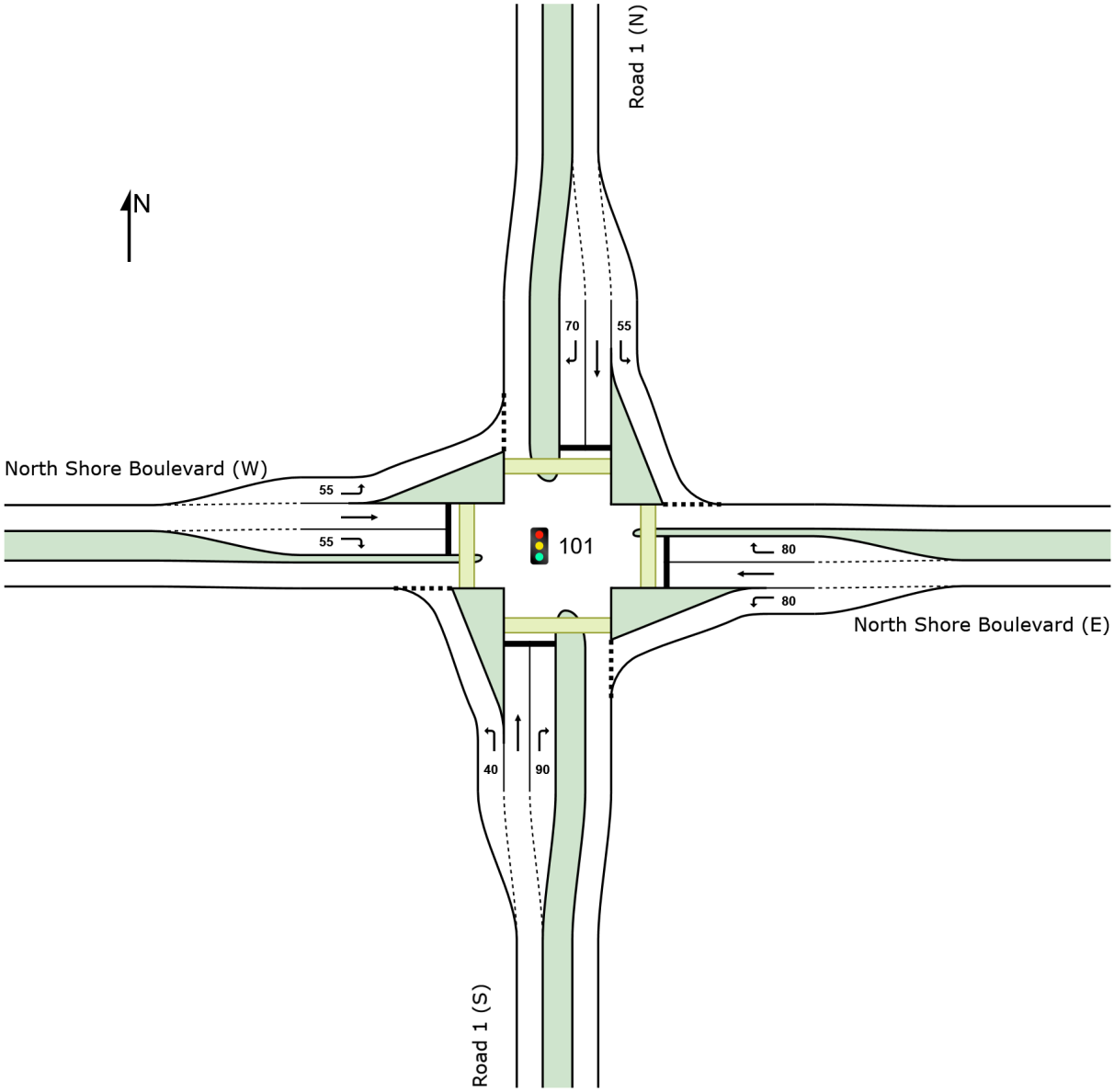
Organisation: BITZIOS CONSULTING | Licence: PLUS / FLOATING | Processed: Friday, 31 May 2024 10:04:39 AM
Project: P:\P6159 Mount Low Northern Precinct TIAs\Technical\Models\SIDRA\P6159.002S North Shore Boulevard & Lionel Turner Drive Intersection.sip9

SITE LAYOUT

Site: 101 [2027DES AM - Signals (Site Folder: Ultimate Layout)]

P6159
Mount Low Northern Precinct TIAs
North Shore Boulevard / Road 1
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Organisation: BITZIOS CONSULTING | Licence: PLUS / FLOATING | Created: Thursday, 30 May 2024 4:20:52 PM
Project: P:\P6159 Mount Low Northern Precinct TIAs\Technical\Models\SIDRA\P6159.002S North Shore Boulevard & Road 1 Intersection.sip9

MOVEMENT SUMMARY

Site: 101 [2027DES AM - Signals (Site Folder: Ultimate Layout)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

P6159
Mount Low Northern Precinct TIAs
North Shore Boulevard / Road 1
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 120 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Road 1 (S)															
1	L2	All MCs	1	5.0	1	5.0	0.001	5.2	LOS A	0.0	0.0	0.14	0.51	0.14	43.5
2	T1	All MCs	1	5.0	1	5.0	0.004	50.1	LOS D	0.1	0.4	0.90	0.54	0.90	15.5
3	R2	All MCs	1	5.0	1	5.0	0.001	27.7	LOS C	0.0	0.3	0.62	0.57	0.62	30.5
Approach			3	5.0	3	5.0	0.004	27.6	LOS C	0.1	0.4	0.56	0.54	0.56	28.5
East: North Shore Boulevard (E)															
4	L2	All MCs	1	5.0	1	5.0	0.001	7.7	LOS A	0.0	0.0	0.10	0.61	0.10	56.9
5	T1	All MCs	45	5.0	45	5.0	*0.098	37.8	LOS D	2.0	14.9	0.81	0.62	0.81	43.9
6	R2	All MCs	5	5.0	5	5.0	0.007	30.6	LOS C	0.2	1.3	0.63	0.65	0.63	38.1
Approach			51	5.0	51	5.0	0.098	36.5	LOS D	2.0	14.9	0.78	0.62	0.78	43.6
North: Road 1 (N)															
7	L2	All MCs	27	5.0	27	5.0	0.020	5.1	LOS A	0.1	0.9	0.13	0.53	0.13	44.2
8	T1	All MCs	1	5.0	1	5.0	0.004	50.1	LOS D	0.1	0.4	0.90	0.54	0.90	15.5
9	R2	All MCs	83	5.0	83	5.0	*0.117	29.2	LOS C	3.1	22.3	0.67	0.70	0.67	31.0
Approach			111	5.0	111	5.0	0.117	23.6	LOS C	3.1	22.3	0.54	0.66	0.54	33.3
West: North Shore Boulevard (W)															
10	L2	All MCs	23	5.0	23	5.0	0.015	7.7	LOS A	0.1	0.5	0.11	0.63	0.11	58.1
11	T1	All MCs	77	5.0	77	5.0	0.118	28.8	LOS C	3.1	22.3	0.72	0.57	0.72	49.2
12	R2	All MCs	1	5.0	1	5.0	*0.011	67.4	LOS E	0.1	0.4	0.97	0.59	0.97	22.9
Approach			101	5.0	101	5.0	0.118	24.4	LOS C	3.1	22.3	0.58	0.58	0.58	50.1
All Vehicles			266	5.0	266	5.0	0.118	26.4	LOS C	3.1	22.3	0.60	0.62	0.60	41.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Road 1 (S)												
P1	Full	30	32	54.2	LOS E	0.1	0.1	0.95	0.95	208.1	200.0	0.96

East: North Shore Boulevard (E)												
P2	Full	30	32	54.2	LOS E	0.1	0.1	0.95	0.95	208.1	200.0	0.96
North: Road 1 (N)												
P3	Full	30	32	54.2	LOS E	0.1	0.1	0.95	0.95	208.1	200.0	0.96
West: North Shore Boulevard (W)												
P4	Full	30	32	54.2	LOS E	0.1	0.1	0.95	0.95	208.1	200.0	0.96
All Pedestrians		120	126	54.2	LOS E	0.1	0.1	0.95	0.95	208.1	200.0	0.96

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [2027DES PM - Signals (Site Folder: Ultimate Layout)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

P6159
Mount Low Northern Precinct TIAs
North Shore Boulevard / Road 1
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 120 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Road 1 (S)															
1	L2	All MCs	1	5.0	1	5.0	0.001	5.1	LOS A	0.0	0.0	0.14	0.51	0.14	43.6
2	T1	All MCs	1	5.0	1	5.0	0.004	50.1	LOS D	0.1	0.4	0.90	0.54	0.90	15.5
3	R2	All MCs	1	5.0	1	5.0	0.002	39.2	LOS D	0.0	0.3	0.76	0.58	0.76	26.4
Approach			3	5.0	3	5.0	0.004	31.5	LOS C	0.1	0.4	0.60	0.54	0.60	27.0
East: North Shore Boulevard (E)															
4	L2	All MCs	1	5.0	1	5.0	0.001	7.7	LOS A	0.0	0.0	0.10	0.61	0.10	56.9
5	T1	All MCs	58	5.0	58	5.0	* 0.081	25.6	LOS C	2.2	15.7	0.68	0.53	0.68	51.4
6	R2	All MCs	38	5.0	38	5.0	0.070	39.3	LOS D	1.6	11.5	0.75	0.72	0.75	33.7
Approach			97	5.0	97	5.0	0.081	30.7	LOS C	2.2	15.7	0.70	0.60	0.70	44.3
North: Road 1 (N)															
7	L2	All MCs	9	5.0	9	5.0	0.007	5.0	LOS A	0.0	0.2	0.12	0.52	0.12	44.2
8	T1	All MCs	1	5.0	1	5.0	0.004	50.1	LOS D	0.1	0.4	0.90	0.54	0.90	15.5
9	R2	All MCs	37	5.0	37	5.0	* 0.079	40.6	LOS D	1.6	11.9	0.79	0.70	0.79	27.2
Approach			47	5.0	47	5.0	0.079	34.0	LOS C	1.6	11.9	0.66	0.66	0.66	29.2
West: North Shore Boulevard (W)															
10	L2	All MCs	68	5.0	68	5.0	0.046	7.8	LOS A	0.2	1.7	0.12	0.63	0.12	58.0
11	T1	All MCs	57	5.0	57	5.0	0.069	20.9	LOS C	1.9	13.9	0.61	0.48	0.61	55.0
12	R2	All MCs	1	5.0	1	5.0	* 0.011	67.4	LOS E	0.1	0.4	0.97	0.59	0.97	22.9
Approach			126	5.0	126	5.0	0.069	14.2	LOS B	1.9	13.9	0.35	0.56	0.35	55.8
All Vehicles			273	5.0	273	5.0	0.081	23.7	LOS C	2.2	15.7	0.53	0.59	0.53	45.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Road 1 (S)												
P1	Full	30	32	54.2	LOS E	0.1	0.1	0.95	0.95	208.1	200.0	0.96
East: North Shore Boulevard (E)												

P2	Full	30	32	54.2	LOS E	0.1	0.1	0.95	0.95	208.1	200.0	0.96
North: Road 1 (N)												
P3	Full	30	32	54.2	LOS E	0.1	0.1	0.95	0.95	208.1	200.0	0.96
West: North Shore Boulevard (W)												
P4	Full	30	32	54.2	LOS E	0.1	0.1	0.95	0.95	208.1	200.0	0.96
All Pedestrians		120	126	54.2	LOS E	0.1	0.1	0.95	0.95	208.1	200.0	0.96

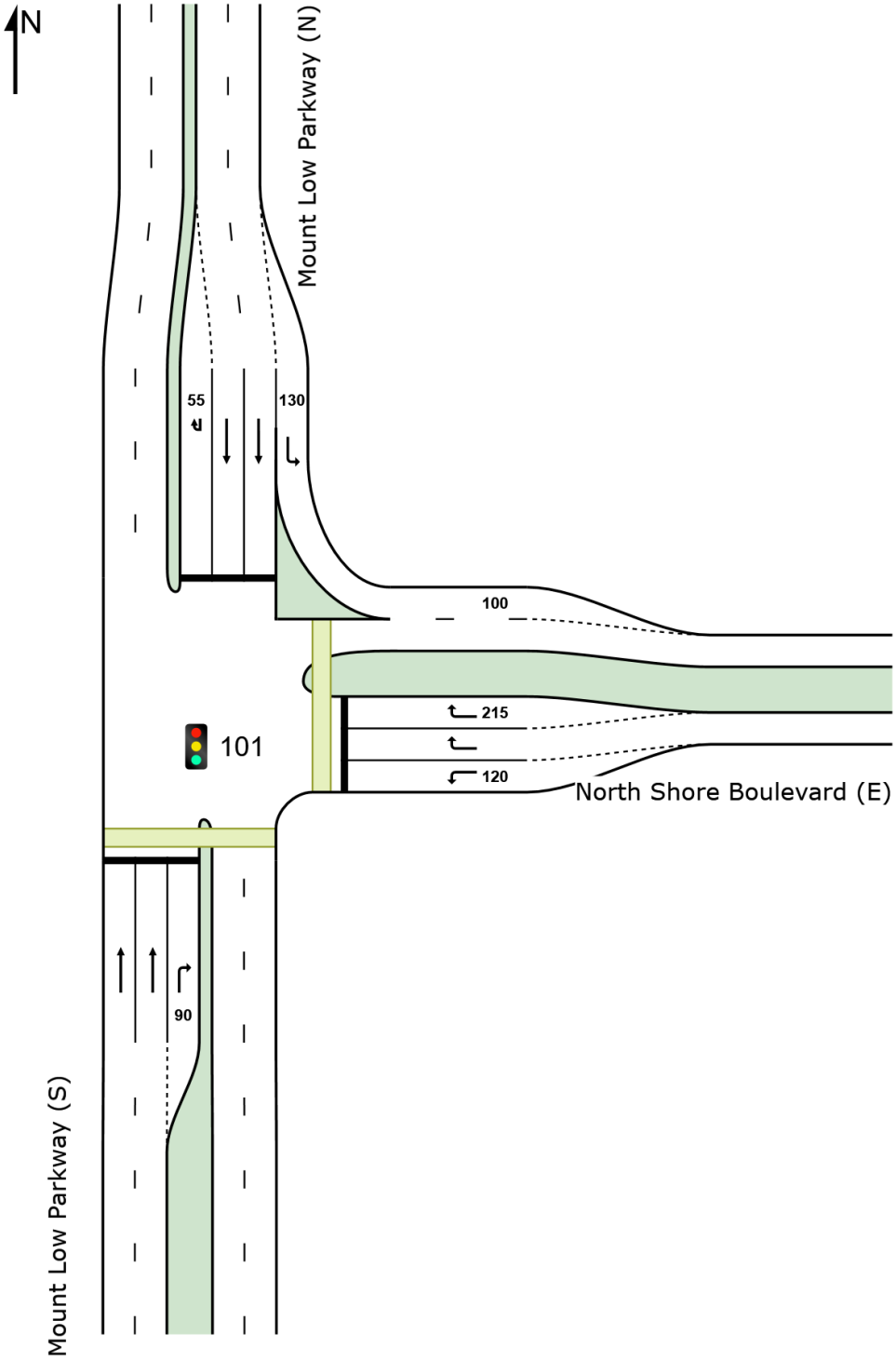
Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

SITE LAYOUT

Site: 101 [2027DES AM (Site Folder: Priority Controlled Layout)]

P6159
Mount Low Northern Precinct TIAs
North Shore Boulevard / Mount Low Parkway
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: 101 [2027DES AM (Site Folder: Priority Controlled Layout)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

P6159
Mount Low Northern Precinct TIAs
North Shore Boulevard / Mount Low Parkway
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 120 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Mount Low Parkway (S)															
2	T1	All MCs	122	5.0	122	5.0	0.047	6.5	LOS A	1.1	8.3	0.34	0.27	0.34	62.3
3	R2	All MCs	71	5.0	71	5.0	* 0.168	46.2	LOS D	3.3	24.2	0.84	0.75	0.84	35.7
Approach			193	5.0	193	5.0	0.168	21.1	LOS C	3.3	24.2	0.52	0.45	0.52	48.9
East: North Shore Boulevard (E)															
4	L2	All MCs	124	5.0	124	5.0	0.171	31.7	LOS C	4.6	33.7	0.68	0.76	0.68	44.2
6	R2	All MCs	3	5.0	3	5.0	0.006	55.7	LOS E	0.1	0.6	0.89	0.61	0.89	34.6
Approach			127	5.0	127	5.0	0.171	32.2	LOS C	4.6	33.7	0.69	0.75	0.69	43.9
North: Mount Low Parkway (N)															
7	L2	All MCs	8	5.0	8	5.0	0.004	6.8	LOS A	0.0	0.0	0.00	0.57	0.00	58.1
8	T1	All MCs	320	5.0	320	5.0	0.173	18.5	LOS B	5.2	37.8	0.60	0.50	0.60	51.9
9u	U	All MCs	1	5.0	1	5.0	* 0.015	68.8	LOS E	0.1	0.4	0.97	0.60	0.97	29.0
Approach			329	5.0	329	5.0	0.173	18.3	LOS B	5.2	37.8	0.58	0.50	0.58	51.9
All Vehicles			649	5.0	649	5.0	0.173	21.9	LOS C	5.2	37.8	0.59	0.53	0.59	49.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Mount Low Parkway (S)												
P1	Full	30	32	54.2	LOS E	0.1	0.1	0.95	0.95	208.1	200.0	0.96
East: North Shore Boulevard (E)												
P2	Full	30	32	54.2	LOS E	0.1	0.1	0.95	0.95	208.1	200.0	0.96
All Pedestrians		60	63	54.2	LOS E	0.1	0.1	0.95	0.95	208.1	200.0	0.96

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [2027DES PM (Site Folder: Priority Controlled Layout)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

P6159
Mount Low Northern Precinct TIAs
North Shore Boulevard / Mount Low Parkway
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 120 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Mount Low Parkway (S)															
2	T1	All MCs	346	5.0	346	5.0	0.133	6.9	LOS A	3.4	25.1	0.37	0.31	0.37	61.9
3	R2	All MCs	110	5.0	110	5.0	* 0.143	29.0	LOS C	3.9	28.3	0.65	0.73	0.65	42.8
Approach			456	5.0	456	5.0	0.143	12.3	LOS B	3.9	28.3	0.44	0.41	0.44	55.9
East: North Shore Boulevard (E)															
4	L2	All MCs	72	5.0	72	5.0	0.067	18.0	LOS B	1.7	12.7	0.45	0.70	0.45	53.0
6	R2	All MCs	9	5.0	9	5.0	0.019	56.2	LOS E	0.2	1.7	0.89	0.65	0.89	34.4
Approach			81	5.0	81	5.0	0.067	22.2	LOS C	1.7	12.7	0.50	0.70	0.50	50.0
North: Mount Low Parkway (N)															
7	L2	All MCs	4	5.0	4	5.0	0.002	6.9	LOS A	0.0	0.0	0.00	0.57	0.00	58.1
8	T1	All MCs	159	5.0	159	5.0	0.143	33.5	LOS C	3.4	24.9	0.78	0.61	0.78	42.8
9u	U	All MCs	1	5.0	1	5.0	* 0.015	68.8	LOS E	0.1	0.4	0.97	0.60	0.97	29.0
Approach			164	5.0	164	5.0	0.143	33.1	LOS C	3.4	24.9	0.76	0.61	0.76	42.9
All Vehicles			701	5.0	701	5.0	0.143	18.3	LOS B	3.9	28.3	0.52	0.49	0.52	51.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Mount Low Parkway (S)												
P1	Full	30	32	54.2	LOS E	0.1	0.1	0.95	0.95	208.1	200.0	0.96
East: North Shore Boulevard (E)												
P2	Full	30	32	54.2	LOS E	0.1	0.1	0.95	0.95	208.1	200.0	0.96
All Pedestrians		60	63	54.2	LOS E	0.1	0.1	0.95	0.95	208.1	200.0	0.96

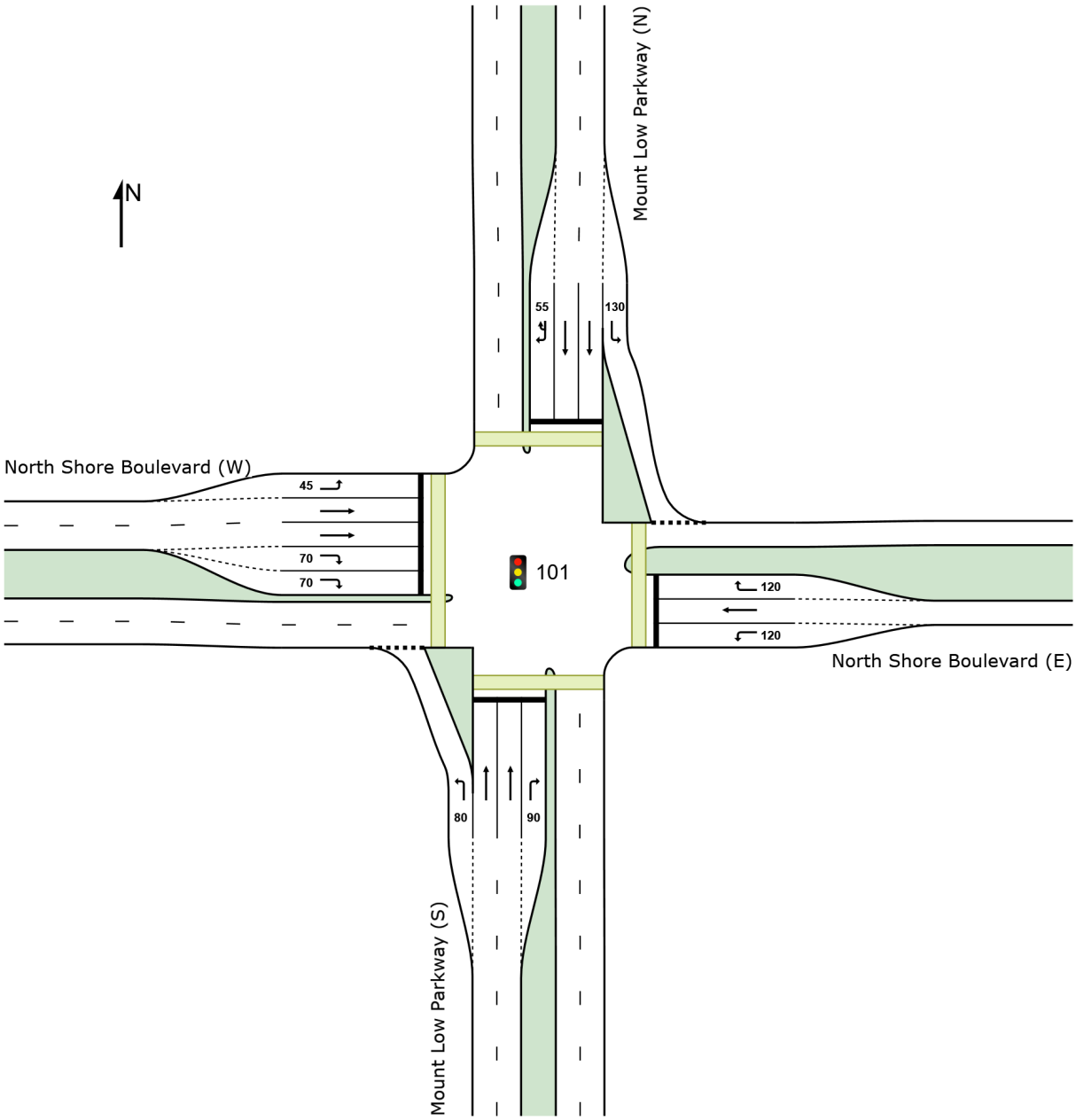
Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

SITE LAYOUT

Site: 101 [2027DES AM (Site Folder: Ultimate Layout)]

P6159
Mount Low Northern Precinct TIAs
North Shore Boulevard / Mount Low Parkway
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Organisation: BITZIOS CONSULTING | Licence: PLUS / FLOATING | Created: Thursday, 30 May 2024 4:18:19 PM
Project: P:\P6159 Mount Low Northern Precinct TIAs\Technical\Models\SIDRA\P6159.002S North Shore Boulevard & Mount Low Parkway Intersection.sip9

MOVEMENT SUMMARY

Site: 101 [2027DES AM (Site Folder: Ultimate Layout)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

P6159
Mount Low Northern Precinct TIAs
North Shore Boulevard / Mount Low Parkway
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 120 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Mount Low Parkway (S)															
1	L2	All MCs	1	5.0	1	5.0	0.001	5.9	LOS A	0.0	0.0	0.09	0.55	0.09	52.7
2	T1	All MCs	122	5.0	122	5.0	0.074	21.0	LOS C	2.0	14.9	0.61	0.48	0.61	50.1
3	R2	All MCs	71	5.0	71	5.0	* 0.247	55.0	LOS E	3.7	27.0	0.92	0.76	0.92	32.9
Approach			194	5.0	194	5.0	0.247	33.4	LOS C	3.7	27.0	0.72	0.58	0.72	42.1
East: North Shore Boulevard (E)															
4	L2	All MCs	124	5.0	124	5.0	0.257	44.3	LOS D	5.7	41.7	0.83	0.78	0.83	38.3
5	T1	All MCs	1	5.0	1	5.0	0.002	33.8	LOS C	0.0	0.3	0.75	0.45	0.75	38.7
6	R2	All MCs	3	5.0	3	5.0	* 0.014	58.0	LOS E	0.2	1.1	0.91	0.63	0.91	33.8
Approach			128	5.0	128	5.0	0.257	44.6	LOS D	5.7	41.7	0.83	0.77	0.83	38.2
North: Mount Low Parkway (N)															
7	L2	All MCs	8	5.0	8	5.0	0.005	7.2	LOS A	0.0	0.3	0.14	0.60	0.14	57.2
8	T1	All MCs	320	5.0	320	5.0	0.258	31.9	LOS C	6.9	50.0	0.78	0.64	0.78	43.7
9	R2	All MCs	1	5.0	1	5.0	* 0.022	65.2	LOS E	0.1	0.8	0.96	0.62	0.96	28.8
9u	U	All MCs	1	5.0	1	5.0	0.022	67.2	LOS E	0.1	0.8	0.96	0.62	0.96	29.1
Approach			330	5.0	330	5.0	0.258	31.5	LOS C	6.9	50.0	0.76	0.64	0.76	43.8
West: North Shore Boulevard (W)															
10	L2	All MCs	1	5.0	1	5.0	0.003	44.4	LOS D	0.0	0.3	0.80	0.60	0.80	33.8
11	T1	All MCs	1	5.0	1	5.0	0.002	38.6	LOS D	0.0	0.3	0.80	0.47	0.80	36.9
12	R2	All MCs	1	5.0	1	5.0	* 0.006	65.3	LOS E	0.0	0.2	0.96	0.56	0.96	28.5
Approach			3	5.0	3	5.0	0.006	49.4	LOS D	0.0	0.3	0.85	0.54	0.85	32.7
All Vehicles			655	5.0	655	5.0	0.258	34.7	LOS C	6.9	50.0	0.77	0.65	0.77	42.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Mount Low Parkway (S)												
P1	Full	30	32	54.2	LOS E	0.1	0.1	0.95	0.95	208.1	200.0	0.96

East: North Shore Boulevard (E)												
P2	Full	30	32	54.2	LOS E	0.1	0.1	0.95	0.95	208.1	200.0	0.96
North: Mount Low Parkway (N)												
P3	Full	30	32	54.2	LOS E	0.1	0.1	0.95	0.95	208.1	200.0	0.96
West: North Shore Boulevard (W)												
P4	Full	30	32	54.2	LOS E	0.1	0.1	0.95	0.95	208.1	200.0	0.96
All Pedestrians		120	126	54.2	LOS E	0.1	0.1	0.95	0.95	208.1	200.0	0.96

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [2027DES PM (Site Folder: Ultimate Layout)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

P6159
Mount Low Northern Precinct TIAs
North Shore Boulevard / Mount Low Parkway
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 120 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Mount Low Parkway (S)															
1	L2	All MCs	1	5.0	1	5.0	0.001	6.0	LOS A	0.0	0.0	0.10	0.55	0.10	52.6
2	T1	All MCs	346	5.0	346	5.0	* 0.184	18.0	LOS B	5.6	40.6	0.59	0.50	0.59	52.2
3	R2	All MCs	110	5.0	110	5.0	0.192	38.5	LOS D	4.7	34.0	0.77	0.76	0.77	38.6
Approach			457	5.0	457	5.0	0.192	22.9	LOS C	5.6	40.6	0.63	0.56	0.63	48.1
East: North Shore Boulevard (E)															
4	L2	All MCs	72	5.0	72	5.0	0.191	49.4	LOS D	3.5	25.5	0.86	0.76	0.86	36.4
5	T1	All MCs	1	5.0	1	5.0	0.003	39.6	LOS D	0.0	0.3	0.81	0.49	0.81	36.5
6	R2	All MCs	9	5.0	9	5.0	* 0.085	67.6	LOS E	0.5	3.8	0.97	0.67	0.97	31.0
Approach			82	5.0	82	5.0	0.191	51.3	LOS D	3.5	25.5	0.87	0.75	0.87	35.7
North: Mount Low Parkway (N)															
7	L2	All MCs	4	5.0	4	5.0	0.003	7.3	LOS A	0.0	0.2	0.15	0.60	0.15	57.1
8	T1	All MCs	159	5.0	159	5.0	0.185	40.5	LOS D	3.8	27.5	0.85	0.67	0.85	39.6
9	R2	All MCs	1	5.0	1	5.0	* 0.026	66.8	LOS E	0.1	0.9	0.97	0.62	0.97	28.5
9u	U	All MCs	1	5.0	1	5.0	0.026	68.8	LOS E	0.1	0.9	0.97	0.62	0.97	28.8
Approach			165	5.0	165	5.0	0.185	40.0	LOS D	3.8	27.5	0.83	0.66	0.83	39.8
West: North Shore Boulevard (W)															
10	L2	All MCs	1	5.0	1	5.0	0.003	44.4	LOS D	0.0	0.3	0.80	0.60	0.80	33.8
11	T1	All MCs	1	5.0	1	5.0	0.002	38.6	LOS D	0.0	0.3	0.80	0.47	0.80	36.9
12	R2	All MCs	1	5.0	1	5.0	* 0.006	65.3	LOS E	0.0	0.2	0.96	0.56	0.96	28.5
Approach			3	5.0	3	5.0	0.006	49.4	LOS D	0.0	0.3	0.85	0.54	0.85	32.7
All Vehicles			707	5.0	707	5.0	0.192	30.3	LOS C	5.6	40.6	0.71	0.60	0.71	44.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Mount Low Parkway (S)												
P1	Full	30	32	54.2	LOS E	0.1	0.1	0.95	0.95	208.1	200.0	0.96

East: North Shore Boulevard (E)												
P2	Full	30	32	54.2	LOS E	0.1	0.1	0.95	0.95	208.1	200.0	0.96
North: Mount Low Parkway (N)												
P3	Full	30	32	54.2	LOS E	0.1	0.1	0.95	0.95	208.1	200.0	0.96
West: North Shore Boulevard (W)												
P4	Full	30	32	54.2	LOS E	0.1	0.1	0.95	0.95	208.1	200.0	0.96
All Pedestrians		120	126	54.2	LOS E	0.1	0.1	0.95	0.95	208.1	200.0	0.96

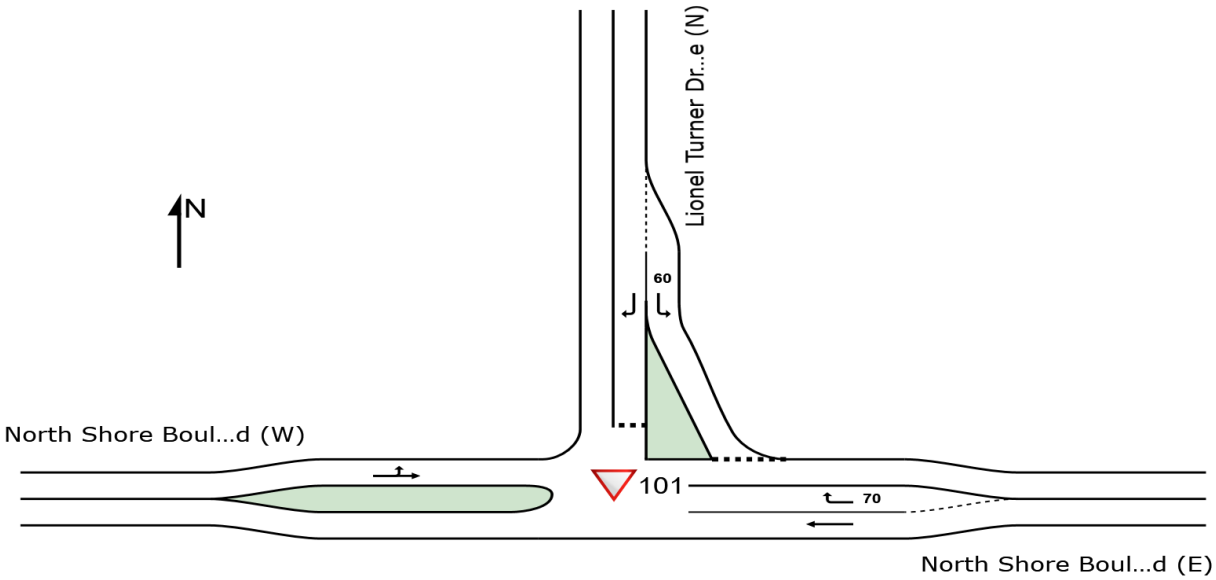
Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

SITE LAYOUT

Site: 101 [2027DES AM_CHR (Site Folder: Priority Controlled Layout)]

P6159
Mount Low Northern Precinct TIAs
North Shore Boulevard / Lionel Turner Drive
Site Category: (None)
Give-Way (Two-Way)

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Organisation: BITZIOS CONSULTING | Licence: PLUS / FLOATING | Created: Thursday, 30 May 2024 4:15:26 PM
Project: P:\P6159 Mount Low Northern Precinct TIAs\Technical\Models\SIDRA\P6159.002S North Shore Boulevard & Lionel Turner Drive Intersection.sip9

MOVEMENT SUMMARY

Site: 101 [2027DES AM_CHR (Site Folder: Priority Controlled Layout)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

P6159
Mount Low Northern Precinct TIAs
North Shore Boulevard / Lionel Turner Drive
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: North Shore Boulevard (E)															
5	T1	All MCs	52	5.0	52	5.0	0.027	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
6	R2	All MCs	200	5.0	200	5.0	0.125	5.9	LOS A	0.6	4.4	0.23	0.55	0.23	51.3
Approach			252	5.0	252	5.0	0.125	4.7	NA	0.6	4.4	0.18	0.44	0.18	53.0
North: Lionel Turner Drive (N)															
7	L2	All MCs	622	5.0	622	5.0	0.427	6.2	LOS A	2.5	18.5	0.29	0.53	0.29	51.4
9	R2	All MCs	1	5.0	1	5.0	0.001	7.7	LOS A	0.0	0.0	0.43	0.55	0.43	50.4
Approach			623	5.0	623	5.0	0.427	6.2	LOS A	2.5	18.5	0.29	0.53	0.29	51.4
West: North Shore Boulevard (W)															
10	L2	All MCs	1	5.0	1	5.0	0.055	5.6	LOS A	0.0	0.0	0.00	0.01	0.00	57.0
11	T1	All MCs	103	5.0	103	5.0	0.055	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	59.9
Approach			104	5.0	104	5.0	0.055	0.1	NA	0.0	0.0	0.00	0.01	0.00	59.9
All Vehicles			979	5.0	979	5.0	0.427	5.2	NA	2.5	18.5	0.23	0.45	0.23	52.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101 [2027DES PM_CHR (Site Folder: Priority Controlled Layout)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

P6159
Mount Low Northern Precinct TIAs
North Shore Boulevard / Lionel Turner Drive
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: North Shore Boulevard (E)															
5	T1	All MCs	92	5.0	92	5.0	0.048	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
6	R2	All MCs	725	5.0	725	5.0	0.438	5.9	LOS A	3.0	22.1	0.24	0.54	0.24	51.3
Approach			817	5.0	817	5.0	0.438	5.3	NA	3.0	22.1	0.21	0.48	0.21	52.2
North: Lionel Turner Drive (N)															
7	L2	All MCs	255	5.0	255	5.0	0.169	5.9	LOS A	0.8	5.6	0.17	0.52	0.17	51.9
9	R2	All MCs	4	5.0	4	5.0	0.013	15.9	LOS C	0.0	0.3	0.74	0.82	0.74	44.9
Approach			259	5.0	259	5.0	0.169	6.0	LOS A	0.8	5.6	0.18	0.52	0.18	51.7
West: North Shore Boulevard (W)															
10	L2	All MCs	2	5.0	2	5.0	0.035	5.6	LOS A	0.0	0.0	0.00	0.02	0.00	56.9
11	T1	All MCs	64	5.0	64	5.0	0.035	0.0	LOS A	0.0	0.0	0.00	0.02	0.00	59.8
Approach			66	5.0	66	5.0	0.035	0.2	NA	0.0	0.0	0.00	0.02	0.00	59.7
All Vehicles			1142	5.0	1142	5.0	0.438	5.1	NA	3.0	22.1	0.19	0.46	0.19	52.5

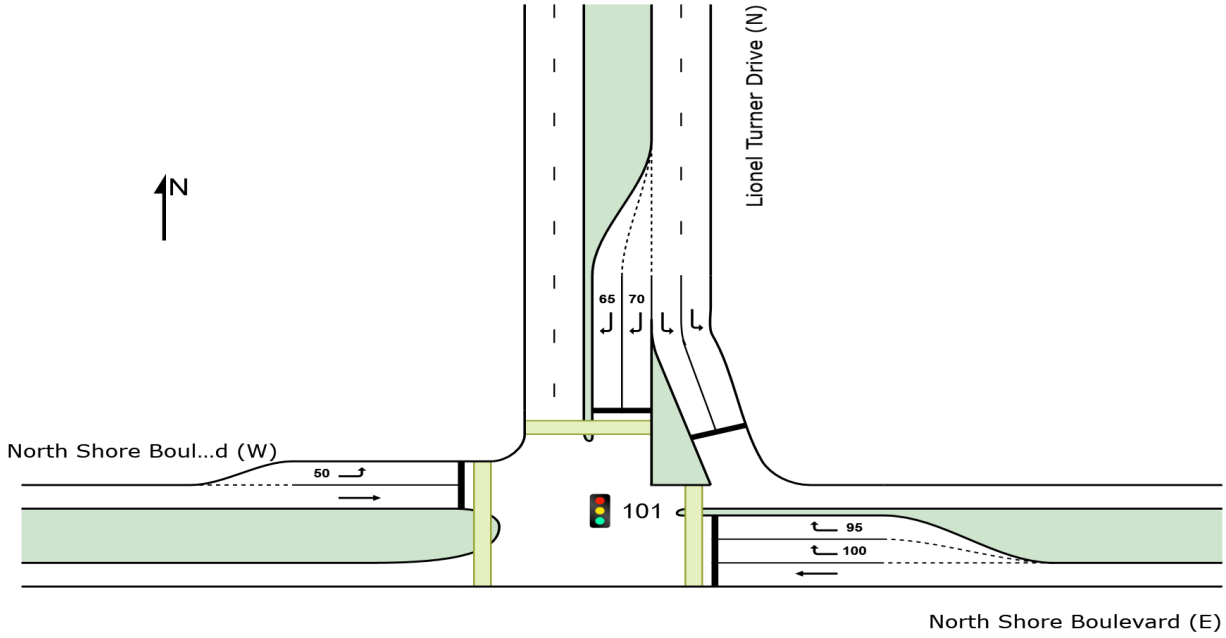
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

SITE LAYOUT

Site: 101 [2027DES AM (Site Folder: Ultimate Layout)]

P6159
Mount Low Northern Precinct TIAs
North Shore Boulevard / Lionel Turner Drive
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Organisation: BITZIOS CONSULTING | Licence: PLUS / FLOATING | Created: Thursday, 30 May 2024 4:15:31 PM
Project: P:\P6159 Mount Low Northern Precinct TIAs\Technical\Models\SIDRA\P6159.002S North Shore Boulevard & Lionel Turner Drive Intersection.sip9

MOVEMENT SUMMARY

Site: 101 [2027DES AM (Site Folder: Ultimate Layout)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

P6159
Mount Low Northern Precinct TIAs
North Shore Boulevard / Lionel Turner Drive
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 120 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: North Shore Boulevard (E)															
5	T1	All MCs	52	5.0	52	5.0	0.037	4.6	LOS A	0.8	5.9	0.29	0.23	0.29	55.9
6	R2	All MCs	200	5.0	200	5.0	0.102	19.7	LOS B	2.8	20.3	0.51	0.68	0.51	43.1
Approach			252	5.0	252	5.0	0.102	16.6	LOS B	2.8	20.3	0.47	0.59	0.47	45.4
North: Lionel Turner Drive (N)															
7	L2	All MCs	622	5.0	622	5.0	* 0.377	10.6	LOS B	10.0	73.3	0.35	0.67	0.35	48.8
9	R2	All MCs	1	5.0	1	5.0	0.003	49.7	LOS D	0.0	0.3	0.85	0.58	0.85	31.2
Approach			623	5.0	623	5.0	0.377	10.7	LOS B	10.0	73.3	0.35	0.67	0.35	48.7
West: North Shore Boulevard (W)															
10	L2	All MCs	1	5.0	1	5.0	0.002	31.3	LOS C	0.0	0.3	0.66	0.60	0.66	37.3
11	T1	All MCs	103	5.0	103	5.0	* 0.381	51.4	LOS D	5.6	40.8	0.95	0.75	0.95	32.7
Approach			104	5.0	104	5.0	0.381	51.2	LOS D	5.6	40.8	0.95	0.75	0.95	32.7
All Vehicles			979	5.0	979	5.0	0.381	16.5	LOS B	10.0	73.3	0.44	0.66	0.44	45.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
East: North Shore Boulevard (E)												
P2	Full	30	32	54.2	LOS E	0.1	0.1	0.95	0.95	208.1	200.0	0.96
North: Lionel Turner Drive (N)												
P3	Full	30	32	54.2	LOS E	0.1	0.1	0.95	0.95	208.1	200.0	0.96
West: North Shore Boulevard (W)												
P4	Full	30	32	54.2	LOS E	0.1	0.1	0.95	0.95	208.1	200.0	0.96
All Pedestrians		90	95	54.2	LOS E	0.1	0.1	0.95	0.95	208.1	200.0	0.96

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [2027DES PM (Site Folder: Ultimate Layout)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

P6159
Mount Low Northern Precinct TIAs
North Shore Boulevard / Lionel Turner Drive
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 120 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: North Shore Boulevard (E)															
5	T1	All MCs	92	5.0	92	5.0	0.066	4.7	LOS A	1.5	10.7	0.30	0.24	0.30	55.8
6	R2	All MCs	725	5.0	725	5.0	* 0.353	20.6	LOS C	11.3	82.5	0.58	0.74	0.58	42.6
Approach			817	5.0	817	5.0	0.353	18.8	LOS B	11.3	82.5	0.55	0.68	0.55	43.9
North: Lionel Turner Drive (N)															
7	L2	All MCs	255	5.0	255	5.0	0.150	8.9	LOS A	3.0	21.7	0.26	0.62	0.26	49.9
9	R2	All MCs	4	5.0	4	5.0	0.011	50.1	LOS D	0.2	1.2	0.85	0.62	0.85	31.1
Approach			259	5.0	259	5.0	0.150	9.6	LOS A	3.0	21.7	0.27	0.62	0.27	49.5
West: North Shore Boulevard (W)															
10	L2	All MCs	2	5.0	2	5.0	0.003	33.5	LOS C	0.1	0.6	0.68	0.62	0.68	36.4
11	T1	All MCs	64	5.0	64	5.0	* 0.287	53.5	LOS D	3.5	25.7	0.95	0.73	0.95	32.1
Approach			66	5.0	66	5.0	0.287	52.9	LOS D	3.5	25.7	0.95	0.73	0.95	32.2
All Vehicles			1142	5.0	1142	5.0	0.353	18.7	LOS B	11.3	82.5	0.51	0.67	0.51	44.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

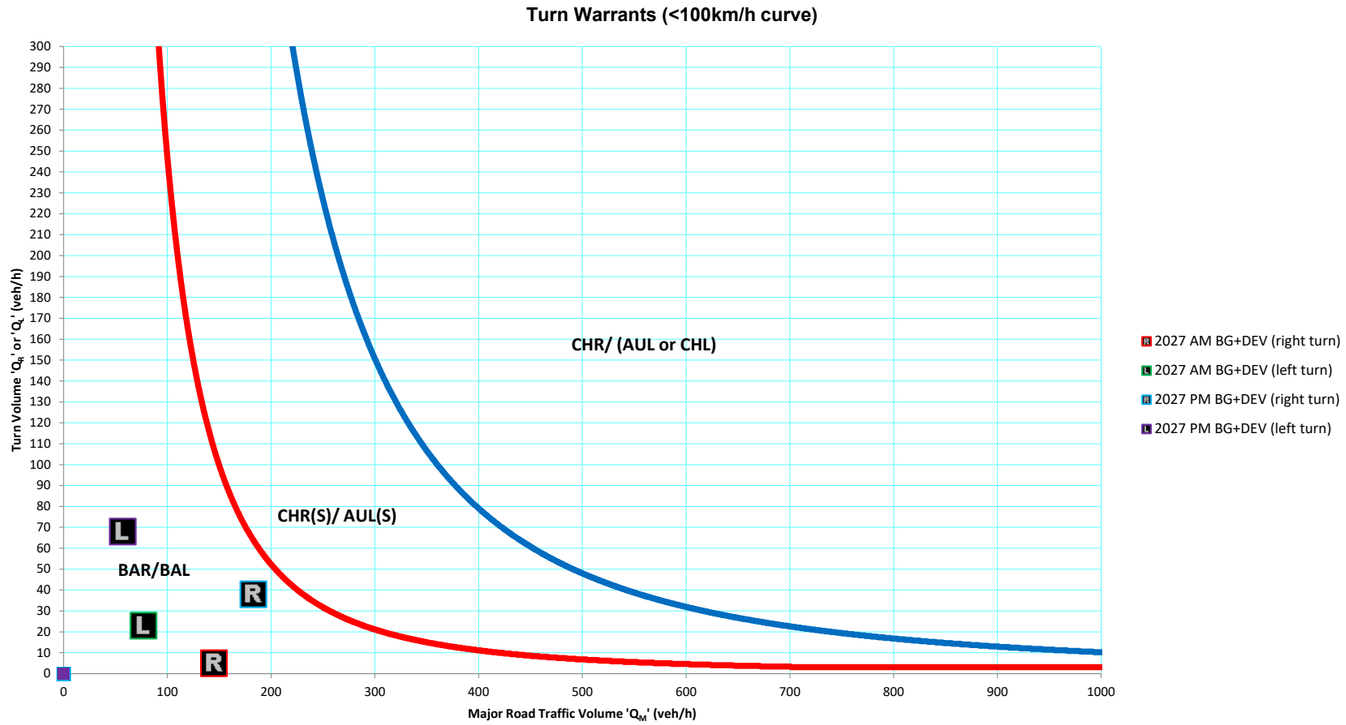
* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
East: North Shore Boulevard (E)												
P2	Full	30	32	54.2	LOS E	0.1	0.1	0.95	0.95	208.1	200.0	0.96
North: Lionel Turner Drive (N)												
P3	Full	30	32	54.2	LOS E	0.1	0.1	0.95	0.95	208.1	200.0	0.96
West: North Shore Boulevard (W)												
P4	Full	30	32	54.2	LOS E	0.1	0.1	0.95	0.95	208.1	200.0	0.96
All Pedestrians		90	95	54.2	LOS E	0.1	0.1	0.95	0.95	208.1	200.0	0.96

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Appendix F: Turn Warrants Assessment



AM Peak Hour Volumes (Without Increase)

Splitter Island? No

Q_{T1}= ____ Q_R= ____ Q_{T2}= ____ Q_L= ____

GRAPH	Q_M	Q_R/Q_L
Right	0	0
Left	0	0

AM Peak Hour Volumes (With Increase) 2027 AM BG+DEV

Splitter Island? No

Q_{T1}= 45 Q_R= 5 Q_{T2}= 77 Q_L= 23

GRAPH	Q_M	Q_R/Q_L
Right	145	5
Left	77	23

PM Peak Hour Volumes (Without Increase)

Splitter Island? No

Q_{T1}= ____ Q_R= ____ Q_{T2}= ____ Q_L= ____

GRAPH	Q_M	Q_R/Q_L
Right	0	0
Left	0	0

PM Peak Hour Volumes (With Increase) 2027 PM BG+DEV

Splitter Island? No

Q_{T1}= 58 Q_R= 38 Q_{T2}= 57 Q_L= 68

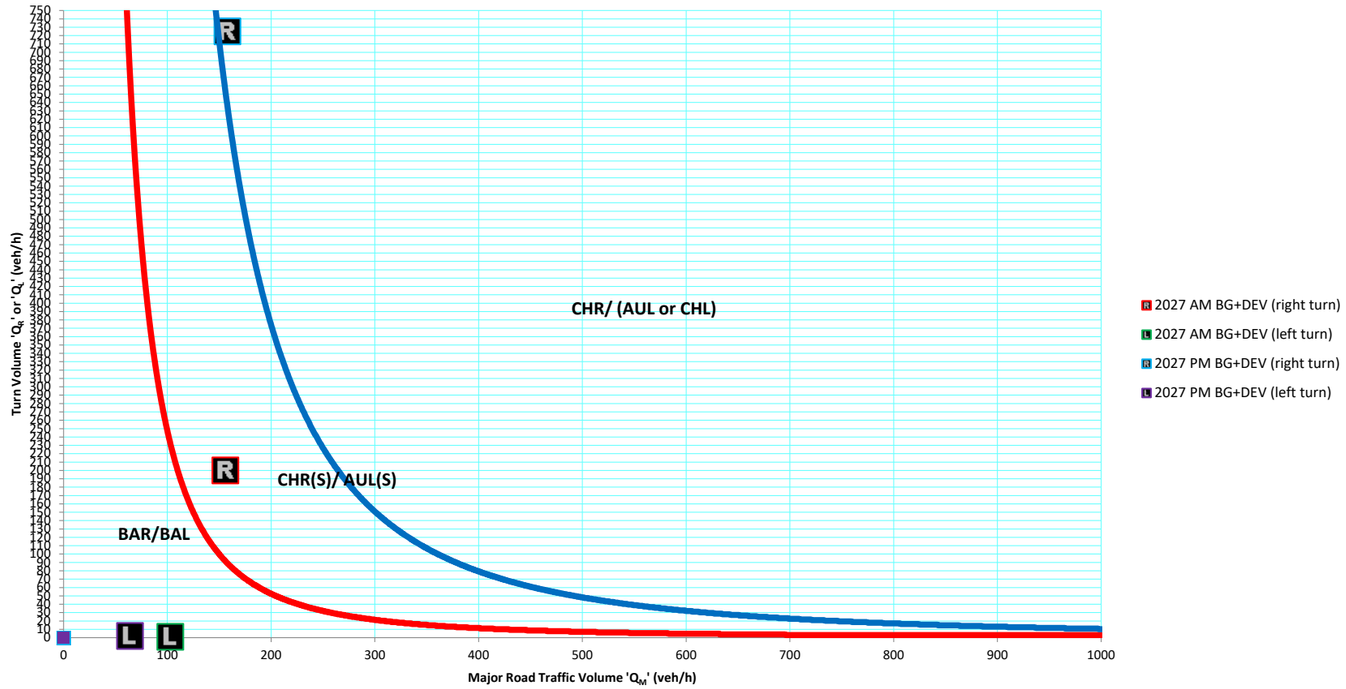
GRAPH	Q_M	Q_R/Q_L
Right	183	38
Left	57	68

Fig Title	North Shore Boulevard / Road 1 Intersection		
Project:	Mount Low Northern Precinct TIAs	*Prepared by:*	Eric Secondes
Project No:	P6159	*Reviewed by*	Eric Secondes
24/10/2024	*P:\P6159 Mount Low Northern Precinct TIAs\Technical\Turn Warrant\[P6159.001S Turn Warrants.xlsx]NBS_Road 1*		

Legend

BAR	Basic Right Turn	BAL	Basic Left Turn
CHR(S)	Channelised Right Turn (short)	AUL(S)	Auxiliary Left Turn (short)
CHR	Channelised Right Turn	AUL	Auxiliary Left Turn

Turn Warrants (<100km/h curve)



AM Peak Hour Volumes (Without Increase) — 2027 AM BG

Splitter Island? No

Q_{T1}= ; Q_R= ; Q_{T2}= ; Q_L=

GRAPH	Q_M	Q_R/Q_L
Right	0	0
Left	0	0

AM Peak Hour Volumes (With Increase) — 2027 AM BG+DEV

Splitter Island? No

Q_{T1}= 52 ; Q_R= 200 ; Q_{T2}= 103 ; Q_L= 1

GRAPH	Q_M	Q_R/Q_L
Right	156	200
Left	103	1

PM Peak Hour Volumes (Without Increase) — 2027 PM BG

Splitter Island? No

Q_{T1}= ; Q_R= ; Q_{T2}= ; Q_L=

GRAPH	Q_M	Q_R/Q_L
Right	0	0
Left	0	0

PM Peak Hour Volumes (With Increase) — 2027 PM BG+DEV

Splitter Island? No

Q_{T1}= 92 ; Q_R= 725 ; Q_{T2}= 64 ; Q_L= 2

GRAPH	Q_M	Q_R/Q_L
Right	158	725
Left	64	2

Fig Title: North Shore Boulevard / Lionel Turner Drive

Project: Mount Low Northern Precinct TIAs — *Prepared by:* Eric Secondes

Project No: P6159 — *Reviewed by* Eric Secondes

24/10/2024 *P:\P6159 Mount Low Northern Precinct TIAs\Technical\Turn Warrant\[P6159.001S Turn Warrants.xlsx]NBS_Road 1*

Legend

BAR	Basic Right Turn	BAL	Basic Left Turn
CHR(S)	Channelised Right Turn (short)	AUL(S)	Auxiliary Left Turn (short)
CHR	Channelised Right Turn	AUL	Auxiliary Left Turn

MILFORD PLANNING

Attachment 4

MOUNT LOW DEVELOPMENT ECOLOGICAL ASSESSMENT

Lyndel Owens

202207-2

Mount Low Development Ecological Assessment

24/10/2024

Document status

Project No	Version	Document name	Client	Author	Reviewer	Review date
202207-2	Draft	Mount Low Development Ecological Assessment	Lyndel Owens	Anton Fitzgerald	L. Liessmann	28/10/2022
202207-2	V1	Mount Low Development Ecological Assessment	Lyndel Owens	Anton Fitzgerald	L. Liessmann	16/07/2024
202207-2	V2	Mount Low Development Ecological Assessment	Lyndel Owens	Anton Fitzgerald	L. Liessmann	24/10/2024

Approval for issue

Approver	Signature	Approval date
A. Fitzgerald		24/10/2024

Prepared by:	Prepared for:
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1 INTRODUCTION

Terra Solutions Pty Ltd (Terra Solutions) was engaged by Lyndel Owens of Mount Low Developments to undertake an ecological assessment of land proposed for part of the Mount Low residential subdivision within the Townsville City Council Local Government Area. The proposed development involves the cancelling of Lot 1001 on SP345441 and reconfiguration into 195 lots plus balance land.

This ecological assessment report describes the environmental values present within and adjacent to the project area with a focus on Matters of National Environmental Significance (MNES) pursuant to the *Environment Protection and Biodiversity Conservation Act 1999* and threatened species under the *Nature Conservation Act 1992*.

The subject land is located to the near east of the Mt Low Parkway, Mt Low. The total area of the subject land is approximately 300 hectares and located within a rapidly urbanising part of northern Townsville city.

The land assessed is formally described as part of Lot 1001 on SP345441 (Lot 1001) and Lot 1002 on SPSP345441 (Lot 1002) and occupies approximately 18.8 ha (**Figure 1**). These lots have recently been reconfigured from parts of Lot 91 on SP222103 (Lot 91), Lot 92 on SP282784 (Lot 92) and the entirety of Lot 93 on SP222103 (Lot 93).

1.1 Project Background

Mt. Low Developments has previously lodged several Development Applications with Townsville City Council (TCC) for the Mt. Low masterplanned community. The applications at that time proposed to develop a community comprising a combination of higher density and larger lot area residential precincts, mixed uses (Mt Low Urban Village Precinct) and green space (natural area precincts). It is now intended to develop part of this land for new residential development.

During the assessment and approvals process, Mt. Low Developments sought advice regarding the application from the former Commonwealth Department of Environment, Water, Heritage and the Arts (DEWHA) (now Department of Climate Change, Energy, the Environment and Water (DCCEEW)) in relation to MNES. DCCEEW advised that MNES which are relevant to the application included the black-throated finch (*Poephila cincta cincta*) (BTF) which is listed as endangered under the EPBC Act.

In 2010, Austecology was commissioned by Mt. Low Developments to undertake detailed investigations and reporting regarding the site's value to BTF and the implications of development on the values identified.

This document was provided to DCCEEW as supporting information to the EPBC Act referral submitted in April 2012 (Bushland Grove Pty Ltd /Residential development/Mt Low/QLD/Mt Low Developments Master Planned Community Reference Number: 2012/6351).

During the assessment period, Austecology was requested by Mt. Low Developments to provide a review of the previous work to provide the Department with an updated assessment of the subject land's values regarding BTF. The requirement to provide this assessment was due to the lengthy decision timeframe and the potential for ecological change to occur within the four years since the previous assessment.

Conditioned approval for the development was issued by for the project on 28 October 2016, which has since been varied to extend the period in which Mt Low Developments must commence the action (i.e. within seven years of 26 October 2021).

It is noted that the EPBC referral relates to the entire project area which consists of Lot 91 on SP222103 (Lot 91), Lot 92 on SP282784 (Lot 92) and Lot 93 on SP222103 (Lot 93), some of which have been recently reconfigured.

1.2 Project Description

This component of the aforementioned project relates to part of the proposed Mount Low Residential Development, specifically Lot 1001 on SP345441 and Lot 1002 on SPSP345441. The land assessed is bounded to the south by North Shore Boulevard, the west by Mount Low Parkway, the north by a tributary of Stony Creek (the watercourse) and the east by the proposed Lionel Turner Drive.

The proposed layout of the residential development is presented in **Appendix A** – RaL Proposal Plan (RPS 2024). The layout includes areas typical of a residential subdivision including the proposed location of saleable land (9.50 ha), roads (3.88 ha), stormwater treatment area, greenspace and a riparian protection area.

A proposed pump station is proposed to be situated within future Lot 2001 north of New Road 2 (**Appendix A**). This site was selected to balance noise-related impacts to future residents whilst maintaining riparian habitat values associated with the watercourse. Recommendations on methods to reduce noise to residents and local fauna are provided in **Section 6**.

The majority of the subject area is mapped as high or very high environmental importance on TCC's overlay map OM-08.0 Natural Assets Environmental Importance which related to natural features that include, but are not limited to:

- *Vegetation Management Act 1999* (VMA) least concern remnant vegetation.
- VMA essential habitat for the endangered eastern curlew, and
- DCCEEW modelled BTF habitat.

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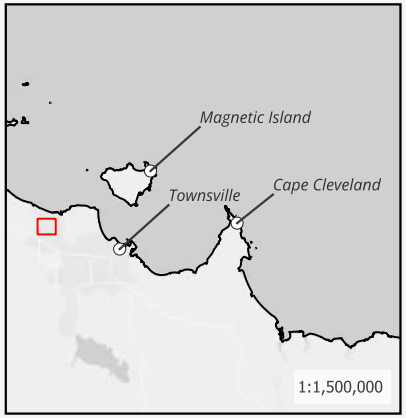
FIGURE 1: SITE LOCATION

0 100 200 300 400 500 m

1:15,000

LEGEND:

- EPBC Approval Area
- Study Area (Precinct 1)



PAGE SIZE: A4
CLIENT: Mount Low Developments
DATE: 16/07/2024
AUTHOR: Keeleigh
COORDINATE SYSTEM: GDA2020 / MGA zone 55

1.3 Purpose & Scope of Work

The purpose of this ecological assessment report is to identify and describe the environmental values of the project area and adjacent land to enable an assessment of potential impacts to MNES and support an application for a residential development at the site.

The scope of works included the following tasks:

- Desktop assessment of background information and legislative/policy documents along with Commonwealth and State mapping layers and databases.
- Ecological assessment of the project area and surrounds, and
- A report detailing the methodology, results and recommendations.

2 RELEVANT LEGISLATION

This section provides a summary of the key environmental legislation, policies and plans related to the proposed development (**Table 1**).

Table 1: Relevant Legislation

Legislation	Brief Description
Commonwealth Legislation	
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	The EPBC Act is the key piece of Commonwealth environmental legislation. It provides a legal framework to protect and manage the following nine matters of national environmental significance (MNES): • Listed critically endangered, endangered and vulnerable species and communities. • Listed migratory species. • Ramsar wetlands of international importance. • Commonwealth marine environment. • World heritage properties. • National heritage places. • The great barrier reef marine park. • Nuclear actions, and • Water resources in relation to coal seam gas development and large coal mining developments. Under the EPBC Act, an action that has, will have, or is likely to have a significant impact on any MNES or other protected matters must not be undertaken without approval from the Commonwealth Minister for the Environment. Before a proponent can lawfully undertake an action that may have a significant impact on a MNES, the action must be referred to the minister for consideration. If it is determined that an action is likely to have a significant impact on MNES it is categorised as a 'controlled action' requiring assessment and approval under the EPBC Act. This impact assessment may be undertaken in accordance with a relevant bilateral agreement between the commonwealth and a state or territory.
Nature Conservation Act 1992 (NC Act)	The *Nature Conservation Act 1992* (NC Act) aims to conserve nature in Queensland, while allowing for the involvement of Indigenous people in the management of protected areas in which they have an interest under Aboriginal tradition or Island custom. The NC Act provides for the protection of wildlife, including listed threatened and special least concern (SL) species, and areas of conservation significance. The subordinate Nature Conservation (Animals) Regulation 2020 (NCR - Animals) and the Nature Conservation (Plants) Regulation 2020 (NCR - Plants) prescribes species in accordance with the categories set out in the Act. It is an offence to take protected wildlife without a licence, permit or other authority (section 320). It is also an offence for a person, without a reasonable excuse, to tamper with an animal breeding place being used by a protected animal to incubate or rear offspring (section 335, Nature Conservation (Animals) Regulation 2020).

3 METHOD

3.1 Desktop Assessment

The desktop assessment included a review of supporting material primarily relating to the MNES. These materials include but are not necessarily limited to the following mapping, databases and reports:

- Aerial Photograph Interpretation (API) to determine the broad categorisation of vegetation within and surrounding the site and to review the extent of historical clearing and land use, and any other significant environmental features such as watercourses and wetlands.
- The Queensland Department of Natural Resources, Mines and Energy (DNRME) Regulated Vegetation Management Mapping (Version 11.1) under the VM Act.
- WildNet database: This database is maintained by the Department of Environment and Science (DES) and holds records of plants and animals that have been sighted or collected at a location. Species records were retrieved within a five (5) kilometre radius around a central point in the site (-19.2171 146.6753) (**Appendix B**).
- Atlas of Living Australia. ALA is a collaborative, digital, open infrastructure that consolidates Australian biodiversity data from multiple sources.
- State Planning Policy (SPP) Interactive Mapping System (IMS). The SPP IMS includes mapping layers to spatially represent matters of state interest as expressed in the SPP (i.e., Matters of State Environmental Significance).
- Wetland and watercourse mapping including drainage boundaries, watercourses, and other wetland features (Queensland Globe).
- TCC City Plan overlay codes.
- Previous ecological assessment reports and approvals, including:
  - EPBC Act referral Reference 2012/6351.
  - Black-throated finch habitat values review (Austecology 2015).
  - Black-throated Finch (*Poephila cincta cincta*) Supplementary Assessment December 2012 and April 2013. Townsville Ring Road Section 4 Project. A report prepared for AECOM Australia Pty Ltd on behalf of the Queensland Department of Transport and Main Roads (NRA 2013).
  - Black-throated finch survey and habitat assessments (Austecology 2010).
  - Assessment of Potential Impacts on the Black-throated Finch (*Poephila cincta cincta*): Section of the Proposed North Shore Boulevard and Wastewater Upgrade Project within the North Shore Development (NRA 2009).
  - Flora and fauna assessment report (C&R 2008), and
  - Property Vegetation Management Plan (Earthworks 2006) The desktop assessment included a review of previous habitat assessments relating to the Black-throated Finch (southern) (BTF) habitat values.

3.2 Likelihood of Occurrence Assessment

A likelihood of occurrence assessment was undertaken for listed species returned from the WildNet and Protected Matters Search. The LoO was based on the known distributions and ecological requirements of the returned species and the environmental conditions and habitat values observed on the site. Typically, the ecological features relevant to species include topography, vegetation, soils, geology and hydrology. Each species was given a LoO in accordance with the following criteria:

- Present: Species observed through direct observation within or immediately adjacent to the site.
- Likely to Occur: The species has been recorded in habitat adjacent to the project area and habitat within the project area is highly suitable/similar. Includes situations where habitat within the project area is considered highly suitable (but not marginally suitable) and there is ecological connectivity with habitat containing a species record off-site but within the desktop search extent.
- May Occur: Species records exist within the extent of desktop searches and habitat is moderately suitable. This category may also apply where a species is genuinely rare (i.e. rarely present even within habitat that is highly suitable) and good quality habitat is present on the site; or the species was not recorded within the extent of desktop searches but occurs in the general area and suitable habitat in good condition is present, and
- Unlikely to Occur: Negligible or very low probability of occurrence within the project area. There are no official records in the search area and habitat on the site is unsuitable, significantly degraded and/or marginal. Includes situations where the site is unlikely to occur within the natural range of the species.

The likelihood of occurrence assessment was used to inform the field investigations and was updated following the survey.

3.3 Site Investigation

A site inspection of the project area was undertaken by ecologists Anton Fitzgerald (Terra Solutions) and Keeleigh Parison (Terra Solutions) on 20 October 2022.

A ground traverse of the Project area was undertaken, including an examination of onsite vegetation communities and fauna habitat values. The habitat assessment focused on identifying the microhabitat features typically associated with threatened species considered to potentially occur onsite. Traverses were undertaken on foot which enabled excellent access to the site.

On ground surveys were used to verify the various layers assessed in the desktop assessment including important features associated with geology, soil type, water resources and vegetation communities.

3.3.1 Vegetation & Flora Survey Methods

Vegetation communities discernible in the field were surveyed using the outline for recording quaternary type information as defined by the 'Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland' (Neldner et al. 2022).

The survey included:

- Verification of Regrowth Vegetation and Regional Ecosystem mapping.
- An on-ground description of each regional ecosystem on the site and each structural layer of the community.
- Searches for threatened flora species within each vegetation survey site, and
- Identification of significant infestations of weed species

3.3.2 Fauna Survey

The fauna survey was undertaken in conjunction with the flora survey. This survey relied on an assessment of available habitats and their suitability for threatened and migratory fauna (listed species) that have been previously recorded or might occur in the vicinity of the Project area. The assessment was based on opportunistic and targeted searches of suitable habitats observed whilst traversing the Project area including the following fauna survey techniques:

- Habitat assessment for potential occurrence of likely Endangered, Vulnerable and Near Threatened species.

- Identification of animal signs (e.g. tracks, scats, feathers, sloughed skins), and
- Opportunistic records.

The habitat assessment focused on identifying those features typically associated with threatened species and similar fauna groups. Particular attention was paid to the following habitat features:

- Mature trees containing hollows, fissures and/or other suitable roosting/nesting places.
- Condition, size, flow and water quality of drainage lines and bodies of water.
- Areas of dense vegetation.
- Hollow logs, coarse woody debris, eroded areas and dense leaf litter.
- Presence of blossoming or fruiting flora species.
- Vegetation connectivity and to areas of intact vegetation, and
- Caves and man-made structures suitable as bat roost sites.

The identification of animal signs consisted of searches for tracks, scratch-marks, feeding scars, scats, roadkill, feathers or sloughed skins.

These searches were undertaken in habitats considered suitable for listed species with a primary focus on searches for BTF food sources, nesting habitat and water resource. Any threatened fauna species observed opportunistically whilst traversing the site were identified and recorded.

4 ASSESSMENT OF SITE VALUES

4.1 Vegetation Communities

4.1.1 Regional Ecosystems

Remnant vegetation communities in Queensland are classified as Regional Ecosystems (REs) for the purposes and administration of the VMA. Regional ecosystems are defined as:

"Communities of vegetation that is consistently associated with a particular combination of geology, landform and soil in a bioregion". Each regional ecosystem has been assigned a conservation status which is based on its current remnant extent (how much of it remains) in a bioregion" (Neldner et al. 2022).

The RE mapping (Version 12.1) displays three RE's in the Project area all of which are homogeneous polygons (**Figure 2**). A description of each RE and its status under the VMA is presented in **Table 2.**

Table 2: Regional Ecosystems Description

RE Code	Description	Vegetation Management Act Class	Biodiversity Status
11.3.35	*Eucalyptus platyphylla, Corymbia clarksoniana* woodland, occasionally with *Corymbia tessellaris*. A secondary tree layer commonly occurs, including *Planchonia careya*, *Pandanus spiralis*, *Melaleuca viridiflora* or *M. nervosa* and *Petalostigma pubescens*. The ground layer is usually tussock grasses, including *Themeda triandra, Heteropogon contortus, Mnesithea rottboellioides* and *Bothriochloa decipiens*, together with herbs or forbs such as *Glycine tabacina, Galactia tenuiflora* or *Sida hackettiana*. Occurs on Cainozoic alluvial plains. Older floodplain complexes, major stream levees and lighter deltaic deposits.	Least concern	No concern at present
11.3.12	*Melaleuca viridiflora* woodland to open woodland, occasionally with *M. argentea* and *M. dealbata*. Occasional midstratum of *Grevillea pteridifolia* and *Acacia leptocarpa*. Ground layer of perennial grasses such as *Themeda triandra, Elionurus citreus, Ectrosia leporina, Eriachne rara, Eremochloa bimaculata, Thaumastochloa pubescens, Eragrostis brownii* and *Ischaemum australe*. Occurs on alluvial plains on strongly duplex clay soils with restricted drainage.	Least concern	No concern at present
11.3.31	*Ophiuros exaltatus* and/or *Dichanthium spp*. tussock grassland. The ground layer has a variable composition, with drier areas dominated by *Ophiuros exaltatus, Iseilema membranaceum* or *Dichanthium spp*. or *Brachyachne tenella*. Other common and sometimes dominant grasses include *Themeda triandra, Heteropogon contortus, Eulalia aurea*, *Imperata cylindrica, Eriochloa pseudoacrotricha, Bothriochloa spp., Panicum decompositum* and *Sporobolus spp*. Other species include *Neptunia spp., Rhynchosia minima, Crotalaria spp., Euphorbia spp., Aristida latifolia, Sida spp*. and *Desmodium spp*. Trees such as *Eucalyptus platyphylla, Grevillea striata, Corymbia dallachiana* or *C. erythrophloia* may occur as emergent isolated trees or tall shrubs. Occurs on older floodplain complexes on Cainozoic alluvial plains. Black or dark grey earths or brown clays, in some areas with strong gilgai or debil debil microrelief. Often with self-mulching surface, and alkaline subsoil. (BVG1M: 32a).	Least concern	Of concern

Field surveys of the assessment area confirmed that the site is located on land associated with quaternary alluvial deposition from Stony Creek and associated tributaries. The alluvium consists primarily of fine clays which forms a plain developed through overbank flows.

Vegetation within the site is broadly consistent with the mapped RE's with some linework inaccuracies observed. Overall, the vegetation is described as:

Eucalyptus platyphylla, Corymbia clarksoniana woodland, occasionally with *Corymbia tessellaris.* The secondary tree layer was sparse or consisted of isolated trees including *Grevillea pteridifolia, Planchonia careya, Acacia leptocarpa* and immature canopy species. Along the watercourse this community also contains isolated *E.teriticornis* and *Lophostemon grandiflorus*. This ground layer within this RE was dominated by a short, grazed layer of *Themeda triandra* and *Heteropogon contortus.* This RE occupies approximately three quarters of the study area and is consistent with RE 11.3.35 (**Plate 1** and **Plate 2**). When occurring on "prior streams and levees" is identified as an area of very high environmental significance in accordance with the Townsville City Plan. An area of approximately 1.27 ha of this community occurs on the site (**Appendix G**).

Melaleuca viridiflora woodland with a grassy understorey consisting of *Themeda triandra* and *Heteropogon contortus.* This community occupies approximately one quarter of the study area and is consistent with RE 11.3.12 (**Plate 3**).

A small, fringing mangrove community associated with quaternary estuarine and marine deposits occurs in the downstream extent of the watercourse located in the northeastern extent of the study area. This community consists primarily of *Lumnitzera racemosa* which grows sparsely within the bed and banks of the watercourse. This community does not extend outside the bed and banks of the watercourse and is associated with the high-water mark.

There is no value in amending the vegetation mapping as it would only require slight modifications to the linework between least concern communities.

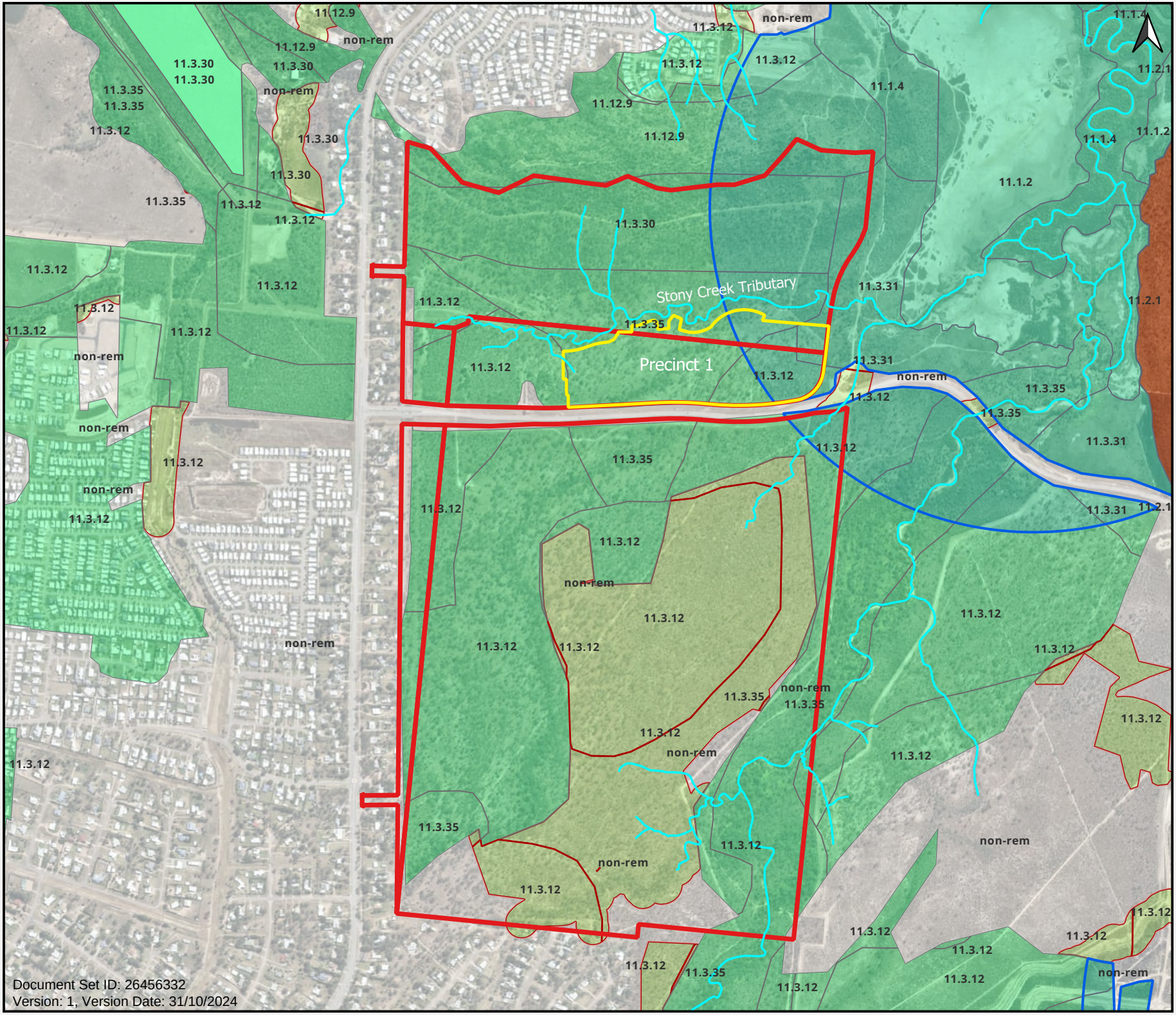


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FIGURE 2: REGIONAL ECOSYSTEMS

0 100 200 300 400 500 m

1:15,000

LEGEND:

- VM Watercourses
- Study Area (Precinct 1)
- Essential habitat map

Vegetation management regional ecosystems

- Category A or B area containing of concern
- Category A or B area that is least concern
- Category C or R area that is of least concern
- Non-remnant

PAGE SIZE: A4
CLIENT: Mount Low Developments
DATE: 16/07/2024
AUTHOR: Keeleigh
COORDINATE SYSTEM: GDA2020 / MGA zone 55

Plate 1: RE - 11.3.35. Note the Locally Abundant *E. crebra*.

Plate 2: RE 11.3.35 - Mixed Woodland near Stony Creek Tributary

Plate 3: *RE 11.3.12* – Immature *Melaleuca viridflora* in RE 11.3.12

4.1.2 Essential Habitat

Essential habitat is the habitat of native wildlife prescribed under the *Nature Conservation Act 1992* as endangered, vulnerable or near threatened (protected wildlife) and protected through the VMA. Essential habitat on the essential habitat map is derived either through habitat modelling or as a 1.1 km buffer to an existing threatened species record.

Approximately one third of the site is mapped as essential habitat for eastern curlew (**Figure 2**). This area is based on a 1.1 km buffer for a species record and consequently much of the area mapped as essential habitat intersects vegetation, landform, soil and/or other habitats that are unsuitable for the species. To be classified as essential habitat under the VMA, habitat must contain at least one of the mandatory RE's listed for the species and at least three essential habitat features in total. Essential habitat features include specific vegetation communities, altitude, soils and landscape position.

An assessment against the essential habitat criteria for the species **Table 3** confirms that essential habitat for eastern curlew is not present on the site.

Table 3: Essential Habitat for Species Mapped on the Site

Species	NC Act Status	Mandatory RE's for Bioregion	Vegetation Community	Altitude	Soils	Position in Landscape	Assessment
Eastern curlew	E	11.1.1, 11.1.2, 11.1.3, 11.1.4	Foraging on soft, intertidal mudflat, with a preference for broad flats, often in sheltered areas near mangroves and estuaries/creeks, also on sandflats and occasionally ocean beaches, rock platforms and coral reefs. Roost on salt flat, saltmarsh, mangroves, reef flat, sandy spits and grassland near water.	Sea level to 100m.	Sand, sandy mud and mud substrates.	Associated with coastlines and wetlands.	Whilst a small area of suitable vegetation occurs within the watercourse (approximately 3 m wide). This area is not located within the development footprint and is marginal habitat for the species which is more likely to utilise higher quality habitats associated with the Bohle River and Stony Creek estuary.

4.2 Wetlands & Watercourses

The site is in the Bohle River sub-basin of the Ross River basin. The Ross River Basin and associated sub-basins form part of the Great Barrier Reef Catchment.

A small tributary of Stony Creek (the watercourse) traverses land from west to east, eventually combining with the estuarine reach of Stony Creek (**Figure 3**). The watercourse assessed intersects or forms the direct receiving environment and was the northern extremity of the assessment area.

The watercourse is identified in the Fisheries Act spatial layer Queensland Waterways for Waterway Barrier Works (WWBW) as a Low Risk (Green) Fisheries waterway. This stage of the proposed development will not involve the construction or raising of waterway barrier works, however future stages may require waterway barrier works for the continuation of New Road 1 (**Appendix A**).

A shallow depression with no defined bed and banks traverses the development area from the southwest to the northeast. Drainage from the site occurs via this depression along with overland and subsurface flows directed to the Stony Creek tributary to the north. This depression is not a mapped WWBW or Vegetation Management Act 1999 watercourse.

A Wetland of High Ecological Significance (HES) is located approximately 280 m south-east of the south-eastern extent of the assessment area and the associated wetland protection area intersects around one third of the assessment area. The HES wetland does not appear to be hydraulically connected to the site as it is located upstream and in the adjacent Stony Creek Catchment. This HES wetland would not be impacted by development in the assessment. Note also that North Shore Boulevard separates the site and this wetland area (**Figure 3**).

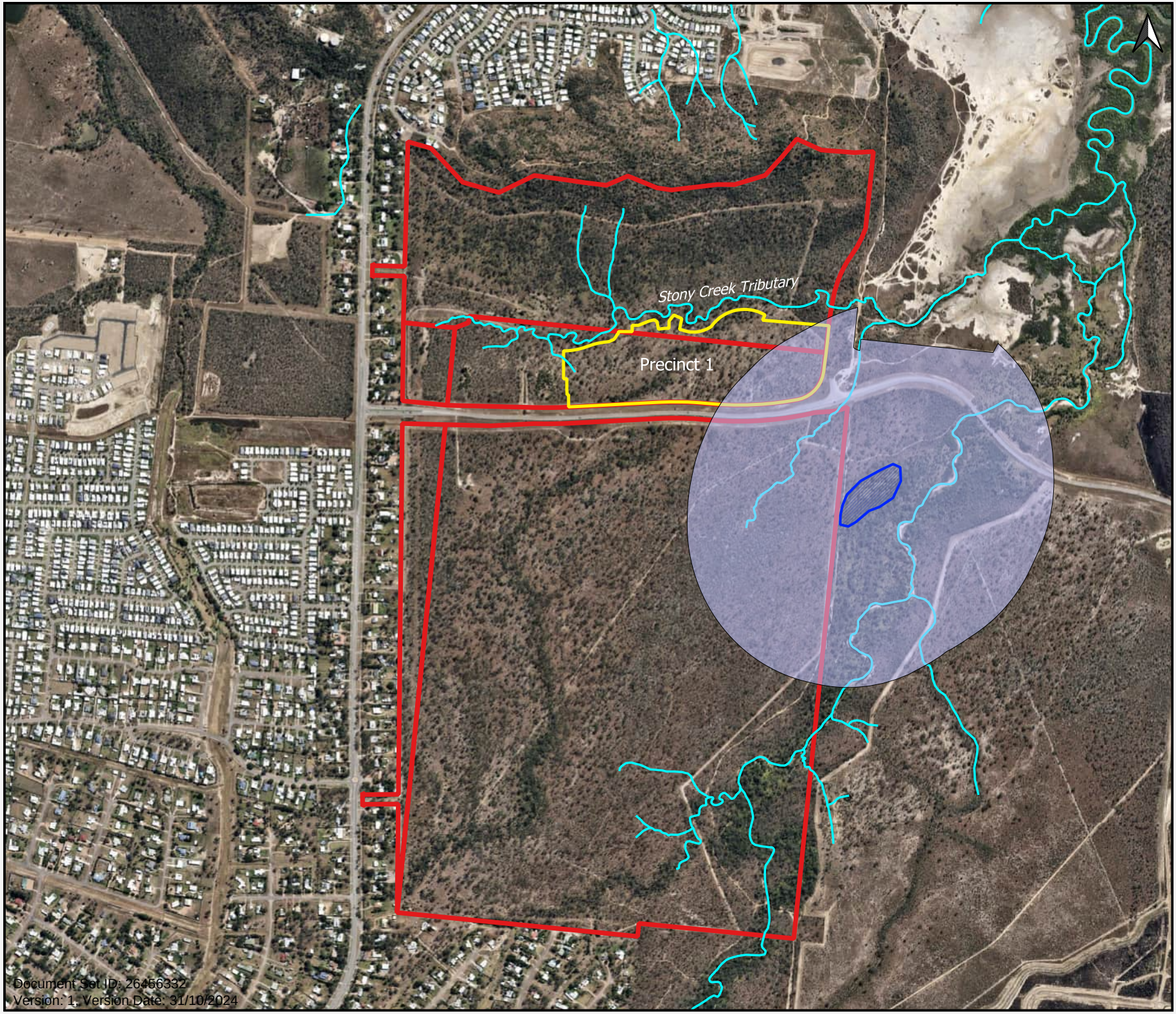

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FIGURE 3: WETLANDS AND WATERCOURSES

0 100 200 300 400 500 m

1:15,000

LEGEND:

- VM Watercourses
- Study Area (Precinct 1)
- Wetlands of high ecological significance
- HES Wetalnd Trigger Area

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4.3 Fauna Habitat Values

Assessment of the fauna habitat values on the site confirmed that most of the key microhabitat values suitable for fauna were located within and adjacent to the Stony Creek tributary.

Vegetation associated with the drainage line had the highest flora diversity in the study area, providing a greater variety of potential foraging sources for local fauna (**Plate 4**). Larger diameter *Eucalyptus platyphylla* are common within ten (10) - fifteen (15) metres of the high bank. This species is a common hollow-bearing species that provides important denning, roosting and or nesting habitat for a range of microbats, possums and gliders, parrots, and owls.

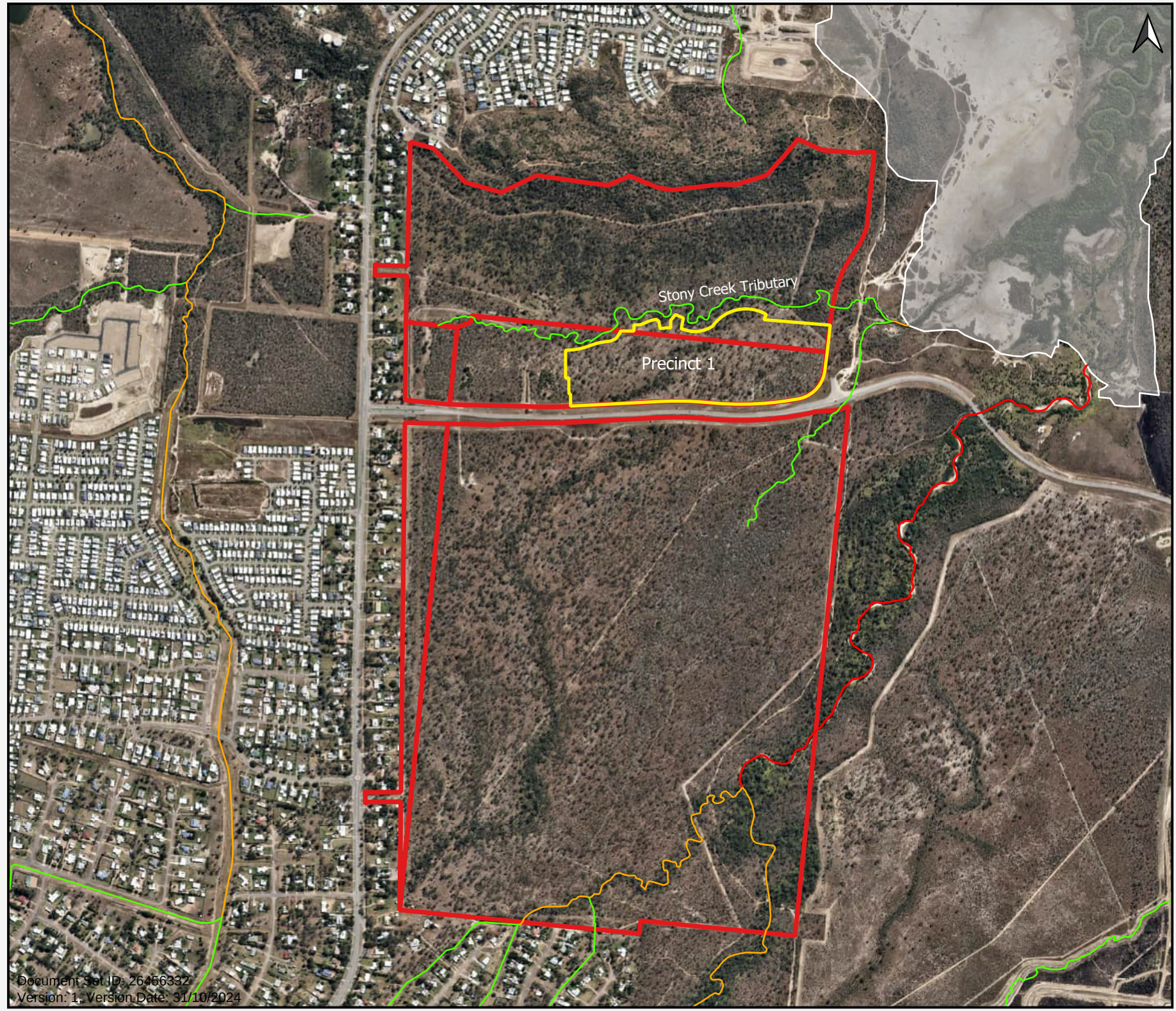
Several small waterbodies were present within this tributary providing a water source for local fauna (**Plate 5**).

Plate 4: Riparian Vegetation Associated with Stony Creek Tributary

Plate 5: A-C - Small Waterbodies

4.3.1 Waterways for Waterway Barrier Works

The northern site boundary lies adjacent to a low risk (green) waterway for waterway barrier works (WWBW) (unnamed Stoney Creek tributary, **Figure 4**) that flows into a tidal WWBW east of the site. WWBWs are waterways that provided for fish passage where construction of a barrier may impact on fisheries resources as defined by the *Fisheries Act 1994*. As no waterway barriers are proposed as part of the development, there are no requirements associated with WWBW.



Terra SOLUTIONS

FIGURE 4: WATERWAYS FOR WATERWAY BARRIER WORKS

0 100 200 300 400 500 m

1:15,000

LEGEND:

- Study Area (Precinct 1)
- Queensland waterways for waterway barrier works - tidal

Queensland waterways for waterway barrier works

- High
- Moderate
- Low

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COORDINATE SYSTEM: GDA2020 / MGA zone 55

4.4 Threatened Flora

The WildNet Database searches did not identify any threatened plant records within two (2) kilometres of the site (**Appendix B**). Several threatened plants were considered in the context of the site including *Tephrosia leveillei*, *Myrmecodia beccarii* (ant plant), *Dichanthium setosum* (bluegrass) and *Leichhardtia brevifolia* (syn, *Marsdenia brevifolia*) but considered unlikely to occur. This assessment was based on the known ecological requirements of each species and the current environmental conditions and habitat values of the site.

The site assessment confirmed the results of the desktop assessment. No significant flora species or suitable habitat for significant flora species were recorded in the Project area.

4.5 Threatened Fauna

The WildNet online database search (**Appendix B**) returned twelve (12) threatened species listed under the NC Act or EPBC Act within five (5) kilometres of the site.

The likelihood of occurrence of each species was assessed with consideration of the species ecological requirements and the current environmental conditions and habitat values present on the site (**Table 4**). Most of the species returned in the WildNet search are unlikely to occur due to the very limited presence of the preferred intertidal habitats[1].

Table 4: Conservation Significant Species Identified in Desktop Searches

Scientific Name	Common Name	NC Act Listing	EPBC Act Listing	Records	Likelihood of Occurrence
Hirundapus caudacutus	white-throated needletail	V	V	1	Possibly – as a flyover species.
Esacus magnirostris	beach stone-curlew	V		18	Unlikely – inhabits intertidal habitats and adjacent coastal vegetation
Charadrius leschenaultii	greater sand plover	V	V	78	Unlikely – inhabits intertidal habitats and adjacent coastal vegetation
Charadrius mongolus	lesser sand plover	E	E	48	Unlikely – inhabits intertidal habitats and adjacent coastal vegetation
Rostratula australis	Australian painted-snipe	E	E	1	Unlikely – inhabits primarily freshwater wetlands
Calidris canutus	red knot	E	E	20	Unlikely – inhabits intertidal habitats and adjacent coastal vegetation
Calidris ferruginea	curlew sandpiper	CR	CE	7	Unlikely – inhabits intertidal habitats and adjacent coastal vegetation
Calidris tenuirostris	great knot	CR	CE	91	Unlikely – inhabits intertidal habitats and adjacent coastal vegetation
Limosa lapponica baueri	Western Alaskan bar-tailed godwit	V	V	156	Unlikely – inhabits intertidal habitats and adjacent coastal vegetation

[1] Preferred intertidal habitats within the project area are limited to the narrow creekline in the north-eastern extent of the site.

Scientific Name	Common Name	NC Act Listing	EPBC Act Listing	Records	Likelihood of Occurrence
Numenius madagascariensis	eastern curlew	E	CE	189	Unlikely – inhabits intertidal habitats and adjacent coastal vegetation
Orcaella heinsohni	Australian snubfin dolphin	V		5	Unlikely – inhabits marine waters
Crocodylus porosus	estuarine crocodile	V		3	Unlikely – primarily inhabits marine waters, estuaries, and watercourse with a marine influence.

4.5.1 Assessment of Habitat Values for Black-throated Finch

The primary species of interest in relation to the proposed development is BTF, primarily due to presence of some habitat values in the locality. Numerous detailed targeted investigations, habitat assessments and monitoring programs have been undertaken to understand the utilisation of these habitat by the species. Primarily, these assessments were undertaken on land for the proposed Mount Low Development and Stockland's North Shore Development.

Although no records of BTF were returned from the WildNet search an assessment of previous reports have confirmed the presence of this species in the east of the North Shore Development. A summary of these reports and primary conclusions from these reports are presented below.

Property Vegetation Management Plan for RP742554, RP741804 & EP1901 in the Mt Low Area (Earthworks 2006 cited in Austecology 2015)

- An ecological survey was undertaken over a five-day period including forty-one (41) hours dedicated to BTF surveys. No BTF were observed (Earthworks 2006 cited in Austecology 2015).

Black-throated Finch Surveys & Habitat Assessments Land at Mt. Low, Townsville (Austecology 2010 cited in Austecology 2015)

This report was prepared as supporting evidence for the EPBC Act referral for the entire Mt Low development. A description of the method key findings from the BTF survey and habitat assessment program (Austecology 2010) as they relate to the current assessment, include:

- A series of survey events between 2006 and 2010 were undertaken with no BTF observed despite >120 hours of targeted survey effort.
- The presence of dense grass cover in the east of the site was regarded as too thick for BTF to successfully forage.
- Patches of dense *Melaleuca viridiflora* regrowth in the eastern extent of the study area appeared unsuitable as BTF habitat due to the combination of canopy and grass density.
- Modelled higher probability nesting habitat is present in the eastern extent of the current study area, and
- The future development of the North Shore Boulevard would subdivide the higher probability nesting habitat. This road has since been constructed.

General comments in relation to the entire study area from this report concluded:

- The findings of the habitat assessment when considered in the context of the site and surrounding land use, indicate that future occurrences of the BTF are more likely to be associated with habitats surrounding Stony Creek, including areas east of the site, and
- It was considered unlikely that the proposed development would lead to a significant impact on BTF in the locality.

2014 Black-throated Finch Habitat Values Review. Land at Mt Low, Townsville (Austecology 2015)

This report was prepared to provide an updated habitat and impact assessment for the previously submitted EPBC Act referral due to the time that had passed since the initial referral. The focus of this assessment related to the entire EPBC Act referral site. In this report Austecology reviewed the previous report and reviewed the habitat suitability of the site and surrounding area for BTF with the following outcomes:

- Habitat conditions for BTF had not improved since Austecology's 2010 assessment of the site.
- There was evidence that North Shore Boulevard has caused significant disruption to habitat connectivity and that the subject site had been subjected to impacts from the development of North Shore Boulevard which have reduced site values for BTF (placement of four construction spoil dumps, drainage works and the clearing of a 20 m wide road reserve).
- Environmental weeds (*Stachytarpheta jamaicensis* and *Stylosanthes scabra*) and dense grassland dominated by *Themeda triandra* and/or *Hetropogen contortus* continued to diminish habitat value for BTF.
- The site contained two of the fundamental resources required by BTF (nesting habitat and a water resource) but typically lacked suitable foraging resources (i.e., grasses are heavily dominated by *Themeda triandra* and/or *Hetropogen contortus*).
- The placement of spoil dumps, and associated vegetation clearing has caused the siltation of a small stock dam. Following inspection of the water body, Austecology concluded that the waterbody no longer represents a valid inclusion in predictive habitat modelling for the site.
- On completion of all existing approved urban developments as shown in **Appendix C**, the subject site will be isolated from connected habitats besides two sub-optimal ecological connections (i.e. a linkage to the south-east corner of the site and the north-east of the site).
- In relation to monitoring data collected by NRA (2005 – 2014) for the adjacent Stockland North Shore development[2], Austecology concluded that the paucity of BTF observations[3] over the course of surveys appears to provide evidence that:
  - Permanent BTF populations no longer occur on that site.
  - BTF are rarely reported in the surrounding area.
  - The likelihood of sporadic use is decreasing over time, and
  - Potential nesting habitat is present even though BTF have not been recorded on the site.
- Austecology concluded that the proposed development would unlikely lead to a significant impact on BTF.

The ecological conditions observed on the site during this 2022 survey are consistent with the appraisal by Austecology in 2014. Whilst the site contains suitable nesting habitat and water resources the absence of a diversity of perennial grasses as a foraging resource for BTF was obvious.

The site assessment confirmed the results of the desktop assessment. No significant fauna species were recorded in the site area.

4.6 Connectivity Areas

Presently the site is somewhat ecologically disconnected from land to the west, north and south. Mount Low Parkway and adjacent residences that provide a substantial barrier to species movement to the west, whilst

[2] BTF monitoring required to comply with EPBC Act approval conditions for the site.

[3] Records of BTF were confirmed in 5 of 25 survey events between 2005 and 2010 for the North Shore Development. These records do not appear in the WildNet search results.

North Shore Boulevard separates the site from remnant land to the south. Both roads are busy arterial roads with a high traffic load and wide, cleared road reserves of approximately twenty (20) metres. North of the site clearing for residential and commercial development at Bushland Beach is almost complete with no ecological connectivity to the coast. The only remaining connected habitat is east of the site, but this area consists of salt flats and a narrow corridor of woodland/grassland of around 140 m in width. This area is suboptimal in terms of a habitat corridor with no connectivity further west and is not considered an ecologically important corridor.

The subject site and much of the surrounding land is zoned as Emerging Community[4] within the Townsville City Plan and consequently there has been substantial residential and commercial development in the locality. Further urban development in the area has also been approved, including a large area east of Stony Creek and west of North Shore Boulevard. Once these developments are complete the subject site will be isolated from all connected habitats besides two sub-optimal ecological connections (i.e., a linkage to the south-east corner of the site and the north-east of the site) (Austecology 2015).

On this basis of existing and proposed developments the primary ecological corridors in the area will include Stony Creek and the area of land between Stony Creek and the Bohle River, but north of North Shore Boulevard. These areas collectively support a diverse range of ecosystems including intertidal and estuarine communities, open woodland, dense mangrove forest and freshwater aquatic communities, all of which contribute to species diversity in the region.

4.7 Marine Plants

Marine plants were identified in the eastern extent of the assessed area lining the tributary to Stony Creek. All marine plants were located within the bed and banks of the Stony Creek tributary.

Note that any development involving the removal, distance or damage of marine plants clearing of marine plants may trigger assessable development under the *Fisheries Act 1994.*

[4] The emerging community zone code intends to identify land that is suitable for urban purposes and sustain land that may be suitable for future urban development.

Plate 6: Photograph of Marine Plants Surrounding Tidal Stony Creek Tributary in Northeast of Site

5 TOWNSVILLE CITY COUNCIL NATURAL ASSETS MAPPING AND CODE RESPONSE

Townsville City Council's Natural Asset Mapping displays areas of very high and high environmental value. These areas include:

An area in the eastern extent of the site classified as 'very high' environmental value based on mapped essential habitat for eastern curlew (**Appendix D**). Based on the requirements for essential habitat mapping under the VM Act, this area does not relate to the subject site. Classification as essential habitat requires vegetation to contain at least three essential habitat factors (e.g., vegetation, relevant soil type, elevation etc.), some of which are mandatory requirements. In the case of eastern curlew, mandatory habitat factors include a select group of regional ecosystems, all of which occur on Land zone 1 – tidal flats and beaches. This land zone is not present within the proposed developed area and since the land zone is mandatory for essential habitat this area of 'very high' environmental value is not considered to be present.

The Natural Asset Supporting Mapping (**Figure 5**) depicts two watercourses within the study area, the Stony Creek tributary which passes along the northern extent of the study area from west to east and a drainage line which flows into this watercourse from south to north. These watercourses are classified as being of very high environmental importance in **Figure 6.** Upon review of hillshade analysis sourced from Queensland Globe (**Appendix E**) the central watercourse (i.e., flowing from south to north) does not extend further than the location marked in **Figure 5** and **Figure 6** (red placemark) and following advice from TCC, the 'very high' environmental importance classification is associated with an area of RE 11.3.35 located on an old levee or prior stream. Terra Solutions has verified the vegetation community in this area, and although it is a recognised 'Least Concern' community under the VM Act, approximately 1.27 ha of the community located on a prior stream and is therefore classified as an area of 'very high' environmental importance under the TCC Planning Scheme.

The remaining areas of high environmental importance are associated with BTF habitat modelling for the site. As discussed in **Section 4.5.1** there have been numerous survey events undertaken on this property (2006 – 2010) and on adjacent land associated with the North Shore Development (2005 – 2014). The consensus in the most recent assessment by Austecology (2015) was that permanent BTF populations no longer occur on the Mt Low Development site or Stockland's North Shore site. Previous records of the species are primarily associated with the eastern extent of the North Shore Development (Austecology 2015), and whilst potential nesting habitat and hydration points are present on the site, the site lacks suitable foraging resources (i.e. the species requires a diversity of perennial grasses).

Based on these ecological assessments (including this assessment), the site does not contain all three of the fundamental habitat requirements to be classified as BTF habitat. As such consideration should be given to whether the site should be classified as containing areas of high environmental importance.

Responses to TCC Natural asset overlay code is provided in **Appendix F**.

Figure 5: TCC Natural Assets Supporting Map

Figure 6: TCC Environmental Importance Map

6 CONCLUSION & RECOMMENDATIONS

The following conclusions are drawn from the ecological assessment of the Project:

- No threatened regional ecosystems under the VM Act occur within or adjacent to the project area.
- No threatened plants have been recorded within five (5) kilometres of the site (WildNet database), are likely to occur or were observed during field investigations.
- Twelve threatened fauna species have been recorded within five (5) kilometres of the site (WildNet database). Except for white throated needletail all these species inhabit intertidal areas, wetlands or estuarine habitats and are unlikely to be affected by the proposed development. White throated needletail is primarily an aerial species and unlikely to be affected by the development.
- Very high environmental value mapping relating to essential habitat for Eastern Curlew is not relevant to the site due to the absence of suitable habitat for the species.
- Approximately 1.27 ha of RE 11.3.35 is located on a prior stream or levee and classified as an area of 'very high' environmental importance under the TCC Planning Scheme (**Section 5**). A map of the area is presented in **Appendix G**. If this area cannot be reasonably avoided, we recommend enhancing an equivalent area (where possible) within the Open space and stormwater treatment area (within Balance Lot 1003) (**Appendix A**). This enhancement may take the form of supplementary planting with species including *Corymbia tessellaris*, *C. clarksoniana* and *Eucalyptus platyphylla*.
- Areas of high environmental importance are associated with broad-scale BTF habitat modelling for the site (i.e., based on the presence of potential nesting habitat, hydration points and foraging habitat). Previous ecological assessments of the site have identified that suitable foraging habitat is lacking on the site and this was confirmed again during this assessment. Consideration should be given to the removal of high ecological value mapping on this basis.
- The Natural Asset Supporting Mapping (**Figure 4**) depicts two watercourses within the study area, the Stony Creek tributary which passes along the northern extent of the study area from west to east and a drainage line which flows into this watercourse from south to north. The extent of the drainage line that flows from south to north is shorter that depicted in the mapping (**Figure 5** and **Figure 6**).
- Ongoing development in the locality including North Shore Boulevard and adjacent residential developments have further isolated remnant habitats in the area and substantially reduced the level of connectivity on the site.
- On initial advice from Terra Solutions, the proponent has applied a minimum ten (10) metre buffer from the development area to the high bank of the onsite tributary of Stony Creek. This buffer was applied to preserve hollow-bearing *E.platyphylla* near the watercourse and to protect the aquatic values of the watercourse. In most cases the development is greater than ten (10) metre from the watercourse.
- Habitat connectivity around the site is currently limited and upon completion of all currently approved developments, all habitat connectivity will be disconnected.
- Marine plants were identified in the eastern extent of the assessed area lining the tributary to Stony Creek. All marine plants were located within the bed and banks of the Stony Creek tributary. Development involving the removal, distance or damage of marine plants clearing of marine plants may trigger assessable development under the *Fisheries Act 1994.*
- The proposed pump station has been positioned approximately thirty (30) metre from the watercourse to avoid riparian habitats. Higher quality microhabitats in the form of hollow-bearing trees suitable for gliders, parrots, microbats and possums have also been avoided. Adequate setback has been provided to protect the water quality and aquatic values of the watercourse. Supplementary vegetation planting between the pump station and watercourse may be undertaken for aesthetic purposes. Consideration may also be given to the use of concealing vegetation and/or built attenuation measures around the pump station to reduce impacts to residents and wildlife.

- All stormwater treatment features (i.e. constructed wetland and bioretention basins) must be located outside of the protected ten (10) metre buffer zone from the high bank of the Stoney Creek Tributary.
- Bioretention basins and the constructed wetlands should be vegetated with a variety of aquatic plant species native to the local region and consideration shall be given to the ecological requirements of the species used when locating them (i.e. suitable depth, water quality, salinity), and
- Design of bioretention basins should follow the guidance provided in the *Water Sensitive Urban Design Guidelines for the Coastal Dry Tropics – Chapter 5 Bioretention Basins* and comply with the TCC Planning Scheme Schedule 6.4.10.6 Bioretention Basins.

7 REFERENCES

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Appendix A

Mount Low Development Plans Northern Precinct (RPS 2024)

Legend

- Site boundary
- Precinct 1 & 2 Boundary
- Balance Lot / Future Development

1. Future signalised intersection. Ultimate configuration shown. The interim intersection will not include a road connection south. Note: The intersection design is based on the current North Shore Boulevard configuration, prior to duplication.
2. Future Left in /Left out intersection. Not part of this application.

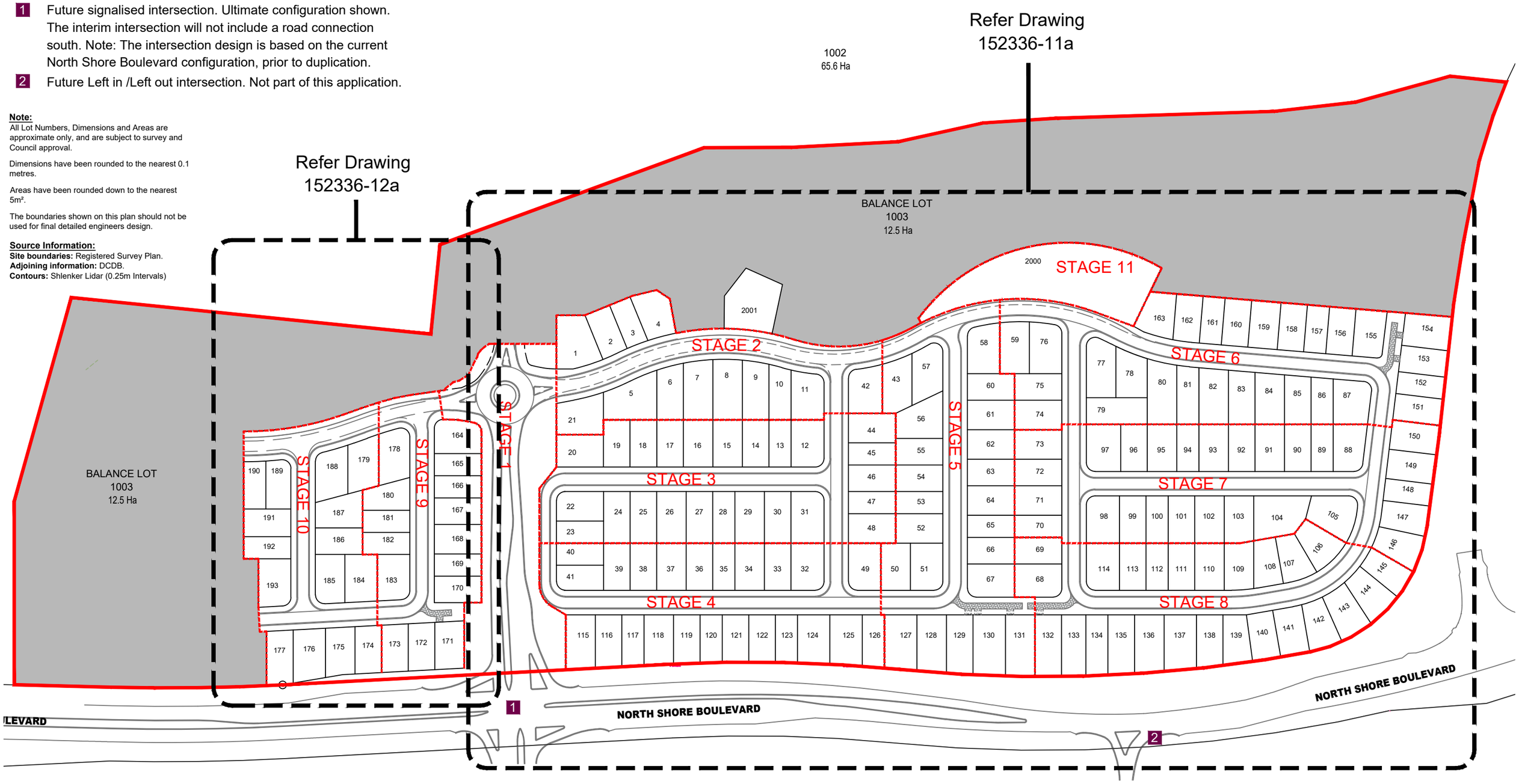
Note:
All Lot Numbers, Dimensions and Areas are approximate only, and are subject to survey and Council approval.

Dimensions have been rounded to the nearest 0.1 metres.

Areas have been rounded down to the nearest 5m².

The boundaries shown on this plan should not be used for final detailed engineers design.

Source Information:
Site boundaries: Registered Survey Plan.
Adjoining information: DCDB.
Contours: Shlenker Lidar (0.25m Intervals)



PLAN REF: 152336 – 13a
DATE: 16th MAY 2024
CLIENT: Bushland Grove Pty Ltd
DRAWN BY: MJB
CHECKED BY: MJB

0 20 40 60 80 100 120 140 1 : 2,500 @ A3

MOUNT LOW
RAL PROPOSAL PLAN
1 INTO 195 LOTS + BALANCE - CANCELLING LOT 1001 SP345441

URBAN DESIGN
Unit 1
5-7 Barlow Street
South Townsville QLD 4810
T +61 7 4724 4244
W rpsgroup.com

Lot Type	Lot Size	No.of Lots
	28m Deep	
Premium Traditional	20.0m x 28m	1
	32m Deep	
Courtyard	15.0m x 32m	25
Traditional	18.0m x 32m	41
Premium Traditional	20.0m x 32m	33
Lifestyle	22.0m x 32m	26
	35m+ Deep	
Courtyard	15.0m x 35m	7
Traditional	18.0m x 35m	13
Premium Traditional	20.0m x 35m	13
Lifestyle	22.0m x 35m	4
Total		**163**

Legend

- Site boundary
- Precinct / Stage boundary
- Watercourse
- Open space & stormwater treatment (within Balance Lot 1003)
- Small local park
- Sewer pump station lot
- Sewer pump station - 30m and 50m buffer

1. Entry statement.
2. 10-14m wide landscaped verge.
3. 2.5m shared footpath.
4. Sewer main alignment (Easement).
5. Future signalised intersection. Ultimate configuration shown. The interim intersection will not include a road connection South. Note: The intersection design is based on the current North Shore Boulevard configuration, prior to duplication
6. Future Left in /Left out intersection. Not part of this application.
7. Primary stormwater treatment area.
8. Future road connection.

Note:
All Lot Numbers, Dimensions and Areas are approximate only, and are subject to survey and Council approval.

Dimensions have been rounded to the nearest 0.1 metres.

Areas have been rounded down to the nearest 5m².

The boundaries shown on this plan should not be used for final detailed engineers design.

Source Information:
Site boundaries: Registered Survey Plan.
Adjoining information: DCDB.
Contours: Shlenker Lidar (0.25m Intervals)

PLAN REF: 152336 – 11a
DATE: 16th MAY 2024
CLIENT: Bushland Grove Pty Ltd
DRAWN BY: MJB
CHECKED BY: MJB

0 20 40 60 80 100 1 : 2,000 @ A3

MOUNT LOW
RAL PROPOSAL PLAN
1 INTO 195 LOTS + BALANCE - CANCELLING LOT 1001 SP345441

URBAN DESIGN
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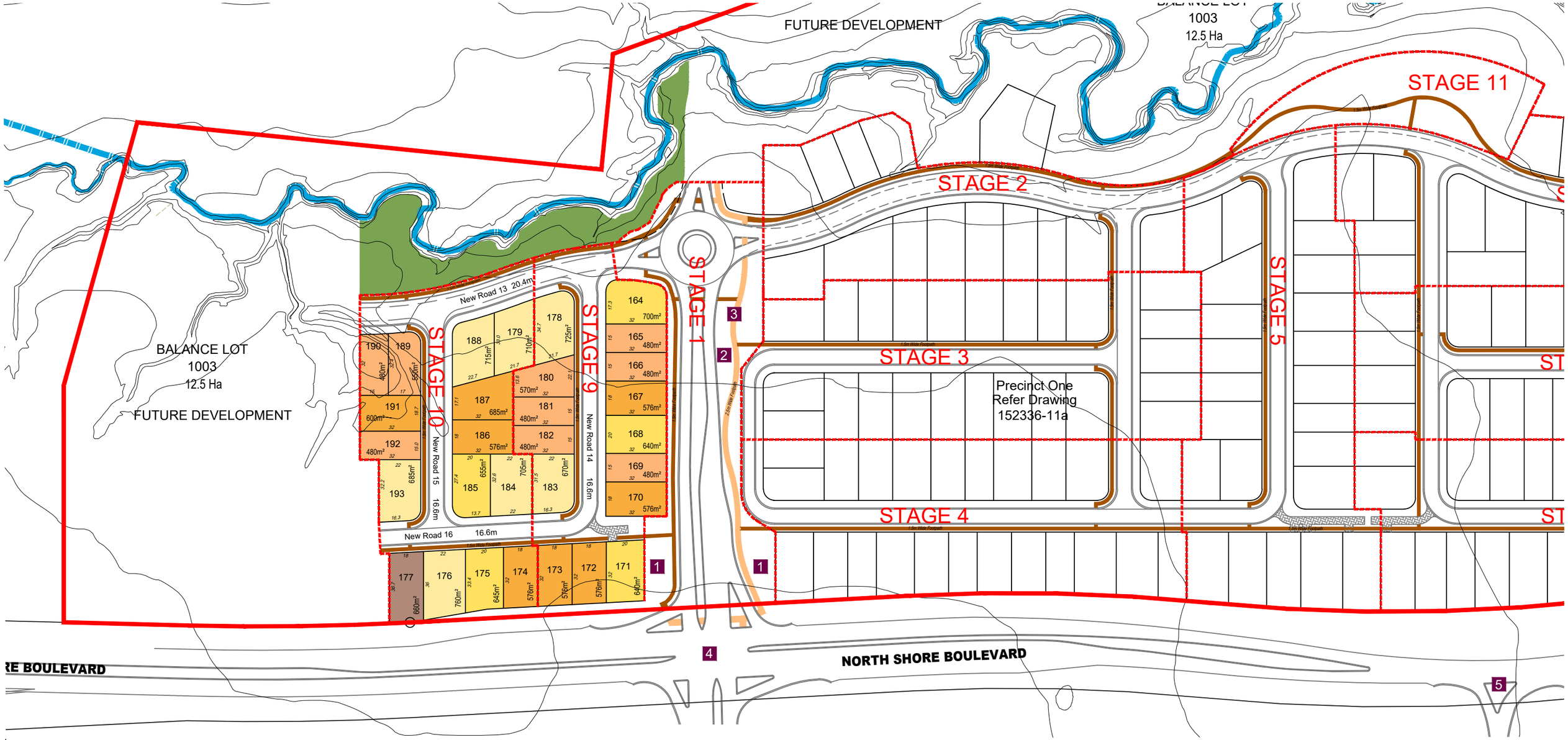


Lot Type	Lot Size	No. of Lots
	28m Deep	
Lifestyle	22m x 28m	0
	32m Deep	
Courtyard	15.0m x 32m	9
Traditional	18.0m x 32m	8
Premium Traditional	20.0m x 32m	5
Lifestyle	22.0m x 32m	7
	35m+ Deep	
Courtyard	15.0m x 35m	0
Traditional	18.0m x 35m	1
Premium Traditional	20.0m x 35m	0
Lifestyle	22.0m x 35m	0
Total		**30**

Legend

- Site boundary
- Precinct / Stage boundary
- Watercourse
- Open space & stormwater treatment (within Balance Lot 1003)
- Small local park
- Sewer pump station - 30m and 50m buffer

1. Entry statement.
2. 10-14m wide landscaped verge.
3. 2.5m shared footpath.
4. Future signalised intersection. Ultimate configuration shown. The interim intersection will not include a road connection south. Note: The intersection design is based on the current North Shore Boulevard configuration, prior to duplication.
5. Future Left in /Left out intersection. Not part of this application.

Note:
All Lot Numbers, Dimensions and Areas are approximate only, and are subject to survey and Council approval.

Dimensions have been rounded to the nearest 0.1 metres.

Areas have been rounded down to the nearest 5m².

The boundaries shown on this plan should not be used for final detailed engineers design.

Source Information:
Site boundaries: Registered Survey Plan.
Adjoining information: DCDB.
Contours: Shlenker Lidar (0.25m Intervals)

PLAN REF: 152336 – 12a
DATE: 16th MAY 2024
CLIENT: Bushland Grove Pty Ltd
DRAWN BY: MJB
CHECKED BY: MJB

0 20 40 60 80 100 1 : 2,000 @ A3

MOUNT LOW
RAL PROPOSAL PLAN
1 INTO 195 LOTS + BALANCE - CANCELLING LOT 1001 SP345441

URBAN DESIGN
Unit 1
5-7 Barlow Street
South Townsville QLD 4810
T +61 7 4724 4244
W rpsgroup.com

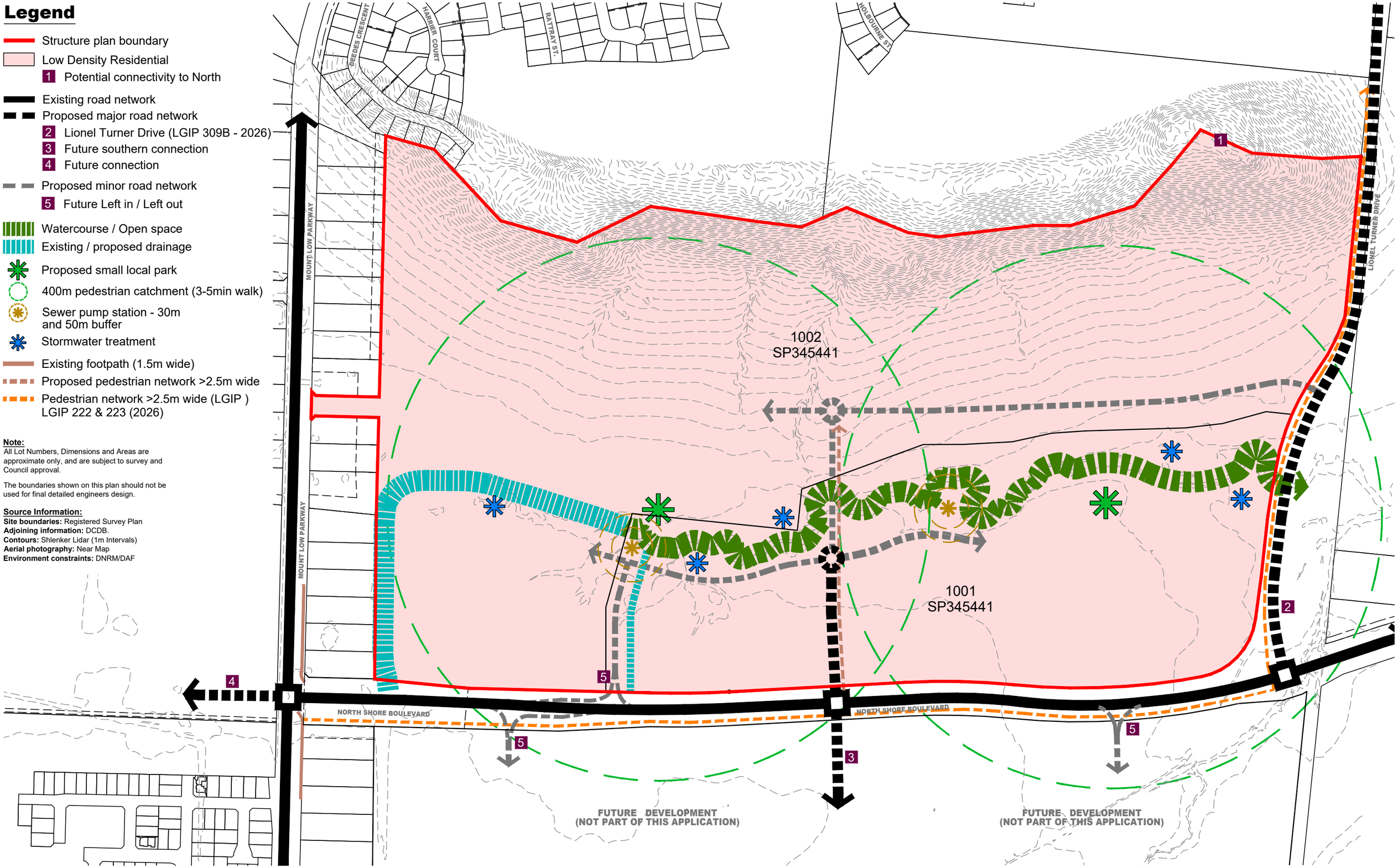
Legend

- Structure plan boundary
- Low Density Residential
  - 1 Potential connectivity to North
- Existing road network
- Proposed major road network
  - 2 Lionel Turner Drive (LGIP 309B - 2026)
  - 3 Future southern connection
  - 4 Future connection
- Proposed minor road network
  - 5 Future Left in / Left out
- Watercourse / Open space
- Existing / proposed drainage
- Proposed small local park
- 400m pedestrian catchment (3-5min walk)
- Sewer pump station - 30m and 50m buffer
- Stormwater treatment
- Existing footpath (1.5m wide)
- Proposed pedestrian network >2.5m wide
- Pedestrian network >2.5m wide (LGIP) LGIP 222 & 223 (2026)

Note:
All Lot Numbers, Dimensions and Areas are approximate only, and are subject to survey and Council approval.

The boundaries shown on this plan should not be used for final detailed engineers design.

Source Information:
Site boundaries: Registered Survey Plan
Adjoining information: DCDB.
Contours: Shlenker Lidar (1m Intervals)
Aerial photography: Near Map
Environment constraints: DNRM/DAF



PLAN REF: 152336 – 09b
DATE: 16th MAY 2024
CLIENT: Bushland Grove Pty Ltd
DRAWN BY: MJB
CHECKED BY: MJB

0 50 100 150 200 250 1 : 5,000 @ A3

MOUNT LOW
STRUCTURE PLAN
EXISTING LOT 1001 & 1002 SP345441

URBAN DESIGN
Unit 1
5-7 Barlow Street
South Townsville QLD 4810
T +61 7 4724 4244
W rpsgroup.com

Appendix B

WildNet Search Results

Queensland Government

WildNet species list

Search Criteria: Species List for a Specified Point
Species: All
Type: All
Queensland status: Rare and threatened species
Records: All
Date: All
Latitude: -19.2171
Longitude: 146.6753
Distance: 5
Email: lochlan@terrasolutions.com.au
Date submitted: Tuesday 16 Jul 2024 13:16:25
Date extracted: Tuesday 16 Jul 2024 13:20:03

The number of records retrieved = 12

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Apodidae	*Hirundapus caudacutus*	white-throated needletail		V	V	1
animals	birds	Burhinidae	*Esacus magnirostris*	beach stone-curlew		V		18
animals	birds	Charadriidae	*Charadrius leschenaultii*	greater sand plover		V	V	78
animals	birds	Charadriidae	*Charadrius mongolus*	lesser sand plover		E	E	48
animals	birds	Rostratulidae	*Rostratula australis*	Australian painted-snipe		E	E	1
animals	birds	Scolopacidae	*Calidris canutus*	red knot		E	V	20
animals	birds	Scolopacidae	*Calidris ferruginea*	curlew sandpiper		CR	CE	7
animals	birds	Scolopacidae	*Calidris tenuirostris*	great knot		CR	V	91
animals	birds	Scolopacidae	*Limosa lapponica baueri*	Western Alaskan bar-tailed godwit		V	E	156
animals	birds	Scolopacidae	*Numenius madagascariensis*	eastern curlew		E	CE	189
animals	mammals	Delphinidae	*Orcaella heinsohni*	Australian snubfin dolphin		V		5/4
animals	reptiles	Crocodylidae	*Crocodylus porosus*	estuarine crocodile		V		3

CODES

I - Y indicates that the taxon is introduced to Queensland and has naturalised.

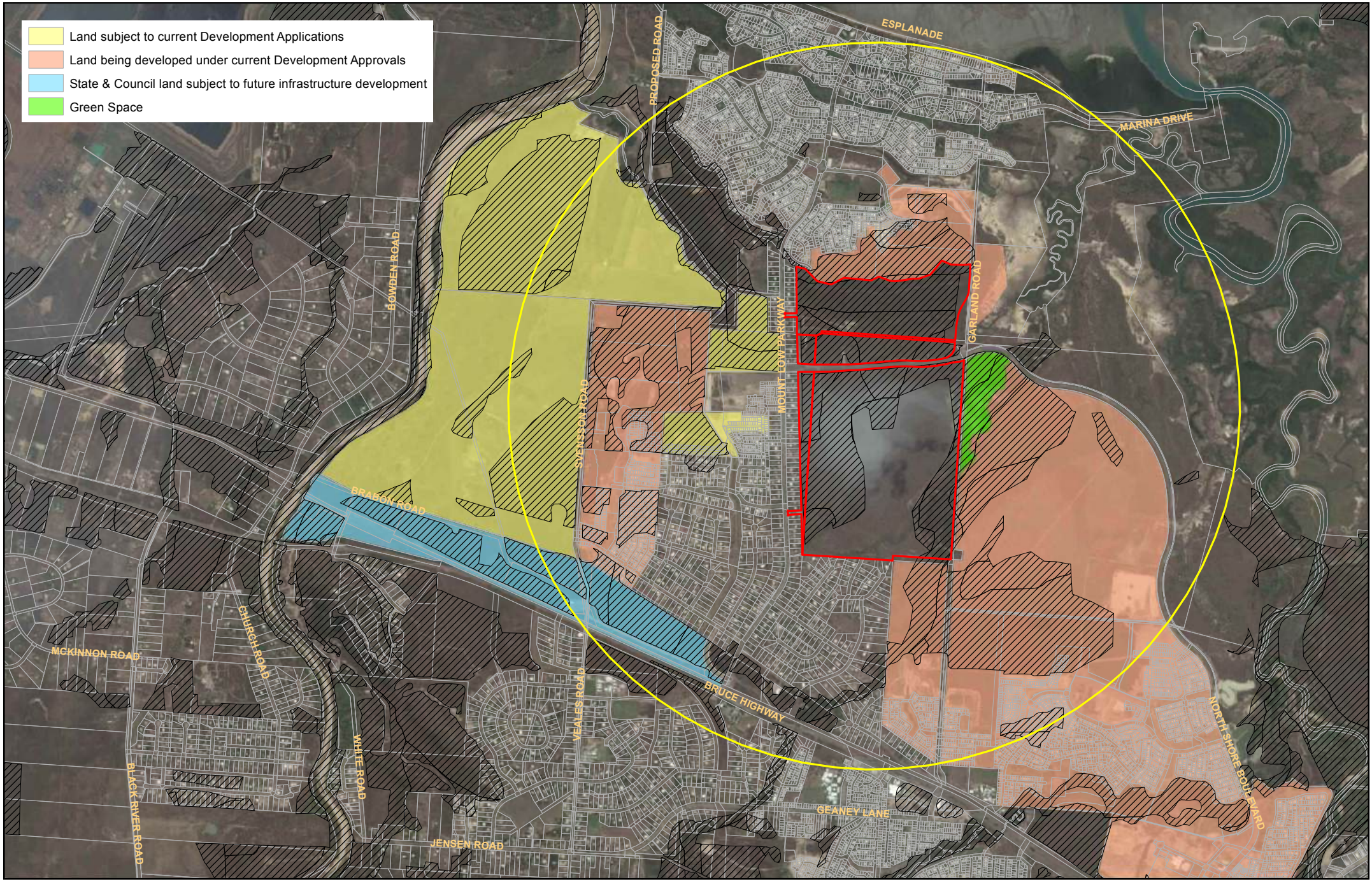
Q - Indicates the Queensland conservation status of each taxon under the *Nature Conservation Act 1992.*
The codes are Extinct (EX), Extinct in the Wild (PE), Critically Endangered (CR), Endangered (E), Vulnerable (V), Near Threatened (NT), Special Least Concern (SL) and Least Concern (C).

A - Indicates the Australian conservation status of each taxon under the *Environment Protection and Biodiversity Conservation Act 1999.*
The values of EPBC are Extinct (EX), Extinct in the Wild (XW), Critically Endangered (CE), Endangered (E), Vulnerable (V) and Conservation Dependent (CD).

Records - The first number indicates the total number of records of the taxon (wildlife records and species listings for selected areas).
This number is output as 99999 if it equals or exceeds this value. A second number located after a / indicates the number of specimen records for the taxon.
This number is output as 999 if it equals or exceeds this value.

Appendix C

Known & Potential Land Use Changes



austecology

Source:	Aerial Photography: Bing maps Aerial (c) 2010 Microsoft Corporation and its data suppliers. DCDB: QGIS 2014 Watercourses: DERM 2013 Landuse: Austecology 2014 Remnant Vegetation: Vegetation management regional ecosystem and remnant map - version 8.0 coastal 2014
Disclaimer:	No warranty is given in relation to the data (including accuracy, reliability, completeness, currency or suitability) and no liability is accepted (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for direct marketing or be used in breach of the privacy laws.
File:	File: Mt-Low-Figure-3-2-Known-Potential-Land-Use-Changes-140629 Date: 29/06/2014

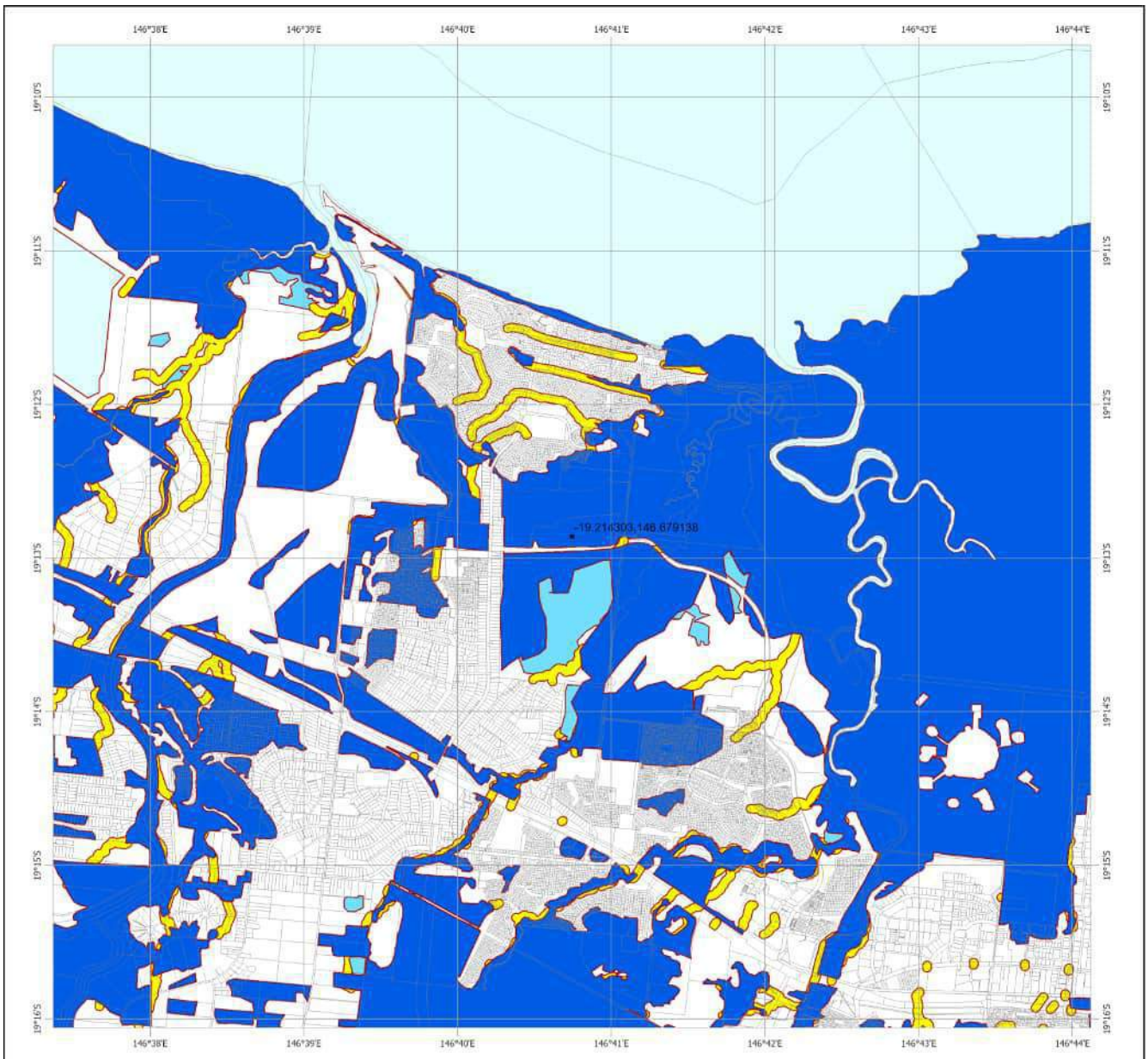
0 400 800 1,200 1,600 2,000
Metres
A4 Scale 1:40,000
Coordinate System: MGA56 Projection: Transverse Mercator

Subject Site
Area of 3km radius from centre of site
Mapped Remnant Vegetation (DERM v8; 2014)

Figure 3-2:
Known and Potential Land Use Changes - Surrounding Area

Appendix D

Regulated Vegetation Management Maps



Regulated Vegetation Management Map

- Category A area (Vegetation offsets/compliance notices/VDecs)
- Category B area (Remnant vegetation)
- Category C area (High-value regrowth vegetation)
- Category R area (Reef regrowth watercourse vegetation)
- Category X area (Exempt clearing work on Freehold, Indigenous and Leasehold land)
- Water
- Other land parcel boundaries
- Coordinates

N

0 675 1,350 2,025 2,700 3,375 m

This product is displayed in:
GDA2020

Disclaimer:
While every care is taken to ensure the accuracy of this product, the Department of Resources makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which you might incur as a result of the product being inaccurate or incomplete in any way and for any reason.

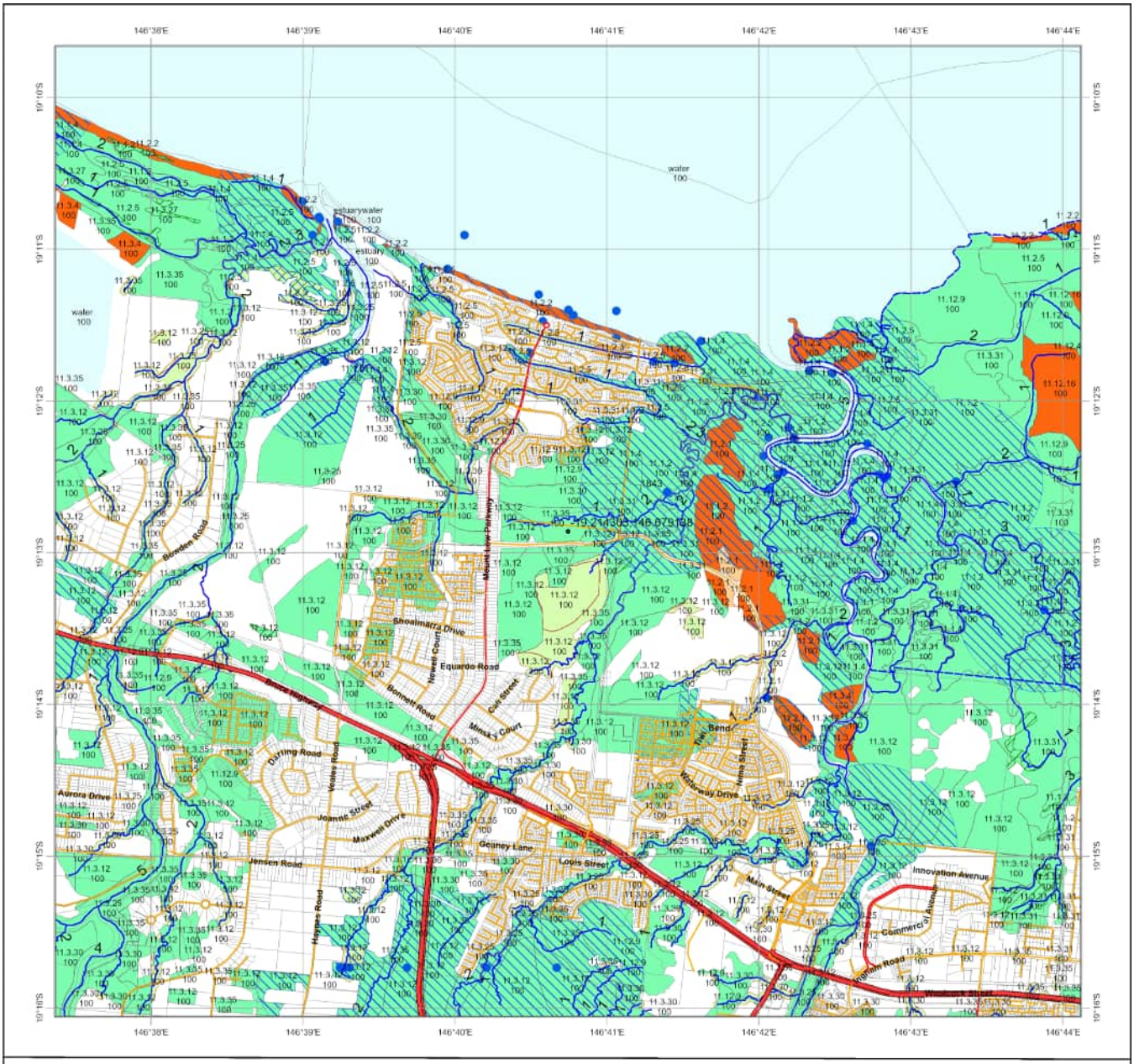
Additional information required for the assessment of vegetation values is provided in the accompanying "Vegetation Management Supporting map". For further information go to the web site: www.resources.qld.gov.au or contact the Department of Resources.

Digital data for the regulated vegetation management map is available from the Queensland Spatial Portal at http://www.information.qld.gov.au/

Land parcel boundaries are provided as locational aid only.

This map is updated on a monthly basis to ensure new PMAVs are included as they are approved.

Queensland Government

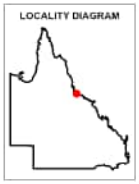


Vegetation Management Supporting Map

- Category A or B area containing endangered regional ecosystems
- Category A or B area containing of concern regional ecosystems
- Category A or B area that is a least concern regional ecosystem
- Category C or R area containing endangered regional ecosystems
- Category C or R area containing of concern regional ecosystems
- Category C or R area that is a least concern regional ecosystem
- Category X area
- Water
- Wetland on the vegetation management wetlands map
- Essential habitat on the essential habitat map
- Essential habitat species record
- Watercourses and drainage features on the vegetation management watercourse and drainage features map (Stream order shown as black number against stream where available)
- Highway
- Connector
- Street/Local Road
- National Parks, State Forest and other reserves
- Other land parcel boundaries
- Coordinates

Queensland Government

LOCALITY DIAGRAM



N

0 480 960 1,440 1,920 2,400 m

This product is displayed in: GDA2020

Labels for Essential Habitat are centred on the area of enquiry.

Regional ecosystem linework has been compiled at a scale of 1:100 000, except in designated areas where a compilation scale of 1:50 000 is available. Linework should be used as a guide only. The positional accuracy of RE data mapped at a scale of 1:100 000 is +/- 100 metres.

Disclaimer:
While every care is taken to ensure the accuracy of this product, the Department of Resources makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which you might incur as a result of the product being inaccurate or incomplete in any way and for any reason.

Additional information may be required for the purposes of land clearing or assessment of a regional ecosystem map or PMAV applications. For further information go to the web site: www.resources.qld.gov.au or contact the Department of Resources.

Digital data for the vegetation management watercourse and drainage feature map, vegetation management wetlands map, essential habitat map and the vegetation management remnant and regional ecosystem map are available from the Queensland Spatial Portal at http://www.information.qld.gov.au/

Land parcel boundaries are provided as locational aid only.

Vegetation Management Act 1999 - Extract from the essential habitat database

Essential habitat is required for assessment under the:

- State Development Assessment Provisions - State Code 16: Native vegetation clearing which sets out the matters of interest to the state for development assessment under the *Planning Act 2016*; and
- Accepted development vegetation clearing codes made under the *Vegetation Management Act 1999*

Essential habitat for one or more of the following species is found on and within 1.1 km of the identified subject lot/s on the accompanying essential habitat map.

This report identifies essential habitat in Category A, B and Category C areas.

The numeric labels on the essential habitat map can be cross referenced with the database below to determine which essential habitat factors might exist for a particular species.

Essential habitat is compiled from a combination of species habitat models and buffered species records.

The Department of Resources website http://www.resources.qld.gov.au has more information on how the layer is applied under the State Development Assessment Provisions - State Code 16: Native vegetation clearing and the *Vegetation Management Act 1999*.

Regional ecosystem is a mandatory essential habitat factor, unless otherwise stated.

Essential habitat, for protected wildlife, means a category A area, a category B area or category C area shown on the regulated vegetation management map-

1. that has at least 3 essential habitat factors for the protected wildlife that must include any essential habitat factors that are stated as mandatory for the protected wildlife in the essential habitat database; or
2. in which the protected wildlife, at any stage of its life cycle, is located.

Protected wildlife includes critically endangered, endangered, vulnerable or near-threatened native wildlife prescribed under the *Nature Conservation Act 1992*.

Essential habitat in Category A and/or Category B and/or Category C

Label	Scientific Name	Common Name	NCA Status	Vegetation Community	Altitude	Soils	Position in Landscape
1843	Numenius madagascariensis	eastern curlew	E	Foraging on soft, intertidal mudflat, with a preference for broad flats, often in sheltered areas near mangroves and estuaries/creeks, also on sandflats and occasionally ocean beaches, rock platforms and coral reefs. Roost on saltflat, saltmarsh, mangroves, reef flat, sandy spits and grassland near water.	Sea level to 100m.	Sand, sandy mud and mud substrates.	Associated with coastlines and wetlands.

Label	Regional Ecosystem (mandatory unless otherwise specified)
1843	2.1.1, 2.1.2, 2.1.3, 2.1.4, 2.1.5, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 7.1.1, 7.1.2, 7.1.3, 8.1.1, 8.1.2, 8.1.3, 8.1.4, 11.1.1, 11.1.2, 11.1.3, 11.1.4, 12.1.2, 12.1.3

Appendix E

Hillshade Analysis (QLD Globe 2022)

A product of Queensland Globe

19°12'18"S 146°40'8"E

19°12'18"S 146°41'15"E

Legend located on next page

N

0 250 metres

Scale: 1:10000

Printed at: A4

Print date: 27/10/2022

Projection: Web Mercator EPSG 102100 (3857)

For more information, visit https://qldglobe.information.qld.gov.au/help-info/Contact-us.html

Queensland Government
Department of Resources

19°13'10"S 146°40'8"E

19°13'10"S 146°41'15"E

Legend

Coastline

Coastline

Lake

Lake

Reservoir

Reservoir

Canal line

Canal

Canal area

Canal area

Watercourse line

Major - perennial

Major - non perennial

Minor - perennial

Minor - non perennial

Watercourse area

Watercourse area

Water area edge

Watercourse stream order

Land parcel

Parcel

Land parcel - gt 1 ha

Parcel

Land parcel - gt 10 ha

Parcel

Land parcel - gt 1000 ha

Parcel

Places: Search Results

93SP222103

Places: Land parcel

92SP282784

Cities and Towns

Road Crossing

Bridge

Tunnel

Railway

Road

Highway

Main

Local

Private

Attribution

Maxar

Appendix F

TCC Natural Assets Overlay Code

Table 5: TCC Natural Assets Overlay Code

Performance Outcomes	Acceptable Outcomes	Response
Protection of Biodiversity Values & Ecological Processes		
PO1 In areas identified as having high or very high environmental importance, significant values are protected and associated ecological functions and biophysical processes are maintained to ensure long term viability. **Editor's note—**Applicants should also refer to other state and federal legislation which may also require applicants to obtain additional approvals.	No acceptable outcome is nominated. **Editor's note**—Natural assets planning scheme policy no. SC6.9 provides information on the primary attributes included in very high, high and medium environmental importance areas. The overlay map has been produced using local government area wide data. Site-specific investigation will be required to confirm the extent and nature of values indicated on the overlay map or otherwise identify site-specific natural assets and ecological functions.	**A performance outcome is sought for PO1.** Areas listed as very high environmental value have been remapped or require removal. Essential habitat for eastern curlew is mapped in the east of the site but no suitable habitat is present. Approximately 1.27 ha of RE 11.3.35 is located on a prior stream or levee and classified as an area of 'very high' environmental importance under the TCC Planning Scheme (Section 5). If this area cannot be reasonably avoided, we recommend enhancing an equivalent area (where possible) within the Open space and stormwater treatment area (within Balance Lot 1003) (refer Appendix A). This enhancement may take the form of supplementary planting with species including Corymbia tessellaris, C. clarksoniana and Eucalyptus platyphylla. A current watercourse passes through the northern extent of the site. A minimum 10 m development buffer should be applied to this watercourse. The remainder of the site is listed as having high environmental value. The habitat was listed as important for the BTF. While the site contains potential nesting habitat and water sources, it lacks sufficient grass diversity to be deemed habitat under typical modelling protocols for the species. There have been no sightings of BTF since 2010 in the broader area and prior to that there were only sightings in 2005. There have been no records of the species within the project area. The listing as high environmental importance in this area is questionable based on current and historical assessment of the site. Notwithstanding it is recommended that areas associated with Stony Creek are retained for the purposes of habitat connectivity.

Performance Outcomes	Acceptable Outcomes	Response
PO2 In areas identified as having medium environmental importance, development is located, designed and operated to: a. retain and protect significant values; and b. maintain the underlying ecological functions and biophysical processes. **Editor's note—**Applicants should also refer to other state and federal legislation which may also require applicants to obtain additional approvals.	No acceptable outcome is nominated. **Editor's note—**This category of environmental importance will also require a high level of investigation as part of any development application, to determine on the ground values and priority for protection. A detailed environmental assessment is to be undertaken by applicants in accordance with the guidance provided in the Natural assets planning scheme policy no. SC6.9.	**A performance outcome is sought for PO2.** Significant values on the site are primarily associated with the riparian habitat of the Stony Creek tributary. The tributary is a small ephemeral watercourse of up to 3 m wide with limited instream habitat. These values will be protected through provision of a 10 m non-development buffer to either side of the watercourse. Further protection of the non-development buffer will be achieved by applying low-impact development between 10 – 25 m of the watercourse high bank such as ecological sensitive greenspaces such as parks, vegetated stormwater management basins and walking paths.
PO3 Degraded areas with significant ecological and environmental values or important to the maintenance of underlying ecological functions and biophysical processes required to maintain biodiversity and ecosystem services are rehabilitated as near as is practical to the naturally occurring suite of native plant species and ecological communities	No acceptable outcome is nominated. **Editor's note—**A rehabilitation plan supported by expert ecological advice prepared in accordance with Natural assets planning scheme policy no. SC6.9 will assist in demonstrating achievement of this performance outcome.	**A performance outcome is sought for PO3.** High value riparian area associated with the Stony Creek tributary along the northern extent of the study area is presently in good condition. This area supports the highest floral diversity on the site, contains tree hollows suitable for a variety of species and holds water resources suitable for fauna hydration. Provided that suitable clearing and development practices are applied, and minimum 10 m development buffers are maintained, the ecological processes associated with this area will be maintained without any significant rehabilitation requirements.
Significant species and ecological communities		
PO4 Development avoids direct and indirect impacts on significant ecological communities and significant species and their habitats, including disturbance from the presence of vehicles, pedestrian use, increased exposure to domestic animals and noise and lighting impacts.	No acceptable outcome is nominated. **Editor's note—**Applications for development should identify any significant species or communities that may be affected by the proposal. A detailed environmental assessment is to be undertaken by applicants in accordance with the guidance provided in the Natural assets planning scheme policy no. SC6.9.	**A performance outcome is sought for PO4.** As detailed in several ecological investigations for the site and surrounds, no significant ecological communities or species are known to occur on the site. Impacts to fauna more generally shall be limited by the implementation of best practice clearing methodology and the

Performance Outcomes	Acceptable Outcomes	Response
Editor's note—Significant species and ecological communities include those identified in the Natural assets planning scheme policy no. SC6.9		engagement of a Department of Environment and Science qualified fauna spotter catcher. The application of a low-impact development buffer between 10 – 25 m of the high bank will further protect the habitat values of the tributary to Stony Creek from indirect impacts associated with the residential development.
PO5 Areas of habitat that support a critical life cycle stage such as feeding, breeding or roosting or ecological function for threatened species, ecological communities or migratory species are not impacted by development.	No acceptable outcome is nominated.	**A performance outcome is sought for PO5.** While the site contains potential nesting habitat and water resources for the BTF, there is no suitable foraging grass resource present. Furthermore, there have been no sightings since 2010 within the broader area. The BTF is not considered likely to utilise the site. High value riparian vegetation lines the Stony Creek tributary in the northern extent of the study area. The Stony Creek tributary supports increased floral diversity, supporting many tree hollows. It is recommended that 10 m either side of the bank is preserved to maintain these areas and where possible all trees with hollows are retained.
Buffering & Edge Impacts		
PO6 Development provides a vegetated buffer to an area of significant ecological or environmental value, in order to: a. protect core habitat areas from threatening processes; b. maintain connectivity or support linkages; c. reduce threats to the environmental values from non-native or pest fauna or flora; and	**AO6** A buffer extending from the outside edge of a declared fish habitat area (measured from highest astronomical tide (HAT)) has a minimum width of 100m. For other areas, no acceptable outcome is nominated. **Editor's note—**Areas which are expected to constitute core habitat as well as declared fish habitat areas are identified on maps contained in the Natural assets planning scheme policy no. SC6.9. Declared fish habitat areas may also be	**Development complies with AO6.** No fish habitat areas are located within 100 m of the site.

Performance Outcomes	Acceptable Outcomes	Response
d. avoid undesirable microclimate effects. Any setbacks or other areas required for bushfire management, safety, recreation, maintenance or any other purpose, are provided in addition to a vegetated buffer provided for ecological and environmental protection purposes.	obtained from the relevant state agency. Buffers for significant species and ecological communities, including areas of habitat for listed threatened and migratory species, should be based on best practice and current scientific knowledge of individual species requirements and supported by an environmental assessment prepared in accordance with the Natural assets planning scheme policy no. SC6.9. Other legislation, including the *Nature Conservation Act* and *Environment Protection and Biodiversity Conservation Act* may establish other requirements with which applicants must comply.	
PO7 Buffering, rehabilitation or restoration: a. uses site appropriate or endemic native vegetation; b. replicates as far as practicable, the species composition and structural components of healthy remnant native vegetation and associated habitats, including understorey vegetation; and c. excludes declared plants, environmental weeds and other non-native plants likely to displace native flora species or degrade habitat	No acceptable outcome is nominated. **Editor's note—**A site-based management and rehabilitation plan prepared in accordance with the Natural assets planning scheme policy no. SC6.9 will assist in demonstrating achievement of this performance outcome.	**A performance outcome is sought for PO7.** Site rehabilitation is unlikely to be necessary provided that basic clearing, civil works and development practices are applied, and that the minimum 10 m non-development zone is applied to onsite watercourses. Where onsite restoration of vegetation is required, the composition will align with Regional Ecosystem 11.3.35. All areas consisting of RE 11.3.12 are likely to be cleared and developed.
PO8 Pest species are prevented from encroaching into ecologically significant areas.	No acceptable outcome is nominated. **Editor's note—**A site-based management and rehabilitation plan prepared in accordance with the Natural assets planning scheme policy no. SC6.9 will assist in demonstrating achievement of this performance outcome.	**A performance outcome is sought for PO8.** The following management measures will be implemented during construction: ▪ Minimise vegetation and soil disturbance to the minimum area of development

Performance Outcomes	Acceptable Outcomes	Response
		▪ Mulch and revegetation any temporarily disturbed areas ▪ Prior to entering all vehicles and equipment involved in clearing and weed removal works should be cleaned down to remove soil and plant material to prevent spreading of soil borne disease and weed seeds or plant material. ▪ Materials (e.g., gravel and sand) brought on to site will be obtained from weed-free sources. ▪ Control key listed weed species in accordance with Department of Agriculture and Fisheries fact sheets. ▪ Monitor disturbed areas for new weed establishment and undertake control of key weed species. ▪ All vehicles, machinery and equipment obtained from Fire Ant, Yellow Crazy Ant or Electric Ant regions are to be washed down and inspected prior to entering the project area. ▪ Ensure all bins are covered and waste is removed from site in a timely manner. ▪ Ensure site offices and other fixtures are rodent-proof as far as practicable. ▪ Regularly inspect the site and buildings for the presence of vermin. ▪ Any pest control work on site will be carried out by a professional pest control organisation, either from the local authority environmental health department, or from a pest control company which is a member of a recognised trade body.
PO9 During construction and operation of development, measures are implemented to prevent light, noise, visual and other disturbances.	No acceptable outcome is nominated. **Editor's note—**A site-based management and rehabilitation plan prepared in accordance with the Natural assets planning scheme policy no. SC6.9 will assist in demonstrating achievement of this performance outcome.	**A performance outcome is sought for PO9.** Measures to prevent disturbances include: ▪ Night and outdoor lighting is designed, constructed and operated in accordance with Australian Standard AS4282 – Control of the obtrusive effects of outdoor lighting. ▪ Liaise with/notify residents of work and intended construction times and the potential for increased noise levels during the works.

Performance Outcomes	Acceptable Outcomes	Response
		▪ Adhere to speed limits on across. ▪ Adhere to approved hours. ▪ No unnecessary use of horns or other audible signals on mobile plant or equipment. ▪ No unnecessary revving or idling of engines on mobile and stationary machines and shut down any equipment not in use. ▪ Keep equipment well maintained to limit noise emissions. ▪ Inform neighbours prior to creating excessive noise. ▪ Schedule noisy activities that could cause vibration during times that will cause the public the least disturbance (e.g., middle of the day when most individuals are at work).
Ecological Corridors & Habitat Connectivity		
PO10 Significant ecological corridors and habitat linkages are protected and have dimensions and characteristics to support: A. ecological processes and functions that enable the natural change in distributions of species and provide connectivity between populations of species over long periods of time; B. ecological responses to climate change; C. connectivity between large tracts and patches of remnant vegetation and habitat areas; and D. effective and unhindered day-to-day and seasonal movement of avian, terrestrial and aquatic fauna.	No acceptable outcome is nominated where in an urban residential zone or centre zone. In all other zones (including the Emerging community zone, Rural residential zone or industry zones): **AO10** Major ecological corridors identified on Figure SC6.9.3 in the Natural assets planning scheme policy no. SC6.9 are maintained and restored to achieve a minimum width of 350 m, consisting of: A. a 250 m wide core corridor to support avian species and most arboreal mammals; and B. a 50 m wide vegetated buffer extending from the outside edges on both sides of the core corridor.	**A performance outcome is sought for PO10.** No major ecological corridors are mapped within 350 m of the site.

Performance Outcomes	Acceptable Outcomes	Response
	No acceptable outcome is nominated for the great eastern ranges conservation corridor identified on Figure SC6.9.3 in the Natural assets planning scheme policy no SC6.9.	
PO11 Corridors and linkages are provided to supplement and create additional ecological corridors and habitat linkages along waterways, drainage lines, ridgelines, coastlines and other areas where possible.	No acceptable outcome is nominated.	**A performance outcome is sought for PO11.** A minimum 20 m corridor (i.e., minimum 10 m development free zone from each high bank) is proposed along the Stony Creek tributary to the north of the site and any other watercourses present.
PO12 Development facilitates unimpeded use and movement of terrestrial and aquatic fauna that are associated with or are likely to use an ecological corridor as part of their normal life cycle by: A. ensuring development, including roads, pedestrian access and in-stream structures, does not create barriers to the movement of fauna along or within ecological corridors; B. providing effective wildlife management infrastructure to direct fauna to locations where wildlife movement infrastructure has been provided to enable fauna to safely negotiate a development area; and C. separating fauna from potential hazards through the use of appropriate barriers and buffers.	No acceptable outcome is nominated.	**A performance outcome is sought for PO12.** A minimum 20 m corridor (I.e. minimum 10 m development free zone on each side of the watercourse) is proposed along the Stony Creek tributary to the north of the site and any other watercourses present. Road crossings and culverts shall be designed in accordance with the acceptable outcomes of the Fisheries Act to ensure free movement of fish.

Performance Outcomes	Acceptable Outcomes	Response
Riparian & Buffer Area Management for Wetlands & Waterways		
PO13 Development locates outside of, and does not impact on wetlands, to ensure long-term ecological function.	**AO13** Development, including any associated filling or excavation (other than restorative works) is located outside of any mapped, defined or identified boundary of a wetland and its associated buffer. **Editor's Note—**Natural assets planning scheme policy no. SC6.9 contains Figure SC6.9.2 which identifies wetland areas. This information may also be obtained from the relevant state agency.	**Development complies with AO13.** A Wetland of High Ecological Significance (HES) is located approximately 280 m south-east of the south-eastern extent of the assessment area and the associated wetland protection area intersects around one third of the assessment area. The HES wetland is hydraulically upgradient of the site and within the catchment associated with the upper reaches of Stony Creek. This HES wetland would not be impacted by development in the assessment area and connectivity has been disrupted by the construction of North Shore Boulevard. The site is not located within 50 m of the wetland and therefore the development complies with the applicable buffer for urban areas.
PO14 Development provides a buffer to a wetland area to: a. protect or enhance habitat values, connectivity and other ecological functions and values; b. protect water quality and aquatic conditions; c. maintain natural micro-climatic conditions; d. maintain natural hydrological processes; e. prevent mass movement, gully erosion, rill erosion, sheet erosion, tunnel erosion, stream bank erosion, wind erosion, or scalding; and	**AO14** A development-free buffer is provided and maintained with a minimum width of: a. for wetlands designated as high ecological significance (HES) by the Queensland Government: i. 50 m from the outermost part of the wetland where located in an urban area; or ii. 200 m from the outermost part of the wetland where located in a non-urban area; or b. for other wetlands: 50 m from the outermost part of the wetland in either urban or non-urban areas. **Editor's note—**Natural assets planning scheme policy no. SC6.9 contains Figure SC6.9.2 which identifies wetland areas. This information may also	**Development complies with AO14a.** A Wetland of High Ecological Significance (HES) is located approximately 280 m south-east of the south-eastern extent of the assessment area and the associated wetland protection area intersects around one third of the assessment area. The HES wetland is hydraulically upgradient of the site and within the catchment associated with the upper reaches of Stony Creek. This HES wetland would not be impacted by development in the assessment area and connectivity has been somewhat disrupted by the construction of North Shore Boulevard. The site is not located within 50 m of the wetland.

Performance Outcomes	Acceptable Outcomes	Response
f. avoid loss or modification of chemical, physical or biological properties or functions of soil. Any setbacks or other areas required for bushfire management, safety, recreation, maintenance or any other purpose, are provided in addition to a vegetated buffer provided for ecological purposes.	be obtained from the relevant state agency. **Editor's note—**To avoid conflict, where a development requires multiple buffers to be established by this code to protect watercourses, corridors, wetlands or core habitat, the greatest distances required by this code will prevail to the extent of any inconsistency.	
PO15 Development (including operation) and construction maintains or enhances the natural hydrological regime of wetlands, including surface and ground waters. **Editor's note—**The hydrological regime of surface waters includes: i. peak flows; ii. volume of flows; iii. duration of flows; iv. frequency of flows; v. seasonability of flows; vi. water depth (seasonal average); and vii. wetting and drying cycle.	**AO15.1** Development does not change the existing surface hydrological regime of a wetland including through channelisation, redirection or interruption of flows.	To be provided
	AO15.2 There is no change to the reference duration high-flow and low-flow duration frequency curves, low-flow spells frequency curve and mean annual flow to and from the wetland.	To be provided
	AO15.3 Any relevant stream flows into the wetland comply with relevant environmental flow objectives.	To be provided
	AO15.4 The water table and hydrostatic pressure in the wetland is either: a. returned to its natural state; or b. not lowered or raised outside the bounds of variability under existing pre-development conditions.	To be provided
	AO15.5 Development does not result in the ingress of saline water into freshwater aquifers.	To be provided

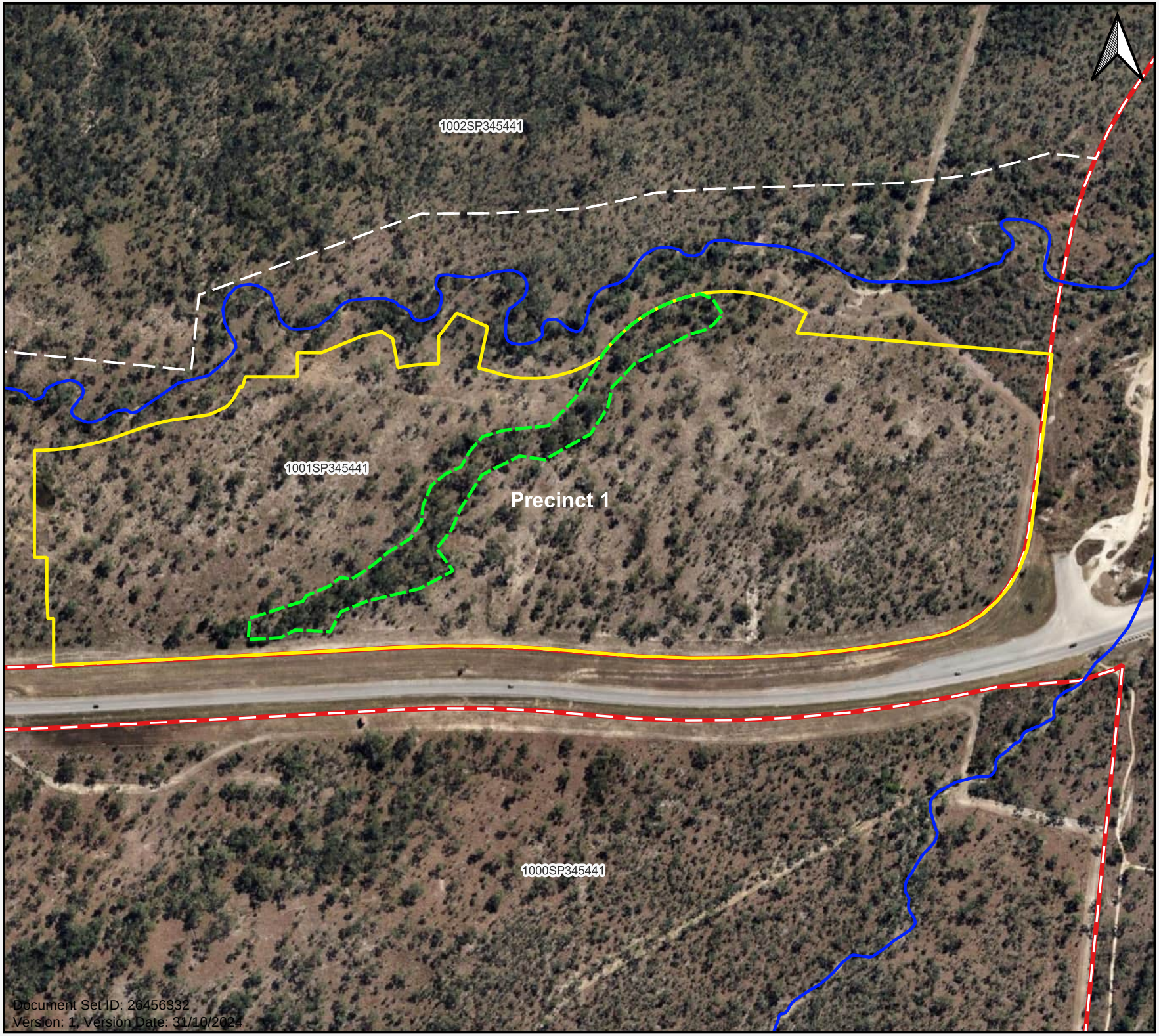
Performance Outcomes	Acceptable Outcomes	Response
PO16 Development provides a buffer to a waterway, in order to: a. protect or enhance habitat values, connectivity and other ecological processes and values; b. protect water quality and aquatic conditions; c. maintain natural micro-climatic conditions; d. maintain natural hydrological processes; e. prevent mass movement, gully erosion, rill erosion, sheet erosion, tunnel erosion, stream bank erosion, wind erosion, or scalding; and f. prevent loss or modification of chemical, physical or biological properties or functions of soil. Any setbacks or other areas required for bushfire management, safety, recreation, maintenance or any other purpose, are provided in addition to a vegetated buffer provided for ecological purposes.	No acceptable outcome is nominated where in an urban residential zone or centre zone. Elsewhere (including the Emerging community zone, Rural residential zone or industry zones): **AO16** Other than where cropping for forestry for wood production, a development-free buffer is provided and maintained, extending from top of the bank of a waterway and with a minimum width of: a. where in the Wet Tropics bioregion: i. stream order 1 to 4: 25 m; or ii. stream order 5 and above: 50 m; OR b. in all other regions (Brigalow Belt North Bioregion or the Einasleigh Uplands Bioregion): i. stream order 1 or 2: 25 m; or ii. stream order 3 or 4: 50 m; or iii. stream order 5 and above: 100 m; **Editor's note—**Natural assets planning scheme policy no. SC6.9 contains Figure SC6.9.1 which identifies stream orders and bioregions. This information may also be obtained from the relevant state agency. **Editor's note—** Where a development requires multiple buffers to be established by this code to protect watercourses, corridors, wetlands or core habitat, the greatest distances required by this code will prevail to the extent of any inconsistency.	**A performance outcome is sought for PO16.** Stony Creek tributary is a stream order one, which according to AO16, a development-free buffer is recommended with a minimum width of 25 meters. The site assessment confirmed that the key ecological values associated with this small drainage line were located within 10 m of the high bank of the watercourse. Key ecological values included the presence of pools within the watercourse and tree hollows which were primarily associated with *E. platyphylla*. The retention of these values within 10 m of the watercourse high bank is considered sufficient to protect ecological processes, water quality, microclimatic conditions and soil stability associated with the watercourse. As such the proponent seeks a minimum 10 m development free buffer associated with this watercourse.

Performance Outcomes	Acceptable Outcomes	Response
Ongoing Management, Construction & Operation		
PO17 During construction and operation of development, ongoing management, monitoring and maintenance is undertaken to ensure impacts on significant ecological areas, underlying ecological functions and biophysical processes and environmental values are avoided or minimised.	No acceptable outcome is nominated. **Editor's note**–Applicants will be asked to prepare a site-based management plan to guide construction and operation.	**A performance outcome is sought for PO17.** The following management measures are proposed during development of the site: ▪ Site inductions to include awareness of significant vegetation or habitat ▪ Prior to any vegetation removal, the area is to be clearly marked using temporary fencing (e.g. star picket fencing or orange barrier mesh) and declared as a 'no go zone'. Where fencing cannot be erected, other protection measures are to be implemented, i.e. trunk, branch and ground protection. Fencing must be provided in accordance with AS 4970-2009 – Protection of Trees on Development Sites (AS 4970-2009). ▪ All trees identified as "to be retained" on any project drawing shall be protected from damage and clearly marked with an easily visible non-injurious and removable means of identification. ▪ Vegetation clearance to be limited to areas designated for vegetation removal. ▪ Except for hollow logs, any felled native trees are to be recycled (milled, chipped or mulched) and reused as mulch for landscape works and/or erosion weed control. ▪ Do not stockpile dead fall. Timber should be mulched or cut into manageable pieces and removed form site. ▪ Where significant habitat trees are identified (e.g. hollow-bearing trees with native fauna occupants), construction works will be scheduled wherever possible to avoid the breeding season of the hollow-roosting species. A spotter-catcher will be present during clearing activities. ▪ Vegetation is not to be burnt on site. ▪ Any wildlife found injured and sick because of site activities will be taken immediately to a wildlife veterinarian or qualified wildlife carer for treatment / rehabilitation.

Performance Outcomes	Acceptable Outcomes	Response
		▪ A fauna spotter/catcher will conduct a pre-clearing survey to identify the presence of active nests and tree hollows. ▪ In the days prior to potential habitat trees being removed, these trees will be subjected to a serious of bangs, knocks and other loud noises to encourage any wildlife to seek shelter elsewhere. ▪ If any animals are identified in trees marked for removal, work shall cease on that tree, and it is not to be damaged or interfered with until the animal has been allowed to move on freely of its own accord. ▪ Sequential clearing is to be undertaken, with clearing works to be commenced from clear areas towards vegetated areas within or adjacent to the site to allow fauna to move off the site of their own accord. ▪ Ensure vehicle speeds within areas of high fauna activity are regulated to avoid collisions. ▪ 'Fauna Warning' signs are to be used in areas of high fauna activity. ▪ Minimise the time that trenches remain open. Where open for more than 24-hours, insulated shelters and trench ramps are to be placed every 50 m (ramps to provide an escape option for fauna).
PO18 Management arrangements facilitate the effective conservation and protection of significant ecological areas and underlying ecological functions and biophysical processes.	**AO18** Significant ecological areas are: a. transferred into public ownership where the land is required for public access or for some other public purpose consistent with its values; or b. incorporated within private open space and included within a voluntary statutory covenant by registration under the *Land Title Act 1994.*	**Development complies with AO18** No significant ecological areas are present on the site.

Appendix G

RE 11.3.35 on Prior Streams or Levees



Terra SOLUTIONS

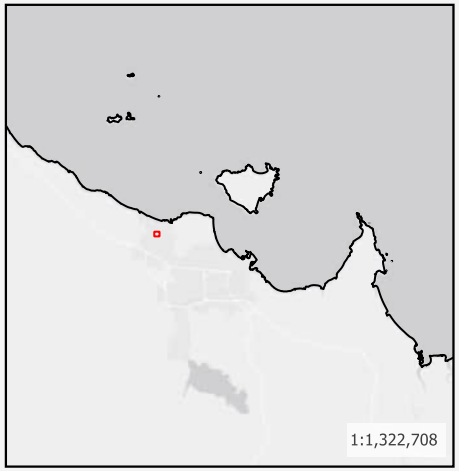
APPENDIX G: RE 11.3.35 ON PRIOR STREAMS OR LEVEES

0 40 80 120 160 200 m

1:4.000

LEGEND:

- Vegetation Management Watercourse
- RE 11.3.35 on prior streams and levees
- Precinct 1 - Study Area
- Project Area Cadastral Parcels
- EPBC Act Approval Area



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