APPENDICES

Meridian Urban

Appendix A - BPA mapping and verification report

TENRIVERS

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Bushfire Prone Area Reliability Assessment:

Toowoomba Regional Council

March 2021

Document Control

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Acronyms

BPARA	Bushfire Prone Area Reliability Assessment (this report)
CSIRO	Commonwealth Scientific and Industrial Research Organisation
FDI	Fire Danger Index
FFDI	Forest Fire Danger Index
FWS	Fire Weather Severity
LGA	Local Government Area
MLS	Maximum Landscape Slope
PFL	Potential Fuel Load
QFES	Queensland Fire and Emergency Services
SPP	State Planning Policy
TRC	Toowoomba Regional Council
VHC	Vegetation Hazard Class

1 Introduction

1.1 Project Background

Ten Rivers was engaged by Meridian Urban to undertake a Bushfire Prone Area Reliability Assessment for the Toowoomba Regional Council (TRC) Local Government Area (LGA). The assessment forms a part of the Toowoomba region 'Bushfire Risk Analysis', which is a risk assessment and planning provisions study that will support the preparation of Council's new Toowoomba Region Planning Scheme.

The purpose of this 'reliability assessment' is to verify[1] the State Planning Policy (SPP) bushfire hazard area (bushfire prone area) mapping (Queensland Fire and Emergency Services, 2017) in several pre-determined 'focus areas'. The outcomes of which, will aid in the development of risk-based recommendations provided in the Bushfire Risk Analysis.

1.2 Bushfire Hazard Background

Bushfires[2] respect no boundaries or land tenures. The subsequent impacts on people and the environment can be profound and long-lasting, and recovery can be slow. While Queensland does not have a legislated fire season, bushfires are common and frequent; an inherent part of the Queensland landscape. Traditionally in southeast Queensland and within the Brigalow Belt bioregions, adverse bushfire conditions start in September with conditions easing, typically, in November (Granger *et al.,* 2001). Though Total Fire Ban days are infrequent, there are recurrent periods of Fire Danger being Very High and above for much of September and October.

Hazards are a situation or condition that has the potential to cause harm to people, or cause damage to property or the environment (i.e. source of risk). With respect to bushfire hazards, the primary sources of risk that can ultimately impact upon life and property include:

- direct flame contact
- ember attack
- radiant heat
- fire-driven winds; and
- smoke.

These are the elements aligned with the term 'bushfire attack' and assets can be lost via one or a combination of the abovementioned sources of risk (Leonard *et al.,* 2014; Ramsay *et al.,* 1987). Within Queensland, direct flame attack, ember attack and radiant heat exposure have been combined into a metric, fire-line intensity, which indicates the potential severity of these

[1]Typically facilitate local refinements
[2] Bushfires are defined as being unplanned vegetation fires which include grass, scrub and forest fires.

three impact mechanisms at a landscape scale (Leonard *et al.,* 2014; Leonard and Blanchi, 2012) (refer to Section 1.3 for further details).

Fire-line intensity is a standardised measure of the rate that an advancing head fire would consume or release fuel energy per unit time and per unit length of fire front, regardless of its depth (Byram, 1959). Simply put, it is a measure of energy released from the flame or combustion zone. Knowing this measure enables appropriate (acceptable or tolerable) land use planning provisions to be put into place, such as minimum separation requirements between assets and bushfire hazards.

1.3 Legislative Context: State Planning Policy 2017

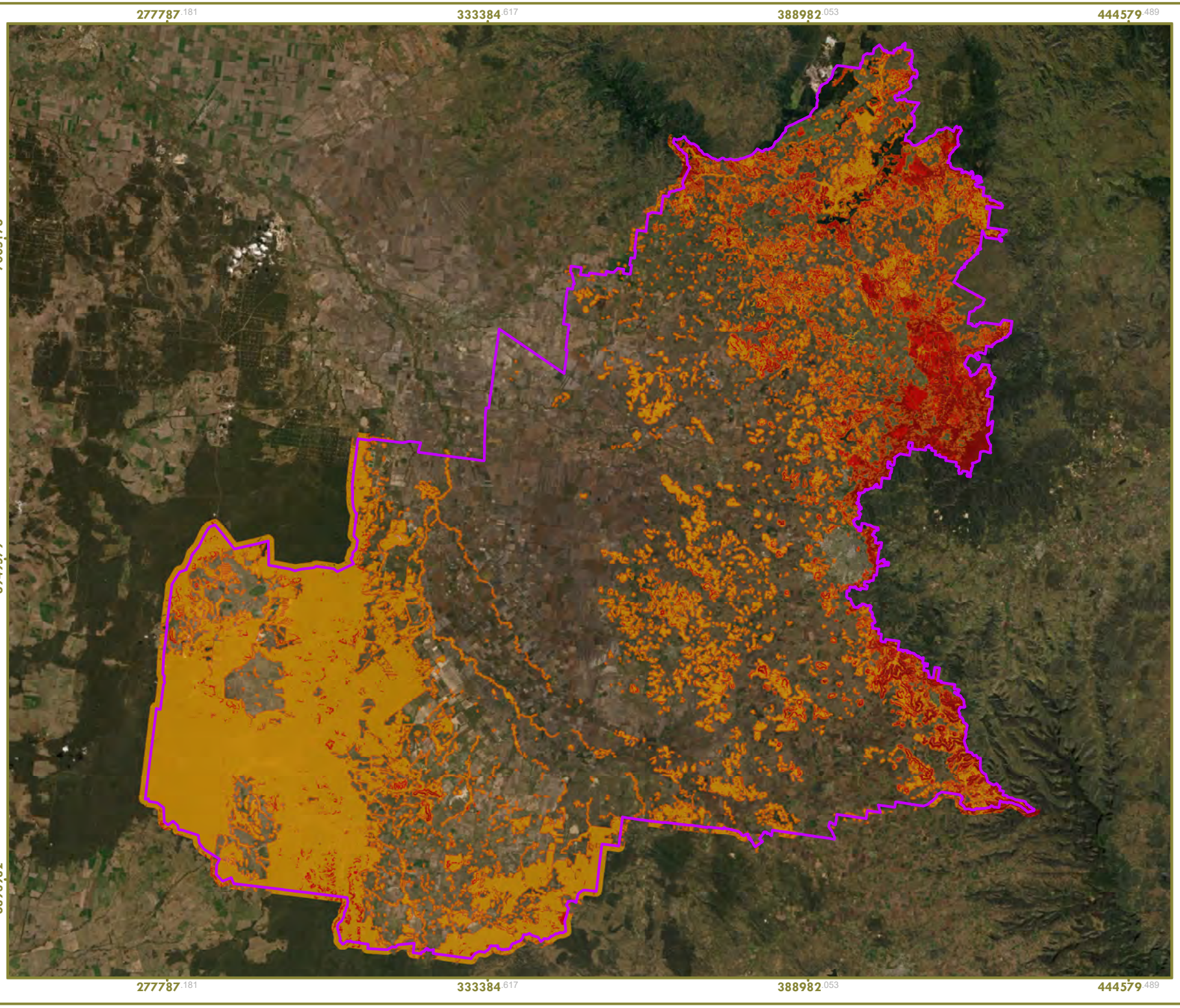
The State Planning Policy[3] (SPP) defines the Queensland Government's polices about matters of State interest, which are condensed into five themes. It serves as a guide to local governments in land-use planning, whereby local governments must appropriately incorporate and reflect the SPP (i.e. State interests) when amending local planning schemes. Of relevance is the safety and resilience to hazards theme which seeks to ensure that natural hazards are properly considered in all levels of the planning system. This includes the avoidance of natural hazard areas or the mitigation of risks to an acceptable or tolerable level. The SPP is supported by the following documents:

- *Natural hazards, risk and resilience – Bushfire: State interest guidance material* (guidance material) (Department of State Development, Manufacturing, Infrastructure and Planning, 2019); and
- *Bushfire resilient communities: Technical reference guide for the State Planning Policy state interest 'Natural hazards, risk and resilience – Bushfire'* (Queensland Fire and Emergency Services, 2019).

These serve as guides to the outcomes sought by the State and detail the methodologies behind natural hazard area mapping, such as the bushfire hazard area (bushfire prone area) mapping. This 'designated' bushfire prone area mapping is accessed via the SPP Interactive Mapping System and has been developed based on the methodologies outlined in Leonard *et al.* (2014). Bushfire prone areas are defined as being *areas* [land] *that could support a significant bushfire or be subject to significant bushfire attack.*

Figure 1 identifies the designated bushfire prone area mapping for the Toowoomba Regional Council LGA.

[3] Supporting document to the *Planning Act 2016* (Qld)



Bushfire Prone Area Reliability Assessment: Toowoomba Regional Council

Meridian Urban

Figure 1

LEGEND

- TRC LGA

Bushfire Prone Area

- Very High Potential Bushfire Intensity
- High Potential Bushfire Intensity
- Medium Potential Bushfire Intensity
- Potential Impact Buffer

SCALE

0 — 25 Km

Reference Scale: 1:850,000 (A4)
Coordinate System: GDA2020 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA2020
False Easting: 500,000.0000
False Northing: 10,000,000.0000
Central Meridian: 153.0000
Scale Factor: 0.9996
Latitude Of Origin: 0.0000
Units: Meter

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Creation Date: 19/03/2021

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As described in Section 1.2 and above, designated bushfire prone area mapping is based on the quantification of the potential fire-line intensity of an area or 'cell'. As described in Leonard *et al.* (2014), three spatial landscape inputs are combined to obtain this metric and include:

- Potential Fuel Load (PFL) (tonnes/ha)
- Maximum Landscape Slope (MLS) (degrees); and
- Fire Weather Severity (Forest Fire Danger Index (FFDI)).

Quantification of the potential fire-line intensity, expressed in kilowatts per linear meter (i.e. kW/m), is based on the equation shown in Figure 2. The resulting metric can then be categorised into a class of 'potential bushfire intensity', namely Medium, High or Very High, with a 100 m impact buffer applied to all relevant areas (i.e. areas resulting in a potential fire-line intensity of ≥4,000 kW/m). The potential bushfire intensity (bushfire prone area) classes and the associated fire-line intensity value ranges have been indicated in Table 1.

Figure 2. Spatial variables used to determine potential fire-line intensity (source: Leonard *et al.*, 2014)

Table 1. *Potential Bushfire Intensity classes and corresponding Potential Fire-line Intensity ranges* (source: Leonard *et al.*, 2014))

Potential Bushfire Intensity Class	Potential Fire-line Intensity
Very high (potential intensity)	>40,000 kW/m
High (potential intensity)	20,000 – 40,000 kW/m
Medium (potential intensity)	4,000 – 20,000 kW/m
Potential impact buffer	100 m buffer to all Medium, High and Very high potential intensity areas.

2 Methodology

This bushfire prone area verification process (reliability assessment) has been undertaken in accordance with Section 4.3 of *Bushfire resilient communities: Technical reference guide for the State Planning Policy state interest 'Natural hazards, risk and resilience – Bushfire'* (Queensland Fire and Emergency Services, 2019) (herein referred to as the 'technical reference guide'). The following sections detail the methods undertaken to undertake the assessment.

2.1 Preliminary Desktop Assessment

In order to undertake the reliability assessment, a desktop assessment and legislative review was undertaken. This included a review of the State Planning Policy (2017) and its associated guidance material and technical reference guide. Specifically, *Natural hazards, risk and resilience – Bushfire: State interest guidance material* (guidance material) (Department of State Development, Manufacturing, Infrastructure and Planning, 2019) and *Bushfire resilient communities: Technical reference guide for the State Planning Policy state interest 'Natural hazards, risk and resilience – Bushfire'* (Queensland Fire and Emergency Services, 2019) (herein referred to as the 'technical reference guide') .

Further, spatial information was obtained and reviewed from the following sources:

- Toowoomba Regional Council
- Queensland Spatial Catalogue
- Queensland Globe
- Geoscience Australia; and
- Nearmap.

In accordance with Section 4.3 of the technical reference guide, 45 1×1 km 'cells of interest' were randomly and subjectively selected ('sample set a[4]' and 'sample set b[5]'), with the aim of covering a range of landscapes and land uses in the local government area. The cells of interest were located within the 'focus areas' identified by Meridian Urban, and within areas that ensured that all bushfire prone area subcategories were represented.

All bushfire prone area subcategories were represented including:

- very high potential bushfire intensity
- high potential bushfire intensity
- medium potential bushfire intensity; and
- potential impact buffer.

[4] *randomly selected cells to confirm the reliability of mapping across the local government area*
[5] *subjectively selected (non-random) cells in known areas of poor reliability for initial or iterative refinement of the mapping*

Within the cells of interest, four 200 m diameter assessment areas were established within, with associated spatial information reviewed and consolidated for all. This included:

- Vegetation Hazard Class (VHC) and associated Potential Fuel Load (PFL)
- Regional Ecosystem (RE) (where applicable)
- Maximum Landscape Slope (MLS); and
- Fire Weather Severity (FFDI).

2.2 Field Assessment

In addition to the desktop assessments, a selection of *in-situ* field assessments were undertaken to verify the relevant spatially mapped extents (e.g. VHC). It must be noted, however, that only a selection of cell of interest locations were surveyed. Refer to Figure 3 (p.13) for the assessment locations; all of which were centred within the 'focus areas' where possible.

The site assessments were undertaken by two fire ecologists (Fire Protection Association Australia Bushfire Attack Level assessors) over two days (1-2 March 2021). At each location, landscape features and observations were described and recorded utilising Collector for ArcGIS (Esri, 2019), including:

- Vegetation community structure, species composition, condition and extent in relation to mapped vegetation hazard classes (Queensland Fire and Emergency Services (QFES))
- Topography details such as slope and aspect – measured using spatial Digital Elevation models (1 m) and/or using a laser rangefinder (Forestry Pro); and
- Evidence of fire history – for example burn scars/charring, regrowth or re-sprouting etc.

2.3 Reliability Assessment

Following all assessments, collected information was collated to facilitate the assignment of each assessment as being either Satisfactory (S) or Not satisfactory (N). This assessment was based on quantifying the fire-line intensity (i.e. potential intensity of a bushfire and indicator of the difficulty of fire suppression) (refer to Figure 2) relevant to each area; comparing mapped inputs[6] with observed/ verified inputs. To quantify mapped versus observed/verified VHC, the associated PFL's were obtained from the 'SPP Bushfire APZ Width Calculator' (Queensland Fire and Emergency Services, 2019). Resulting fire-line intensity values were then assigned to the associated bushfire prone area category shown in Table 1.

It must be noted that during the assessment process, it was identified that the 'designated' BPA mapped areas (i.e. SPP designated bushfire prone area shown in Figure 1) was often categorised higher than the calculated fire-line intensity generated using all Queensland Spatial Catalogue reliability assessment material. This suggests that an additional step which

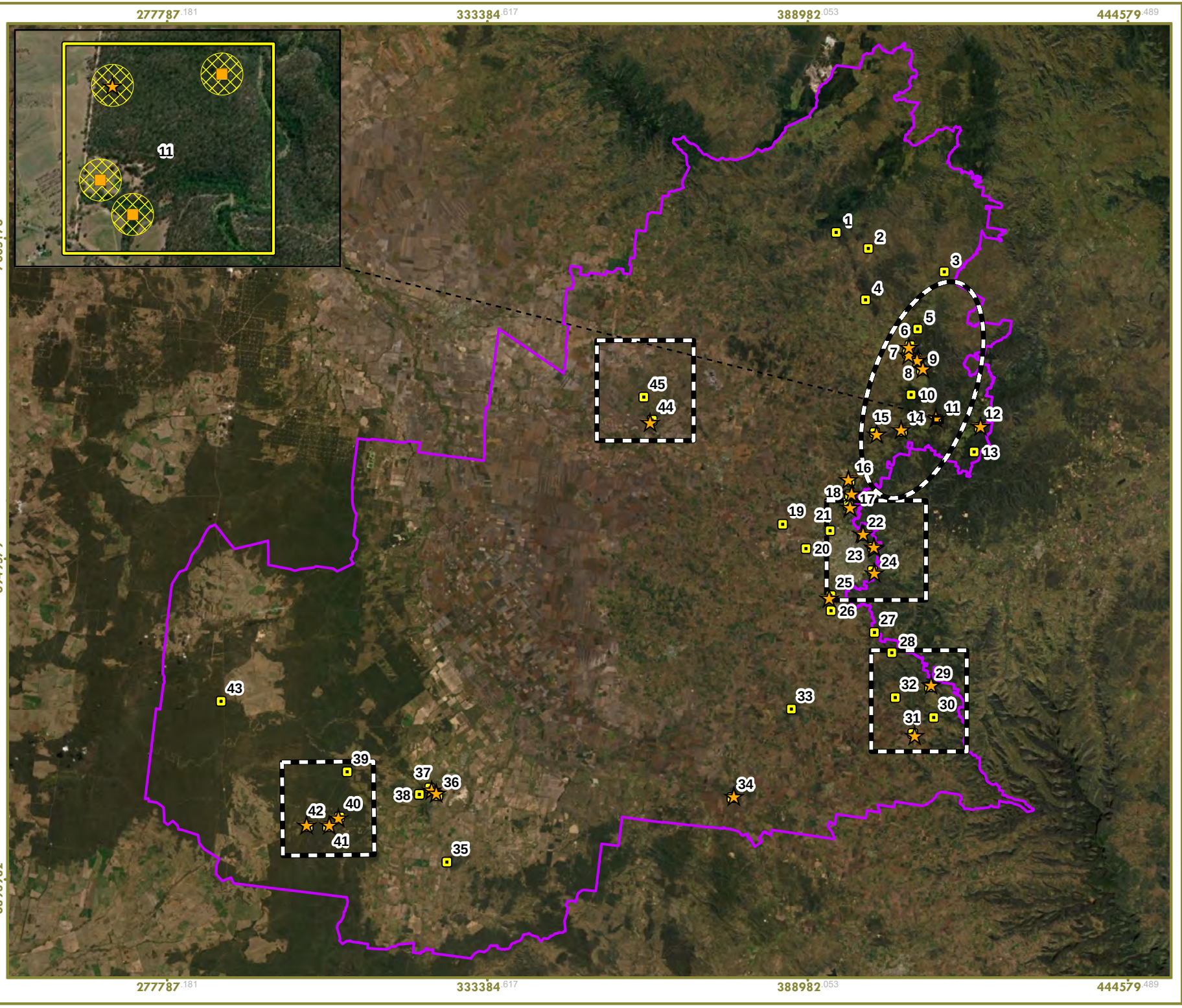
[6] 'mapped inputs' relates to the 'reliability assessment' spatial information obtained from the Queensland Spatial Catalogue not the designated bushfire prone area mapping.

may 'smooth', 'stretch' or classify the potential fire-line intensity classes in a way that is different to that provided in the guidance material or technical reference guide, may have been undertaken to produce the mapping but is not publicly available. As such, the assignment of each assessment area as being Satisfactory (S) or Not satisfactory (N) was based on the comparison between the calculated fire-line intensity values and not a comparison to the designated mapped category.

2.4 Limitations and Assumptions

The following assumptions and limitations have been made in compiling this assessment:

- The outcomes of this report have been based on spatial information primarily obtained from the Queensland Spatial Catalogue and QFES, which includes locally relevant VHC, MLS and FFDI mapping, along with PFL values. It is possible that VHC extents/types or slopes may differ to that provided in the mapping. Further, the LGA and site assessment locations may experience days of higher Fire Danger Index (FDI) than the level used in the assessments. As this reliability assessment is primarily desktop-based, the outcomes rely upon the reliability of information available at the time the assessments were undertaken.
- To minimise intrusions onto private land, assessment locations were originally limited to public or Council-owned land. Few optimal locations were identified and as such, some assessments took place on private land. Intrusion onto private land was minimised with assessments taking place at vantage points along roads or pathways, however, it had to be assumed that what was visible, was consistent across the area.



Bushfire Prone Area Reliability Assessment: Toowoomba Regional Council

Meridian Urban

Figure 3

LEGEND

- TRC LGA
- Focus Areas
- Cell of Interest

Verification Point

Assessment Type

- Desktop Only
- Field

SCALE

0 — 25 Km

Reference Scale: 1:850,000 (A4)
Coordinate System: GDA2020 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA2020
False Easting: 500,000.0000
False Northing: 10,000,000.0000
Central Meridian: 153.0000
Scale Factor: 0.9996
Latitude Of Origin: 0.0000
Units: Meter

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Creation Date: 22/03/2021

Document Path: C:\Users\nesvadban\OneDrive - Broadspectrum Pty Limited\JOBS\MERIDIAN\TOOWOOMBA PLANNING SCHEME\GIS\01 MXD\TR1473_Meridian_TRC_Figure 3_Cells of Interest.mxd

3 Results

3.1 Reliability Assessment

A total of 45 1×1 km cells of interest were randomly and subjectively selected ('sample set a' and 'sample set b') across the TRC LGA. Table 2 identifies the locality associated with each of the subject cells. Four 200 m diameter assessment areas were established within, giving a total of 180 individual sites requiring Satisfactory (S) or Not satisfactory (N) determination. The assessment was based on whether the calculated fire-line intensities resulted in the same BPA category. If yes, then the reliability assessment was Satisfactory, but if not, then the reliability assessment was Not satisfactory. Of the 180 reliability assessments, 22 had a differing VHC to what was mapped, however, in most instances, this did not change the resulting BPA category (i.e. calculated potential fire-line intensity values remained in the same category). Overall, seven (~4%) resulted in a Not satisfactory outcome (refer to Figure 4, p.28).

Refer to Table 3 for all assessment inputs, calculated values, BPA categories and assessment results. The 'designated' BPA mapped categories (i.e. SPP designated bushfire prone area shown in Figure 1) associated with each assessment have been included for reference purposes but as identified in Section 2.3, this information was not used as a part of the assessment.

Table 2. Cells of interest ID and associated locality within TRC LGA

Cell of Interest ID	Locality	Cell of Interest ID	Locality
1	Mount Binga	24	Rangeville
2	Emu Creek	25	Mount Rascal
3	Anduramba	26	Vale View
4	Glenaven	27	Ramsay
5	Crows Nest	28	Ramsay
6	Crows Nest	29	West Haldon
7	Crows Nest	30	Hirstglen
8	Crows Nest	31	Hirstglen
9	Crows Nest	32	Budgee
10	Pechey	33	Felton
11	Grapetree/ Perseverance	34	Ellangowan
12	Ravensbourne	35	Kooroongarra
13	Palmtree	36	Clontarf/ Millmerran
14	Mount Luke	37	Clontarf/ Millmerran
15	Geham	38	Captains Mountain
16	Highfields	39	Western Creek
17	Highfields	40	Captains Mountain
18	Highfields	41	Cypress Gardens
19	Charlton	42	Wattle Ridge
20	Glenvale	43	Cattle Creek
21	Cranley/ Wilsonton	44	Jondaryan

Cell of Interest ID	Locality	Cell of Interest ID	Locality
22	Mount Lofty	**45**	Malu
23	Prince Henry/ Redwood		

Table 3. Outcomes of the verification assessment

Cell of Interest Ref.	Assessment Type	VHC Mapped	VHC Observed / Verified	PFL Mapped (tonnes/ ha	PFL Verified (tonnes/ ha	MLS (av. degrees)	FWS (FFDI)	Fire-line Intensity Mapped	Fire-line Intensity Verified	BPA Category Mapped	BPA Category Verified	BPA Category Designated	Satisfactory (S) or Not satisfactory (N)
1	Desktop Only	9.2	9.2	17.2	17.2	14	58	13966.4	13966.4	Medium	Medium	Very High	S
1	Desktop Only	9.2	9.2	17.2	17.2	9	58	8978.4	8978.4	Medium	Medium	High	S
1	Desktop Only	9.2	9.2	17.2	17.2	3	58	2992.8	2992.8	Low	Low	Medium	S
1	Desktop Only	5.1	5.1	12	12	7	58	4872	4872	Medium	Medium	Buffer	S
2	Desktop Only	17.2	17.2	9.6	9.6	7	57	3830.4	3830.4	Low	Low	Medium	S
2	Desktop Only	40.4	40.4	5	5	6	57	1710	1710	Low	Low	Buffer	S
2	Desktop Only	17.2	17.2	9.6	9.6	6	57	3283.2	3283.2	Low	Low	Medium	S
2	Desktop Only	40.4	40.4	5	5	7	57	1995	1995	Low	Low	Buffer	S
3	Desktop Only	9.2	9.2	17.2	17.2	13	57	12745.2	12745.2	Medium	Medium	Very High	S
3	Desktop Only	9.2	9.2	17.2	17.2	7	57	6862.8	6862.8	Medium	Medium	High	S
3	Desktop Only	9.2	9.2	17.2	17.2	6	57	5882.4	5882.4	Medium	Medium	Medium	S
3	Desktop Only	**40.4**	**9.2**	**5**	**17.2**	7	57	1995	6862.8	Low	Medium	Buffer	N
4	Desktop Only	13.2	13.2	14.4	14.4	2	58	1670.4	1670.4	Low	Low	Medium	S
4	Desktop Only	12.2	12.2	17.4	17.4	7	58	7064.4	7064.4	Medium	Medium	High	S

Cell of Interest Ref.	Assessment Type	VHC Mapped	VHC Observed / Verified	PFL Mapped (tonnes/ ha	PFL Verified (tonnes/ ha	MLS (av. degrees)	FWS (FFDI)	Fire-line Intensity Mapped	Fire-line Intensity Verified	BPA Category Mapped	BPA Category Verified	BPA Category Designated	Satisfactory (S) or Not satisfactory (N)
4	Desktop Only	12.2	12.2	17.4	17.4	10	58	10092	10092	Medium	Medium	Very High	S
4	Desktop Only	40.4	40.4	5	5	1	59	295	295	Low	Low	Buffer	S
5	Desktop Only	8.1	8.1	35	35	4	59	8260	8260	Medium	Medium	Very High	S
5	Desktop Only	8.1	8.1	35	35	3	58	6090	6090	Medium	Medium	Very High	S
5	Desktop Only	40.4	40.4	5	5	6	59	1770	1770	Low	Low	Buffer	S
5	Desktop Only	8.1	8.1	35	35	4	59	8260	8260	Medium	Medium	Very High	S
6	Field	9.2	9.2	17.2	17.2	2	59	2029.6	2029.6	Low	Low	Medium	S
6	Desktop Only	8.1	8.1	35	35	3	59	6195	6195	Medium	Medium	Very High	S
6	Desktop Only	9.2	9.2	17.2	17.2	1	59	1014.8	1014.8	Low	Low	Medium	S
6	Desktop Only	8.1	8.1	35	35	2	59	4130	4130	Medium	Medium	Very High	S
7	Field	18.2	18.2	11	11	6	59	3894	3894	Low	Low	Very High	S
7	Desktop Only	18.2	18.2	11	11	3	59	1947	1947	Low	Low	High	S
7	Desktop Only	41.4	41.4	3	3	4	59	708	708	Low	Low	Buffer	S
7	Desktop Only	41.4	41.4	3	3	2	59	354	354	Low	Low	Low	S
8	Field	9.1	9.1	24.2	24.2	3	59	4283.4	4283.4	Medium	Medium	High	S
8	Field	16.2	16.2	11.6	11.6	3	59	2053.2	2053.2	Low	Low	Medium	S
8	Desktop Only	18.2	18.2	11	11	2	59	1298	1298	Low	Low	High	S

Cell of Interest Ref.	Assessment Type	VHC Mapped	VHC Observed / Verified	PFL Mapped (tonnes/ ha	PFL Verified (tonnes/ ha	MLS (av. degrees)	FWS (FFDI)	Fire-line Intensity Mapped	Fire-line Intensity Verified	BPA Category Mapped	BPA Category Verified	BPA Category Designated	Satisfactory (S) or Not satisfactory (N)
8	Desktop Only	18.2	18.2	11	11	12	59	7788	7788	Medium	Medium	Very High	S
9	Field	8.1	8.1	35	35	3	60	6300	6300	Medium	Medium	Very High	S
9	Desktop Only	8.1	8.1	35	35	6	60	12600	12600	Medium	Medium	Very High	S
9	Desktop Only	40.4	40.4	5	5	3	60	900	900	Low	Low	Low	S
9	Desktop Only	40.4	40.4	5	5	3	60	900	900	Low	Low	Buffer	S
10	Desktop Only	36.1	36.1	26	26	1	60	1560	1560	Low	Low	High	S
10	Desktop Only	36.1	36.1	26	26	4	60	6240	6240	Medium	Medium	Very High	S
10	Desktop Only	36.1	36.1	26	26	2	60	3120	3120	Low	Low	High	S
10	Desktop Only	36.1	36.1	26	26	2	60	3120	3120	Low	Low	High	S
11	Field	9.2	9.2	17.2	17.2	3	61	3147.6	3147.6	Low	Low	High	S
11	Desktop Only	9.2	9.2	17.2	17.2	12	61	12590.4	12590.4	Medium	Medium	Very High	S
11	Desktop Only	16.2	16.2	11.6	11.6	3	61	2122.8	2122.8	Low	Low	Medium	S
11	Desktop Only	40.4	40.4	5	5	5	61	1525	1525	Low	Low	Buffer	S
12	Field	8.1	8.1	35	35	10	61	21350	21350	High	High	Very High	S
12	Desktop Only	40.4	40.4	5	5	8	61	2440	2440	Low	Low	Low	S
12	Desktop Only	8.1	8.1	35	35	16	61	34160	34160	High	High	Very High	S

Cell of Interest Ref.	Assessment Type	VHC Mapped	VHC Observed / Verified	PFL Mapped (tonnes/ ha	PFL Verified (tonnes/ ha	MLS (av. degrees)	FWS (FFDI)	Fire-line Intensity Mapped	Fire-line Intensity Verified	BPA Category Mapped	BPA Category Verified	BPA Category Designated	Satisfactory (S) or Not satisfactory (N)
12	Desktop Only	40.4	40.4	5	5	11	61	3355	3355	Low	Low	Buffer	S
13	Desktop Only	8.1	8.1	35	35	25	62	54250	54250	Very High	Very High	Very High	S
13	Desktop Only	8.1	8.1	35	35	12	62	26040	26040	High	High	Very High	S
13	Desktop Only	8.1	8.1	35	35	8	62	17360	17360	Medium	Medium	Very High	S
13	Desktop Only	**8.1**	**40.4**	**35**	**5**	10	62	21700	3100	High	Low	Very High	N
14	Field	36.1	36.1	26	26	1	61	1586	1586	Low	Low	High	S
14	Desktop Only	36.1	36.1	26	26	2	61	3172	3172	Low	Low	High	S
14	Desktop Only	36.1	36.1	26	26	2	61	3172	3172	Low	Low	High	S
14	Desktop Only	36.1	36.1	26	26	2	61	3172	3172	Low	Low	High	S
15	Field	13.2	13.2	14.4	14.4	5	62	4464	4464	Medium	Medium	Medium	S
15	Desktop Only	13.2	13.2	14.4	14.4	5	62	4464	4464	Medium	Medium	Medium	S
15	Desktop Only	40.4	40.4	5	5	5	62	1550	1550	Low	Low	Buffer	S
15	Desktop Only	13.2	13.2	14.4	14.4	9	62	8035.2	8035.2	Medium	Medium	High	S
16	Field	8.1	8.1	35	35	2	63	4410	4410	Medium	Medium	Very High	S
16	Desktop Only	8.1	8.1	35	35	4	63	8820	8820	Medium	Medium	Very High	S
16	Desktop Only	8.1	8.1	35	35	1	63	2205	2205	Low	Low	Medium	S

Cell of Interest Ref.	Assessment Type	VHC Mapped	VHC Observed / Verified	PFL Mapped (tonnes/ ha	PFL Verified (tonnes/ ha	MLS (av. degrees)	FWS (FFDI)	Fire-line Intensity Mapped	Fire-line Intensity Verified	BPA Category Mapped	BPA Category Verified	BPA Category Designated	Satisfactory (S) or Not satisfactory (N)
16	Desktop Only	39.2	39.2	8	8	2	63	1008	1008	Low	Low	Low	S
17	Field	8.1	8.1	35	35	11	63	24255	24255	High	High	Very High	S
17	Desktop Only	**8.1**	**42.6**	**35**	**2**	4	63	8820	504	Medium	Low	Medium	N
17	Desktop Only	8.1	8.1	35	35	4	63	8820	8820	Medium	Medium	Very High	S
17	Desktop Only	42.6	42.6	2	2	6	63	756	756	Low	Low	Buffer	S
18	Field	11.2	11.2	13	13	4	63	3276	3276	Low	Low	Medium	S
18	Desktop Only	8.1	8.1	35	35	5	63	11025	11025	Medium	Medium	High	S
18	Desktop Only	8.1	8.1	35	35	5	63	11025	11025	Medium	Medium	Very High	S
18	Desktop Only	40.4	40.4	5	5	1	63	315	315	Low	Low	Buffer	S
19	Desktop Only	11.2	11.2	13	13	7	64	5824	5824	Medium	Medium	Medium	S
19	Desktop Only	**40.4**	**38.4**	**5**	**3.8**	5	64	1600	1216	Low	Low	Buffer	S
19	Desktop Only	11.2	11.2	13	13	12	64	9984	9984	Medium	Medium	High	S
19	Desktop Only	11.2	11.2	13	13	17	64	14144	14144	Medium	Medium	Very High	S
20	Desktop Only	**11.2**	**39.2**	**13**	**8**	5	64	4160	2560	Medium	Low	Medium	N
20	Desktop Only	**11.2**	**39.2**	**13**	**8**	13	64	10816	6656	Medium	Medium	High	S
20	Desktop Only	**11.2**	**39.2**	**13**	**8**	9	64	7488	4608	Medium	Medium	Medium	S

Cell of Interest Ref.	Assessment Type	VHC Mapped	VHC Observed / Verified	PFL Mapped (tonnes/ ha	PFL Verified (tonnes/ ha	MLS (av. degrees)	FWS (FFDI)	Fire-line Intensity Mapped	Fire-line Intensity Verified	BPA Category Mapped	BPA Category Verified	BPA Category Designated	Satisfactory (S) or Not satisfactory (N)
20	Desktop Only	**40.4**	**39.2**	**5**	**8**	4	64	1280	2048	Low	Low	Buffer	S
21	Desktop Only	**11.2**	**39.2**	**13**	**8**	6	64	4992	3072	Medium	Low	Medium	N
21	Desktop Only	11.2	11.2	13	13	15	64	12480	12480	Medium	Medium	Very High	S
21	Desktop Only	**11.2**	**41.4**	**13**	**3**	4	64	3328	768	Low	Low	Medium	S
21	Desktop Only	41.4	41.4	3	3	2	64	384	384	Low	Low	Low	S
22	Field	9.2	9.2	17.2	17.2	6	64	6604.8	6604.8	Medium	Medium	Medium	S
22	Field	9.2	9.2	17.2	17.2	8	64	8806.4	8806.4	Medium	Medium	High	S
22	Desktop Only	9.2	9.2	17.2	17.2	9	64	9907.2	9907.2	Medium	Medium	High	S
22	Desktop Only	40.4	40.4	5	5	5	64	1600	1600	Low	Low	Low	S
23	Field	9.2	9.2	17.2	17.2	13	64	14310.4	14310.4	Medium	Medium	Very High	S
23	Field	16.2	16.2	11.6	11.6	14	64	10393.6	10393.6	Medium	Medium	High	S
23	Desktop Only	**9.2**	**40.4**	**17.2**	**5**	9	64	9907.2	2880	Medium	Low	Buffer	N
23	Desktop Only	9.2	9.2	17.2	17.2	16	64	17612.8	17612.8	Medium	Medium	Very High	S
24	Field	9.2	9.2	17.2	17.2	14	64	15411.2	15411.2	Medium	Medium	Very High	S
24	Desktop Only	9.2	9.2	17.2	17.2	10	64	11008	11008	Medium	Medium	High	S
24	Desktop Only	41.4	41.4	3	3	11	64	2112	2112	Low	Low	Buffer	S
24	Desktop Only	42.6	42.6	2	2	2	64	256	256	Low	Low	Low	S

Cell of Interest Ref.	Assessment Type	VHC Mapped	VHC Observed / Verified	PFL Mapped (tonnes/ ha	PFL Verified (tonnes/ ha	MLS (av. degrees)	FWS (FFDI)	Fire-line Intensity Mapped	Fire-line Intensity Verified	BPA Category Mapped	BPA Category Verified	BPA Category Designated	Satisfactory (S) or Not satisfactory (N)
25	Field	11.2	11.2	13	13	9	64	7488	7488	Medium	Medium	High	S
25	Desktop Only	11.2	11.2	13	13	10	64	8320	8320	Medium	Medium	High	S
25	Desktop Only	11.2	11.2	13	13	7	64	5824	5824	Medium	Medium	Medium	S
25	Desktop Only	41.4	41.4	3	3	4	64	768	768	Low	Low	Buffer	S
26	Desktop Only	11.2	11.2	13	13	5	65	4225	4225	Medium	Medium	Medium	S
26	Desktop Only	11.2	11.2	13	13	9	65	7605	7605	Medium	Medium	High	S
26	Desktop Only	**40.4**	**38.4**	**5**	**3.8**	6	65	1950	1482	Low	Low	Buffer	S
26	Desktop Only	11.2	11.2	13	13	10	65	8450	8450	Medium	Medium	High	S
27	Desktop Only	**11.2**	**39.2**	**13**	**8**	3	65	2535	1560	Low	Low	Medium	S
27	Desktop Only	11.2	11.2	13	13	20	65	16900	16900	Medium	Medium	Very High	S
27	Desktop Only	11.2	11.2	13	13	9	65	7605	7605	Medium	Medium	High	S
27	Desktop Only	40.4	40.4	5	5	7	65	2275	2275	Low	Low	Buffer	S
28	Desktop Only	11.2	11.2	13	13	11	65	9295	9295	Medium	Medium	High	S
28	Desktop Only	11.2	11.2	13	13	18	65	15210	15210	Medium	Medium	Very High	S
28	Desktop Only	11.2	11.2	13	13	15	65	12675	12675	Medium	Medium	Very High	S
28	Desktop Only	11.2	11.2	13	13	12	65	10140	10140	Medium	Medium	High	S

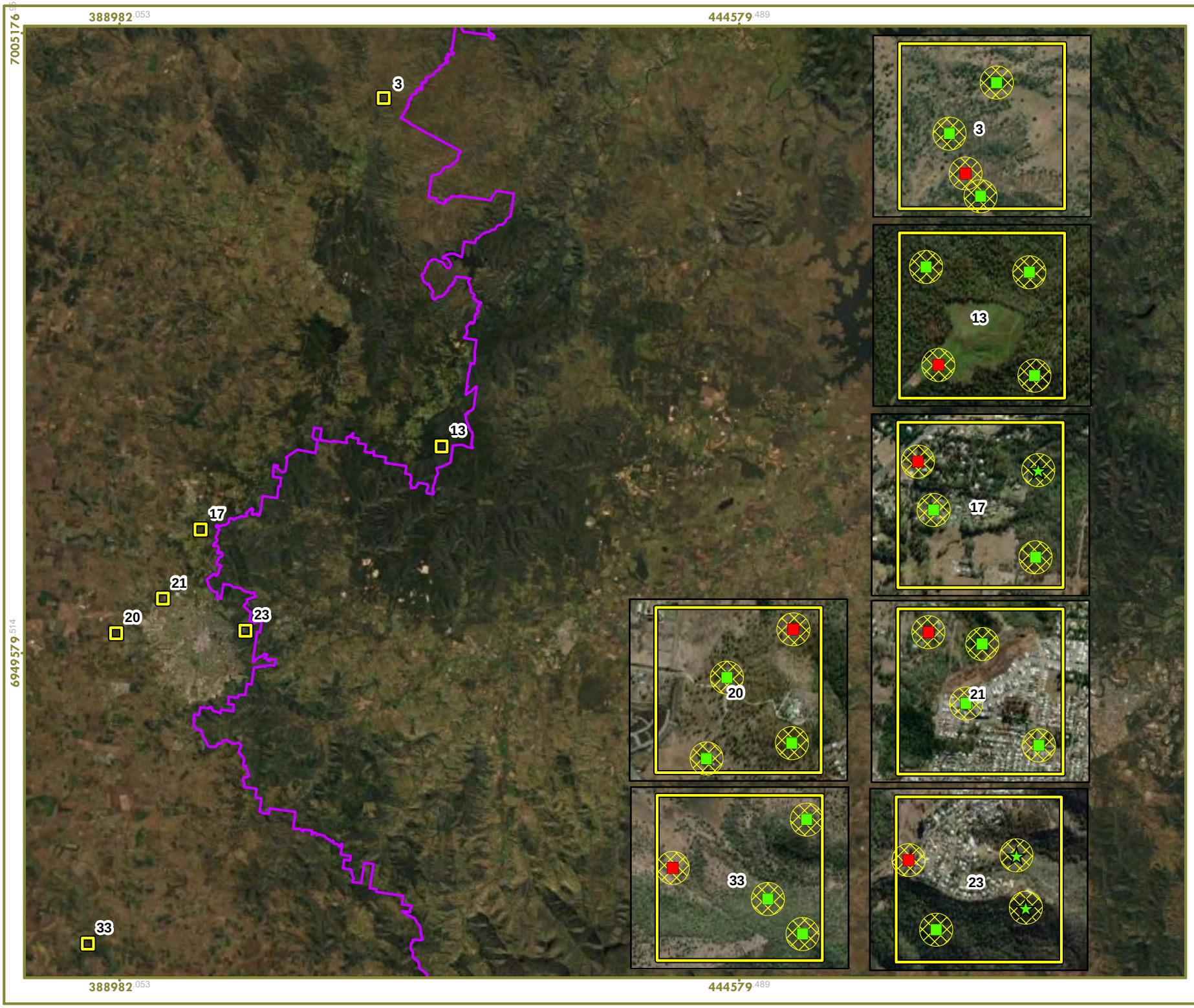
Cell of Interest Ref.	Assessment Type	VHC Mapped	VHC Observed / Verified	PFL Mapped (tonnes/ ha	PFL Verified (tonnes/ ha	MLS (av. degrees)	FWS (FFDI)	Fire-line Intensity Mapped	Fire-line Intensity Verified	BPA Category Mapped	BPA Category Verified	BPA Category Designated	Satisfactory (S) or Not satisfactory (N)
29	Field	9.2	9.2	17.2	17.2	13	65	14534	14534	Medium	Medium	High	S
29	Desktop Only	40.4	40.4	5	5	6	65	1950	1950	Low	Low	Low	S
29	Desktop Only	12.2	12.2	17.4	17.4	6	65	6786	6786	Medium	Medium	Buffer	S
29	Desktop Only	9.2	9.2	17.2	17.2	5	65	5590	5590	Medium	Medium	Medium	S
30	Desktop Only	9.2	9.2	17.2	17.2	21	65	23478	23478	High	High	Very High	S
30	Desktop Only	40.4	40.4	5	5	6	65	1950	1950	Low	Low	Buffer	S
30	Desktop Only	11.2	11.2	13	13	6	65	5070	5070	Medium	Medium	Medium	S
30	Desktop Only	11.2	11.2	13	13	12	65	10140	10140	Medium	Medium	High	S
31	Field	11.2	11.2	13	13	3	65	2535	2535	Low	Low	Medium	S
31	Desktop Only	40.4	40.4	5	5	1	65	325	325	Low	Low	Low	S
31	Desktop Only	40.4	40.4	5	5	1	65	325	325	Low	Low	Low	S
31	Desktop Only	40.4	40.4	5	5	2	65	650	650	Low	Low	Low	S
32	Desktop Only	11.2	11.2	13	13	20	65	16900	16900	Medium	Medium	Very High	S
32	Desktop Only	**11.2**	**38.4**	**13**	**3.8**	2	65	1690	494	Low	Low	Medium	S
32	Desktop Only	**40.4**	**38.4**	**5**	**3.8**	3	65	975	741	Low	Low	Buffer	S
32	Desktop Only	**40.4**	**38.4**	**5**	**3.8**	3	65	975	741	Low	Low	Low	S

Cell of Interest Ref.	Assessment Type	VHC Mapped	VHC Observed / Verified	PFL Mapped (tonnes/ ha	PFL Verified (tonnes/ ha	MLS (av. degrees)	FWS (FFDI)	Fire-line Intensity Mapped	Fire-line Intensity Verified	BPA Category Mapped	BPA Category Verified	BPA Category Designated	Satisfactory (S) or Not satisfactory (N)
33	Desktop Only	11.2	11.2	13	13	6	65	5070	5070	Medium	Medium	Medium	S
33	Desktop Only	11.2	11.2	13	13	13	65	10985	10985	Medium	Medium	Very High	S
33	Desktop Only	**40.4**	**39.2**	**5**	**8**	9	65	2925	4680	Low	Medium	Buffer	N
33	Desktop Only	11.2	11.2	13	13	9	65	7605	7605	Medium	Medium	High	S
34	Field	13.2	13.2	14.4	14.4	3	64	2764.8	2764.8	Low	Low	Medium	S
34	Desktop Only	**40.4**	**38.5**	**5**	**2**	1	64	320	128	Low	Low	Buffer	S
34	Desktop Only	38.5	38.5	2	2	1	64	128	128	Low	Low	Low	S
34	Desktop Only	38.5	38.5	2	2	1	64	128	128	Low	Low	Low	S
35	Desktop Only	15.2	15.2	13.8	13.8	9	67	8321.4	8321.4	Medium	Medium	High	S
35	Desktop Only	15.2	15.2	13.8	13.8	10	67	9246	9246	Medium	Medium	High	S
35	Desktop Only	25.1	25.1	15	15	1	67	1005	1005	Low	Low	Medium	S
35	Desktop Only	15.2	15.2	13.8	13.8	2	67	1849.2	1849.2	Low	Low	Medium	S
36	Field	11.2	11.2	13	13	11	67	9581	9581	Medium	Medium	High	S
36	Desktop Only	11.2	11.2	13	13	4	67	3484	3484	Low	Low	Medium	S
36	Desktop Only	11.2	11.2	13	13	13	67	11323	11323	Medium	Medium	Very High	S
36	Desktop Only	40.4	40.4	5	5	5	67	1675	1675	Low	Low	Buffer	S

Cell of Interest Ref.	Assessment Type	VHC Mapped	VHC Observed / Verified	PFL Mapped (tonnes/ ha	PFL Verified (tonnes/ ha	MLS (av. degrees)	FWS (FFDI)	Fire-line Intensity Mapped	Fire-line Intensity Verified	BPA Category Mapped	BPA Category Verified	BPA Category Designated	Satisfactory (S) or Not satisfactory (N)
37	Field	12.2	12.2	17.4	17.4	3	67	3497.4	3497.4	Low	Low	Medium	S
37	Desktop Only	12.2	12.2	17.4	17.4	2	67	2331.6	2331.6	Low	Low	Medium	S
37	Desktop Only	11.2	11.2	13	13	14	67	12194	12194	Medium	Medium	Very High	S
37	Desktop Only	11.2	11.2	13	13	9	67	7839	7839	Medium	Medium	High	S
38	Desktop Only	11.2	11.2	13	13	14	67	12194	12194	Medium	Medium	Very High	S
38	Desktop Only	38.5	38.4	2	3.8	2	67	268	509.2	Low	Low	Low	S
38	Desktop Only	11.2	11.2	13	13	7	67	6097	6097	Medium	Medium	Medium	S
38	Desktop Only	11.2	11.2	13	13	2	67	1742	1742	Low	Low	Medium	S
39	Desktop Only	40.4	40.4	5	5	1	69	345	345	Low	Low	Buffer	S
39	Desktop Only	40.4	40.4	5	5	1	69	345	345	Low	Low	Buffer	S
39	Desktop Only	18.2	18.2	11	11	1	69	759	759	Low	Low	Medium	S
39	Desktop Only	18.2	18.2	11	11	1	69	759	759	Low	Low	Medium	S
40	Field	18.2	18.2	11	11	1	69	759	759	Low	Low	Medium	S
40	Desktop Only	18.2	18.2	11	11	1	69	759	759	Low	Low	Medium	S
40	Desktop Only	18.2	18.2	11	11	1	69	759	759	Low	Low	Medium	S
40	Desktop Only	12.2	12.2	17.4	17.4	1	69	1200.6	1200.6	Low	Low	Medium	S

Cell of Interest Ref.	Assessment Type	VHC Mapped	VHC Observed / Verified	PFL Mapped (tonnes/ ha	PFL Verified (tonnes/ ha	MLS (av. degrees)	FWS (FFDI)	Fire-line Intensity Mapped	Fire-line Intensity Verified	BPA Category Mapped	BPA Category Verified	BPA Category Designated	Satisfactory (S) or Not satisfactory (N)
41	Field	18.2	18.2	11	11	3	69	2277	2277	Low	Low	Medium	S
41	Desktop Only	18.2	18.2	11	11	1	69	759	759	Low	Low	Medium	S
41	Desktop Only	18.2	18.2	11	11	2	69	1518	1518	Low	Low	Medium	S
41	Desktop Only	18.2	18.2	11	11	1	69	759	759	Low	Low	Medium	S
42	Field	18.2	18.2	11	11	1	70	770	770	Low	Low	Medium	S
42	Desktop Only	18.2	18.2	11	11	1	70	770	770	Low	Low	Medium	S
42	Desktop Only	12.2	12.2	17.4	17.4	2	70	2436	2436	Low	Low	Medium	S
42	Desktop Only	12.2	12.2	17.4	17.4	2	70	2436	2436	Low	Low	Medium	S
43	Desktop Only	12.2	12.2	17.4	17.4	4	73	5080.8	5080.8	Medium	Medium	High	S
43	Desktop Only	18.2	18.2	11	11	1	73	803	803	Low	Low	Medium	S
43	Desktop Only	12.2	12.2	17.4	17.4	3	73	3810.6	3810.6	Low	Low	High	S
43	Desktop Only	12.2	12.2	17.4	17.4	1	73	1270.2	1270.2	Low	Low	Medium	S
44	Field	11.2	11.2	13	13	6	63	4914	4914	Medium	Medium	Medium	S
44	Desktop Only	40.4	40.4	5	5	4	63	1260	1260	Low	Low	Buffer	S
44	Desktop Only	11.2	11.2	13	13	6	63	4914	4914	Medium	Medium	Medium	S
44	Desktop Only	11.2	11.2	13	13	2	63	1638	1638	Low	Low	Medium	S

Cell of Interest Ref.	Assessment Type	VHC Mapped	VHC Observed / Verified	PFL Mapped (tonnes/ ha	PFL Verified (tonnes/ ha	MLS (av. degrees)	FWS (FFDI)	Fire-line Intensity Mapped	Fire-line Intensity Verified	BPA Category Mapped	BPA Category Verified	BPA Category Designated	Satisfactory (S) or Not satisfactory (N)
45	Desktop Only	**40.4**	**39.2**	**5**	**8**	2	63	630	1008	Low	Low	Low	S
45	Desktop Only	**40.4**	**39.2**	**5**	**8**	1	63	315	504	Low	Low	Buffer	S
45	Desktop Only	**11.2**	**39.2**	**13**	**8**	3	63	2457	1512	Low	Low	Medium	S
45	Desktop Only	**11.2**	**39.2**	**13**	**8**	3	63	2457	1512	Low	Low	Medium	S



Bushfire Prone Area Reliability Assessment: Toowoomba Regional Council

Meridian Urban

Figure 4

LEGEND

- TRC LGA
- Cell of Interest

Verification Point

Satisfied or Not satisfied

- Desktop Only - S
- Desktop Only - N
- Field - S

SCALE

0 10 Km

Reference Scale: 1:438,711 (A4)
Coordinate System: GDA2020 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA2020
False Easting: 500,000.0000
False Northing: 10,000,000.0000
Central Meridian: 153.0000
Scale Factor: 0.9996
Latitude Of Origin: 0.0000
Units: Meter

N

TENRIVERS

Creation Date: 22/03/2021

Document Path: C:\Users\nesvadban\OneDrive - Broadspectrum Pty Limited\JOBS\MERIDIAN\TOOWOOMBA PLANNING SCHEME\GIS\01 MXD\TR1473_Meridian_TRC_Figure 4_Cells of Interest Not satisfied.mxd

4 Summary

Ten Rivers was engaged by Meridian Urban to undertake a Bushfire Prone Area Reliability Assessment for the Toowoomba Regional Council Local Government Area. The assessment was undertaken in accordance with Section 4.3 of the *Bushfire resilient communities: Technical reference guide for the State Planning Policy state interest 'Natural hazards, risk and resilience – Bushfire'* (Queensland Fire and Emergency Services, 2019). Although the designated mapping of Bushfire Prone Areas differed (SPP mapping), the potential fire-line intensities which were quantified using Queensland Spatial Catalogue reliability assessment material or amended values associated with observations and/or the verification process, predominantly resulted in the same value or BPA category. Seven (~4%) resulted in a Not satisfactory outcome.

5 References

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Leonard, J., Newnham, G., Opie, K., Blanchi, R., 2014. A new methodology for state-wide mapping of bushfire prone areas in Queensland. CSIRO, Australia.

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Appendix B - Data sources

Register of data sources utilised for the spatial analytics underpinning this risk assessment

Data Layer	Source	Comments
Bushfire hazard overlay	TRC Layer (supplied)	Nil
Statewide Bushfire Prone Area	Bushfire prone area – Darling Downs (QSpatial)	The dataset was clipped to within 100m of the TRC LGA border.
Residential Dwellings (Urban)	TRC Zone Layer (supplied)	Based off residential parcels within the Low density residential, Low-medium density residential, Township and Emerging community zones.
Residential Dwellings (Rural)	Building Points (QSpatial)	Identify all 'residential buildings' that are within the Rural Residential or Rural Zone.
Nursing homes	Aged care service list: 30 June 2020 from the Australian Institute of Health and Welfare Aged Care dataset.	Excluding 'home care only' providers, the coordinates were plotted and aligned with the underlying land parcel.
Child care facilities	Queensland State register of approved services from the Australian Children's Education & Care Quality Authority.	The address was geocoded to create coordinates. The coordinates were in turn potted and aligned with the underlying land parcel.
Educational establishment	Landmark areas (QSpatial)	All facilities identified as 'educational institution' were selected.
Hospitals	Landmark areas (QSpatial)	All 'private hospital' and 'public hospital' facilities were selected.
Power generation facilities	Landmark areas (QSpatial)	All 'power generation facilities' were selected.
Electrical substations	Ergon Energy – zone substations (QSpatial)	All 'zone substations' and 'bulk supply substations' were selected.
Fuel stations	Petrol Stations (Geosciences Australia)	Note, dataset was last updated in 2012.
Water pumping stations	TRC Layer (supplied)	Nil
Water treatment plant	Landmark areas (QSpatial)	All 'water treatment plants' were selected.
Wastewater treatment plants	Landmark areas (QSpatial)	All 'sewage treatment plants' were selected.
Roads	Baseline roads and tracks (QSpatial)	Road classifications 1, 2, 3 and 4 were selected.