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1 INTRODUCTION

1.1 Background

This Bushfire Hazard Assessment and Management Plan has been prepared to assess and manage the degree of potential bushfire hazard and associated risk acting on Lot 10 on SP132272 and Lot 6 on SP184133, located at 1807 Roys Road, Coochin Creek. A development application for a Material Change of Use (Eco-tourism) is to be submitted to Sunshine Coast Regional Council. This assessment is to be used to assist Council with their decision-making process.

1.2 State Planning Policy Bushfire Intensity Overlay Map

The lots are mapped under the State Planning Policy (SPP) as containing the following Potential Bushfire Intensity areas (refer to Plate 1):

- High Potential Bushfire Intensity area;
- Medium Potential Bushfire Intensity area; and
- Potential Impact Buffer.

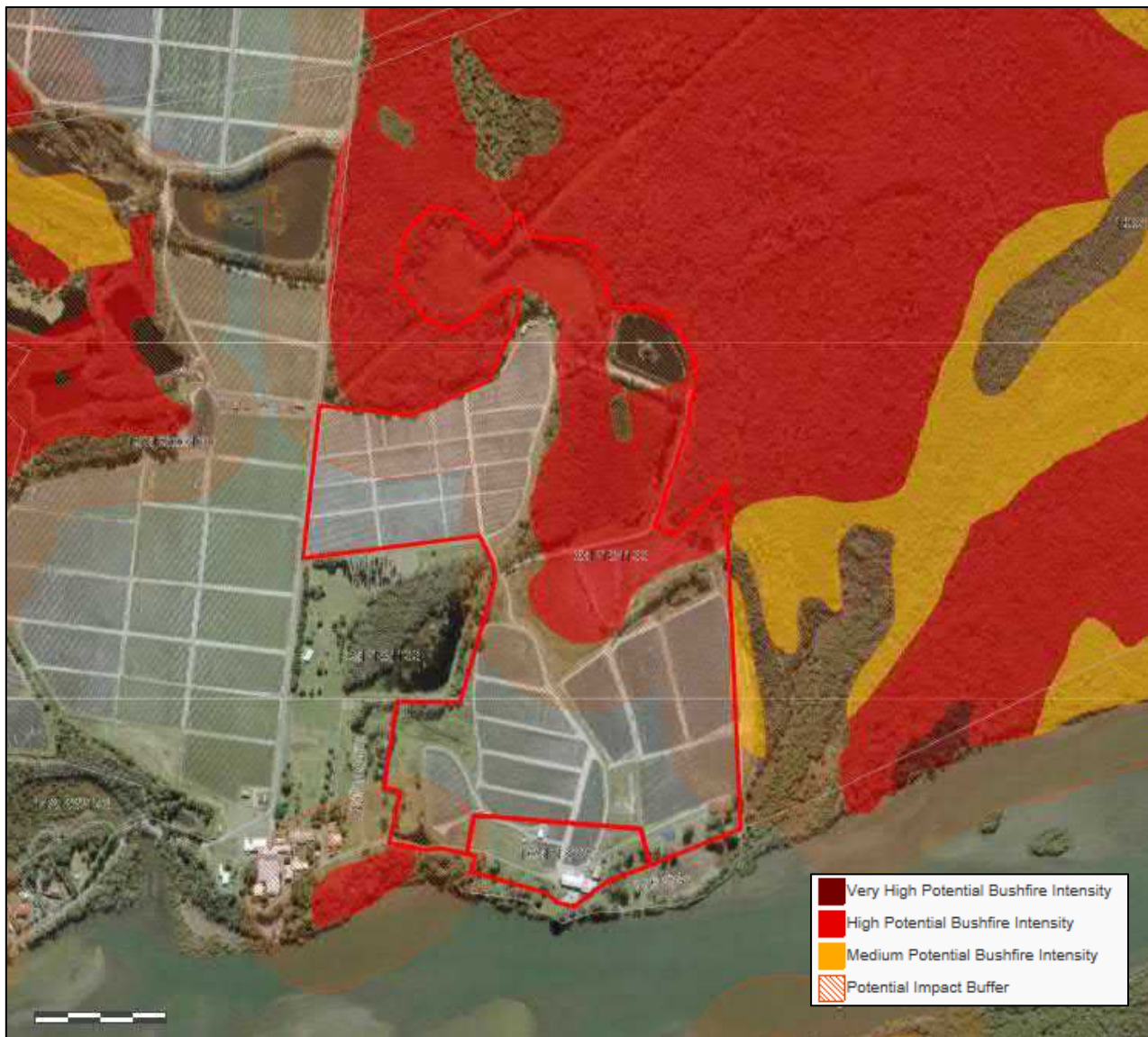


Plate 1 – SPP Bushfire Intensity Mapping Overlay

Under Chapter 2, Part 1, Section 8, Item 4(a) of the *Planning Act 2016*, where there is an inconsistency between a State planning policy and local government planning instrument, a State planning policy applies instead of a regional plan or local planning instrument. As such the SPP

Bushfire Prone Areas mapping prevails with respect to the currency of the methodology used to assign risk classes hence is to be used as the trigger for assessment under Council's Bushfire Hazard Overlay Code in lieu of the SCC Bushfire Hazard Overlay.

1.3 Development Proposal

The lots are proposed to host an eco-tourism camping facility. The proposed plan of development includes 100+ camp sites, reception/admin building, pool, maintenance building, and various outdoor recreational pursuits. The development proposes to gain access from the existing access point within the site's southwest corner. The Plan of Development has been provided as Appendix 1.

The proposed development is deemed to be a nature-based tourism use. Therefore, the appropriate vulnerable use SPP benchmarks will apply.

It is noted that the location of the proposed development is only within the southern extent of Lot 6 on SP184133 and the entirety of Lot 10 on SP132272, as labelled "Eco Park" with grey hatching in Plate 2 (referenced hereafter as 'the site'). This report will focus on this area, alongside the *Effluent irrigation Area* in the north-west of the lot (refer Plate 1). Should the plan of development change and consequently use activities be proposed in the balance areas of the site then further investigation of the resultant impacts of this change will be necessary. It should also be noted that an existing Road license Area – RLO/218025 Lot 1 on AP6741 (1.8ha approx.) is present between the site's southern boundary and Pumicestone Passage.

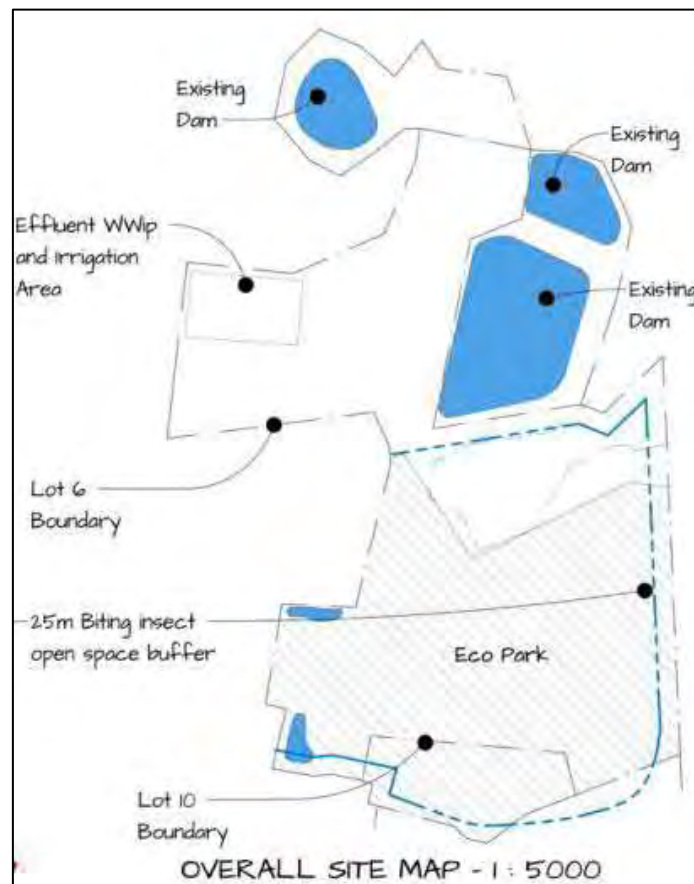


Plate 2 – Proposed development location (Source: Valentine Building Design POD (Appendix 1))

2 Site Description

2.1 General

The site measures approximately 18.6ha and is located in the central extent of Coochin Creek. The site currently supports a single dwelling with several associated sheds and a pool located about the centre of the southern boundary of the site.

In general, the majority of the site is host to relict horticultural areas or agriculture blocks that have been left fallow, resulting in weed dominated pasture areas. Units of woody vegetation are present surrounding the site including paperbark open forest, sedgeland and wetlands. The site is bordered by Pumicestone National Park to the north and east, Pumicestone Passage and then Bribie Island to the south, and rural land uses including a strawberry farm to the west.

The site is zoned as Rural within the *Sunshine Coast Planning Scheme 2014*.

Plate 3 depicts the site's position in the landscape and the extent of existing development.



Plate 3 – Site Context (Source: Nearmap 2021)

2.2 Topography

The slope of land is a major determinant of fire behaviour. Fire burns faster as it travels upslope via preheating of unburnt fuels ahead of the fire front which increases the rate of spread and fireline intensity. Conversely, fires move more slowly as they travel downslope. Fireline intensity is a function of the rate of spread (QFES 2019).

The site is located on generally flat ground showing very little variation in topography. A small rise is present near the existing dwelling producing average slopes of 1-2 degrees except to the south-west where a relatively steep side slope declines from the dwelling down to the Pumicestone Passage foreshore inclusive of an alluvial terrace to the south-west. Numerous dams and artificial drains were observed across the site associated with the former cropping use.

The site reaches a topographic high of approximately 5m AHD in the south near the existing dwelling and a low of approximately 2m AHD in the sites northeast corner.

Plate 4 depicts topography conditions within and adjacent to the site.



Plate 4 – Site Topography (Source: SCC Mymaps)

2.3 Vegetation within the site

The majority of the site is characterised by fallow cropping blocks dominated by blue billygoat weed. Several mature trees are present near the site's southern boundary and include *Eucalyptus tereticornis*, *Casuarina glauca*, and *Ficus macrophylla*.

2.4 Vegetation external of the site

The site is surrounded by patches of paperbark forests set amongst a mosaic of cleared and wetland areas. Units of paperbark open forest are present to the north, northeast, northwest, east and southwest of the site. A regrowth unit of this vegetation is located directly north of the site. Extensive stands of swamp she-oak woodland, mangrove areas and sedgeland is present to the east of the site and to the south of Pumicestone Passage on Bribie Island.

Plate 5 depicts the general extent of bushland fuel sources surrounding the site. Vegetation hazard characteristics are described in detail in Section 3.2.

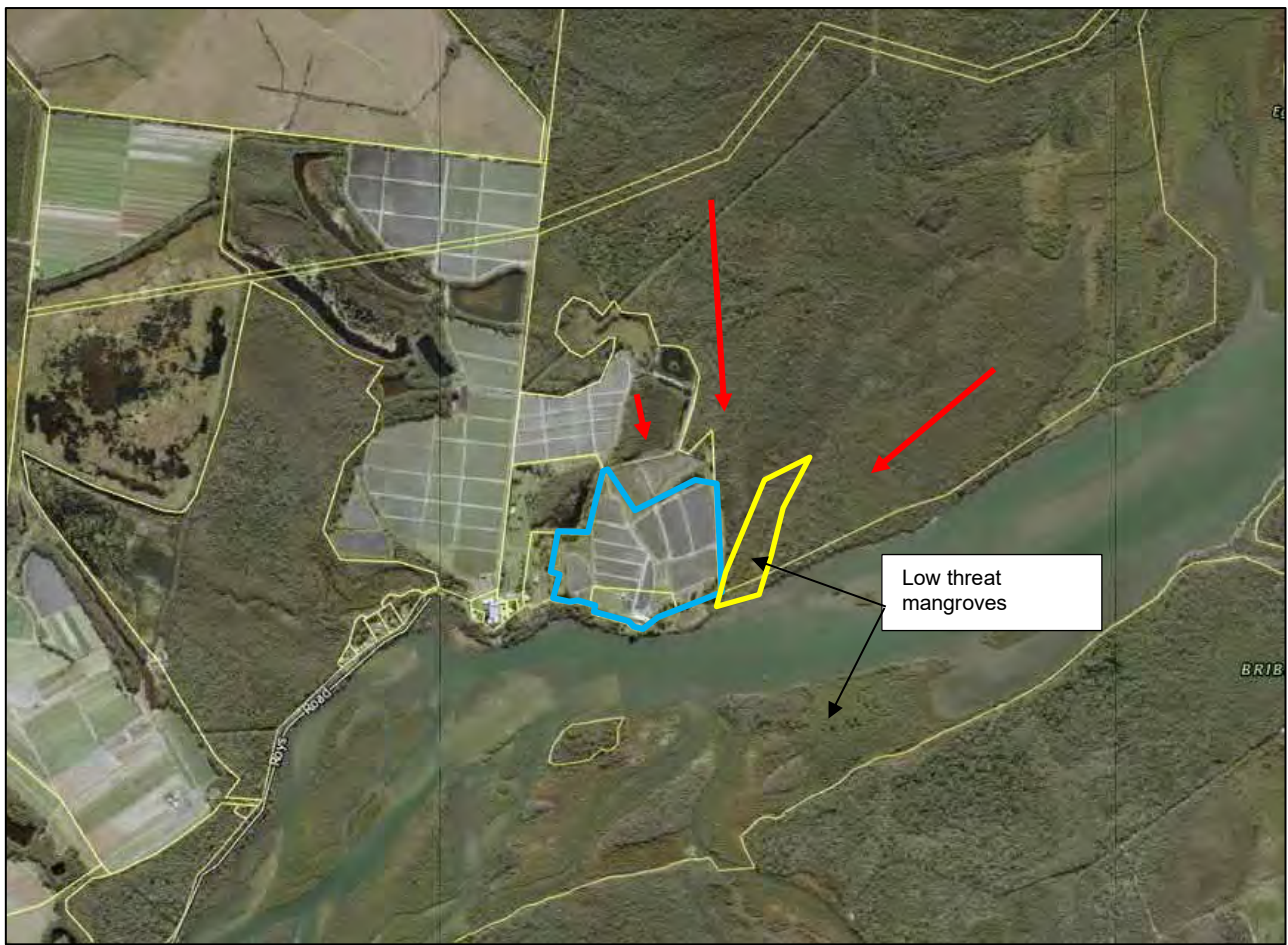


Plate 5 – Dominant forest fire runs (Source: Queensland Globe)

3 **HAZARD ASSESSMENT**

3.1 **Hazard Assessment Methodology**

The SCRC Planning Scheme requires that a site-specific bushfire hazard assessment be prepared to assess the degree of bushfire hazard acting on a development site captured within a mapped Designated Bushfire Hazard Area. The SPP Bushfire Prone Area mapping prevails over the SCRC Bushfire Hazard Area mapping with respect to the currency of the methodology adopted to prepare the mapping. Accordingly, the site-specific hazard mapping required by the Bushfire Hazard Overlay Code is to be prepared consistent with the methodology adopted to prepare the SPP mapping.

The methodology used to prepare the SPP mapping is described in:

- Department of Infrastructure, Local Government and Planning's *Natural Hazards, Risk and Resilience — Bushfire (December 2019) State Planning Policy – state interest guidance material*; and
- Queensland Fire and Emergency Services - (2019) *Planning for Bushfire Resilient Communities*.

Site-specific hazard maps are referred to as Local Hazard Area Maps in the SPP documents. The preparation of Local Hazard Area Maps has been undertaken for the site in accordance with the methodology described in the above referenced documents.

3.1.1 **Local Hazard Area Map**

A Local Hazard Area Map was prepared by adopting the following methodology:

- Categorizing the vegetation within the site in accordance with the vegetation hazard classes derived from QFES (2019);
- Using the patch and corridor filtering process to remove narrow corridors and small patches of VHC's¹;
- Subdividing the identified vegetation hazard classes into bushfire hazard sub-units based on slope differences and vegetation hazard classes. All upslope and across slope vegetation units are allocated an underlying slope of 1 degree as per methodology prescribed within Queensland Fire and Emergency Services - (2019) *Planning for Bushfire Resilient Communities*. The maximal slope recorded within 25m x 25m grids within the VHC's is adopted as the effective slope underlying the VHC. A conservative approach is adopted where multiple slopes persist within VHC's;
- Assigning SPP Potential Bushfire Intensity classes to the sub-units;
- Application of 100m Potential Impact Buffers to the amended sub-units to derive an overall Local Hazard Area Map.

¹ The patch and corridor filtering process to remove or downgrade hazard levels of small patches and narrow corridors involves the following three stages:

- Merging small patches of a single Vegetation Hazard Class less than 0.5 ha;
- Merging small Vegetation Hazard Class patches between 0.5 and 1 ha with higher or moderate fuel loads (greater than 8 tonnes/ha); and
- Removing narrow corridors of vegetation less than 50m wide through a process of patch erosion and dilation. These small patches are merged with surrounding vegetation by allocating a patch to the Vegetation Hazard Class that is most common to the patch boundary (Leonard *et al.*, 2017).

3.2 Vegetation Hazard Classes

The following vegetation hazard classes (classified in accordance with QFES (2019)) were identified within the assessment area which includes a 150m buffer surrounding the site:

- Vegetation Hazard Class 22.1 – Melaleuca open forest on seasonally inundated lowland coastal swamps;
- Vegetation Hazard Class 28.2 – Woodlands in coastal locations with species such as she-oak or swamp box;
- Vegetation Hazard Class 35.3 – Shrubland associated with mangroves and tidal saltmarshes;
- Vegetation Hazard Class 39.2 – Low to moderate tree cover in built-up areas;
- Vegetation Hazard Class 40.4 – Continuous low grass or tree cover; and
- Vegetation Hazard Class 43.6 – Water bodies or very low vegetation cover.

The characteristics of each observed vegetation hazard class are described in the following sections whilst *Plan No. BF01 – Vegetation Hazard Classes* depicts their distribution across the assessment area.

3.2.1 Vegetation Hazard Class 22.1 – Melaleuca open forests on seasonally inundated lowland coastal swamps

Vegetation Hazard Class 22.1 (VHC 22.1) occurs to the north, northeast, northwest, east, and southwest of the site. This wetland vegetation community has attained an average height of approximately 15m and a Projective Foliage Canopy Cover (PFCC) of 30%. The canopy generally contains *Melaleuca quinquenervia* (broad leaved paperbark) and *Eucalyptus tereticornis* (blue gum). This also includes a regrowth patch of this vegetation unit to 1-2m height directly north of the site.

The midstorey contains a range of native species including *Macaranga tanarius*, *Glochidion ferdinandi* (Cheese tree), and *Casuarina glauca* (she-oak).

The understorey comprises a range of native shrubs, ferns, sedges and grasses along with notable infestations of *Lantana camara*.

VHC 22.1 is attributed a potential combined surface fuel load of 23.4t/ha and total fuel load of 28.4t/ha (QFES, 2019). Plate 6 depicts typical conditions within VHC 22.1.



Plate 6 – Characteristic vegetation within VHC 22.1

3.2.2 Vegetation Hazard Class 28.2 – Woodlands in coastal locations with species such as she-oak or swamp box

Vegetation Hazard Class 28.2 (VHC 28.2) occurs as a thin strip ahead of mangrove areas to the east of the site and then more extensively further east. The canopy had attained a height of approximately 6-10m and a Projective Foliage Canopy Cover (PFCC) of 20%. The unit contained almost a monoculture of *Casuarina glauca* (swamp she-oak), however, scattered *Melaleuca quinquenervia* (broad leaved paperbark), *Eucalyptus tereticornis* (blue gum), and *Pinus elliottii* (slash pine) were also present on the fringes of the community.

VHC 28.2 is attributed a potential combined surface fuel load of 15t/ha and total fuel load of 18.3t/ha (QFES, 2019). Plate 7 depicts typical conditions within VHC 28.2.



Plate 7 – Characteristic vegetation within VHC 28.2

3.2.3 Vegetation Hazard Class 35.3 – Shrubland associated with mangroves and tidal saltmarshes

Vegetation Hazard Class 35.3 (VHC 35.3) dominates the mangrove areas present to the east and south of the site. VHC 35.3 is attributed a potential combined surface fuel load of 0t/ha and total fuel load of 0t/ha (QFES, 2019). Plate 8 depicts typical conditions within VHC 35.3.



Plate 8 – Characteristic vegetation within VHC 35.3

3.2.4 Vegetation Hazard Class 39.2 – Low to moderate tree cover in built-up areas

Vegetation Hazard Class 39.2 (VHC 39.2) comprises areas of maintained grass with scattered trees and built-up areas containing sparse vegetation. VHC 39.2 is attributed a potential combined surface fuel load of 5t/ha and total fuel load of 8t/ha (QFES, 2019). Plate 9 depicts typical conditions within VHC 39.2.



Plate 9 – Characteristic vegetation within VHC 39.2

3.2.5 Vegetation Hazard Class 40.4 – Continuous low grass or tree cover

Vegetation Hazard Class 40.4 (VHC 40.4) dominates areas within the site and comprises extensive monoculture of grassland and a sparse distribution of native and exotic trees. VHC 40.4 is attributed a potential combined surface fuel load of 4.5t/ha and total fuel load of 5t/ha (QFES, 2019). Plate 10 depicts typical conditions within VHC 40.4.



Plate 10 – Characteristic vegetation within VHC 40.4 (foreground)

3.2.6 Vegetation Hazard Class 43.6 – Water bodies or very low vegetation cover

Vegetation Hazard Class 43.6 (VHC 43.6) comprises the dam areas within the site and Pumicestone Passage directly south of the site. VHC 43.6 is attributed a potential combined surface fuel load of 0t/ha and total fuel load of 0t/ha (QFES, 2019). Plate 11 depicts typical conditions within VHC 43.6.



Plate 11 – Characteristic conditions within VHC 43.6

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3.3 Potential Bushfire Intensity classes

Table 1 details the Potential Bushfire Intensity classes and their corresponding potential fire-line intensity (KW/m) values as prescribed within Leonard *et. al.* 2017.

Table 1: Potential Bushfire Intensity classes

Potential Bushfire Intensity	Potential Fire-line Intensity
1. Very high	40,000+ kW/m
2. High	20,000 – 39,999 kW/m
3. Medium	4,000 – 19,999 kW/m

3.4 Bushfire Hazard Sub-Units

A sub-unit level Local Hazard Area Map has been prepared; *Plan No. BF02 – Sub-Units* and identifies the site scale Potential Bushfire Intensity classes across the site. The sub-unit level Local Hazard Area Map identifies that a High Potential Bushfire Intensity area associated with VHC 22.1 exists directly north, northeast, and northwest of the site.

3.5 Overall Local Hazard Map

An overall Local Hazard Map has been prepared; *Plan No. BF03 – Local Hazard Map* and identifies the Potential Bushfire Intensity classes across the site as well as associated 100m wide Potential Impact Buffer areas.

BF03 outlines that a Potential Impact Buffer Area has been identified extending into the northern, north-western and eastern site extent derived from the adjoining High Potential Bushfire Intensity areas. The remainder of the site is captured within a Low Potential Bushfire Intensity area.

The Local Hazard Map presented in *Plan No. BF03* is to supersede the SPP broadscale mapping attributed to the site and should be used to guide the formulation of appropriate site-based bushfire management measures for the proposal.

The Local Hazard Map is not expected to change post development subject to site landscaping comprising low threat conditions consistent with that described in the SPP.

Sub Unit 1 – Slope assessed as 1 degree due to Sub Unit being located across slope relevant to the development area.

(Fireline intensity calculated using Flamesol modelling adopting woodland as the relevant vegetation on type)

Vegetation Hazard Class #	Combined Surface and Near Surface Fuel Load (t/ha)	Total Fuel Load (t/ha)	Fire Weather Severity (FFDI)	Maximum Landscape Slope (degrees)	Potential Fireline Intensity (kW/m)	Potential Bushfire Intensity*
VHC - 40.4 Continuous low grass or tree cover	4.5	5	54	1	807	Low

Sub Unit 2 - Slope assessed as 1 degree due to Sub Unit being located across slope relevant to the development area.

(Fireline intensity calculated using Flamesol modelling adopting forest as the relevant vegetation type)

Vegetation Hazard Class #	Combined Surface and Near Surface Fuel Load (t/ha)	Total Fuel Load (t/ha)	Fire Weather Severity (FFDI)	Maximum Landscape Slope (degrees)	Potential Fireline Intensity (kW/m)	Potential Bushfire Intensity*
VHC22.1 - Melaleuca open forests on seasonally inundated	23.4	28.4	54	1	23,838	High

Sub Unit 3 - Slope assessed as 1 degree due to Sub Unit being located across slope relevant to the development area.

(Fireline intensity calculated using Flamesol modelling adopting woodland as the relevant vegetation type)

Vegetation Hazard Class #	Combined Surface and Near Surface Fuel Load (t/ha)	Total Fuel Load (t/ha)	Fire Weather Severity (FFDI)	Maximum Landscape Slope (degrees)	Potential Fireline Intensity (kW/m)	Potential Bushfire Intensity*
VHC - 39.2 Low to moderate tree cover in built up areas	5	8	54	1	1,434	Low

Sub Unit 4 - Slope assessed as 1 degree due to Sub Unit being located across slope relevant to the development area.

(Fireline intensity calculated using Flamenco) modelling adopting shrubland as the relevant vegetation type)

Vegetation Hazard Class #	Combined Surface and Near Surface Fuel Load (t/ha)	Total Fuel Load (t/ha)	Fire Weather Severity (FFDI)	Maximum Landscape Slope (degrees)	Potential Fireline Intensity (kw/m)	Potential Bushfire Intensity*
VHC 35.3 Shrubland associated with mangroves and tidal saltmarshes	0	0	54	1	0	Low

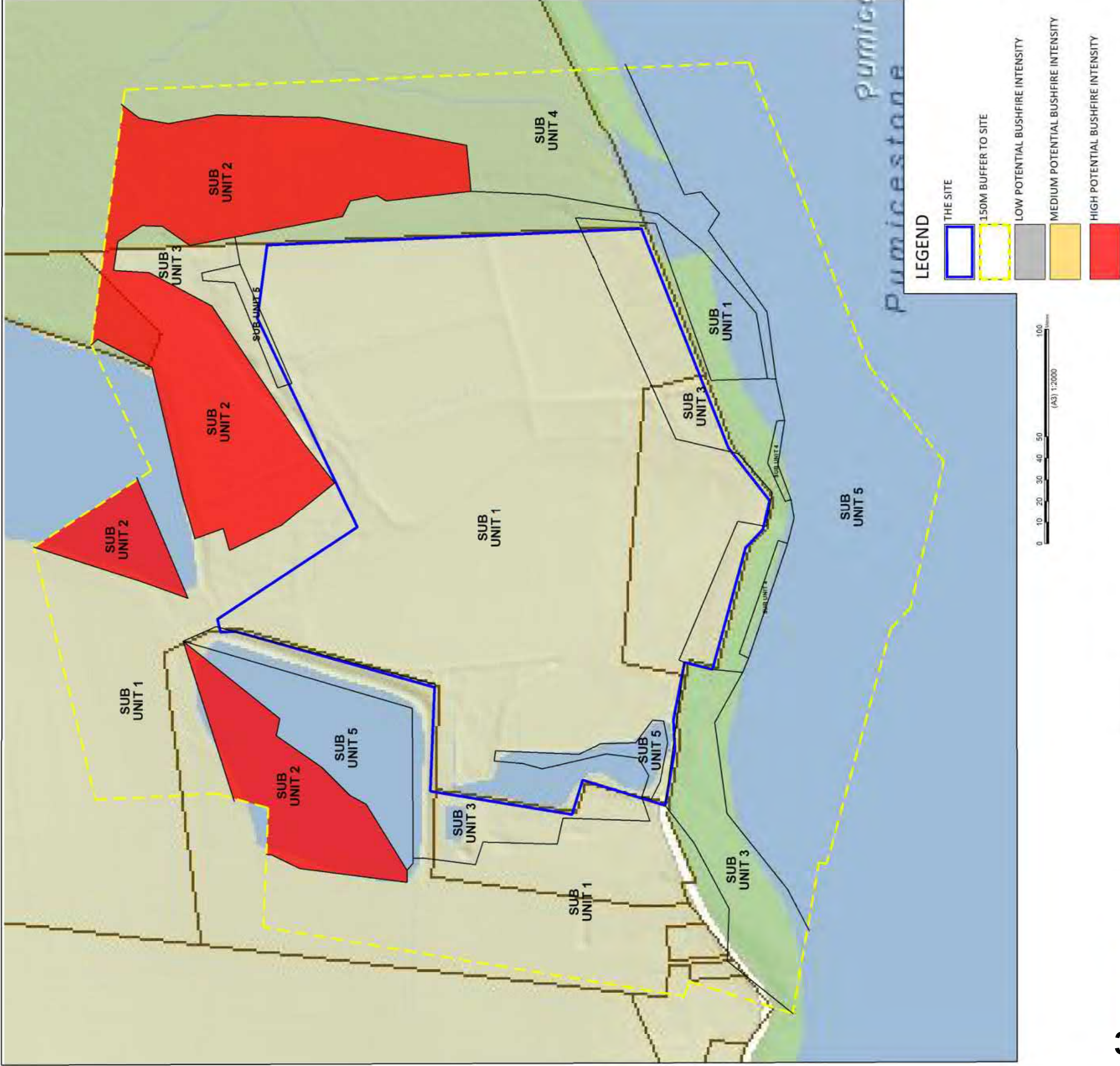
Sub Unit 5 - Slope assessed as 1 degree due to Sub Unit being located across slope relevant to the development area.

(Fireline intensity calculated using Flammex) modelling adopting shrubland as the relevant vegetation type)

Vegetation Hazard Class #	Combined Surface and Near Surface Fuel Load (t/ha)	Total Fuel Load (t/ha)	Fire Weather Severity (FFDI)	Maximum Landscape Slope (degrees)	Potential Fireline Intensity (kw/m)	Potential Bushfire Intensity* (kw/m)
VHC 43.6 - Water bodies or very low vegetation cover	0	0	54	1	0	Low

From: Leonard, J., & Opie, K., (2017) Estimating the potential bushfire hazard of vegetation patches and corridors – an enhancement of Queensland’s methodology for State-wide mapping of bushfire prone areas. CSIRO, Australia.

* From: Leonard, J., Newnham, G., Ople, K., and Bianchi, R. (2014) A new methodology for state-wide mapping of bushfire prone areas in Queensland. CSIRO, Australia.





LEGEND

- THE SITE
- 150M BUFFER TO SITE
- LOW POTENTIAL BUSHFIRE INTENSITY
- MEDIUM POTENTIAL BUSHFIRE INTENSITY
- HIGH POTENTIAL BUSHFIRE INTENSITY
- POTENTIAL IMPACT BUFFER



3.6 Quantitative Modelling

Quantitative modelling of the potential bushfire conditions that may be experienced within the VHC 22.1 Melaleuca open forests has been undertaken to assist in understanding the risk to the development and determining the suitability of the layout with respect to any asset setback requirements.

The models used comprise industry standard bushfire equations which have been built into the FPAA endorsed FLAMESOL computer model. FLAMESOL allows numerous input variables to be adjusted including fuel loads, fire danger index, site slope and distance to vegetation. FLAMESOL uses the following algorithms:

- Rate of Spread – McArthur (1973) and Nobel *et al.* (1980)
- Flame Length – NSW Rural Fire Service (2001) and Nobel *et al.* (1980)
- Elevation of Receiver – Douglas and Tan (2005)
- Flame Angle – Douglas and Tan (2005)
- Radian Heat Flux – Drysdale (1999), Sullivan *et al.* (2003) and Douglas and Tan (2005)

The FLAMESOL Minimum Distance calculator has been used and comprises an AS 3959:2018 Method 2 (Appendix B) based calculator which can determine a suite of bushfire behaviour variables including the minimum distances required to achieve a range of different radiant heat level exposures.

Fuel load inputs have been drawn from *Planning for Bushfire Resilient Communities* (QFES 2019) based on the calculated potential fuel loads for VHC 22.1 (23.4 t/ha surface and near surface fuels and 28.4 t/ha total fuels). A 1° effective slope was adopted for the slope underlying the hazardous vegetation given the underlying slope conditions are dominated by cross slope and low-lying terrain. A Flame width of 100m has been adopted commensurate with the edge width of VHC 22.1 units to the northeast and northwest, whilst a flame width of 60m was adopted for northern most unit of VHC 22.1.

A FFDI of 54 has been adopted for the site consistent with the assignment of same by QFES (Catalyst 2020) (refer Plate 12).

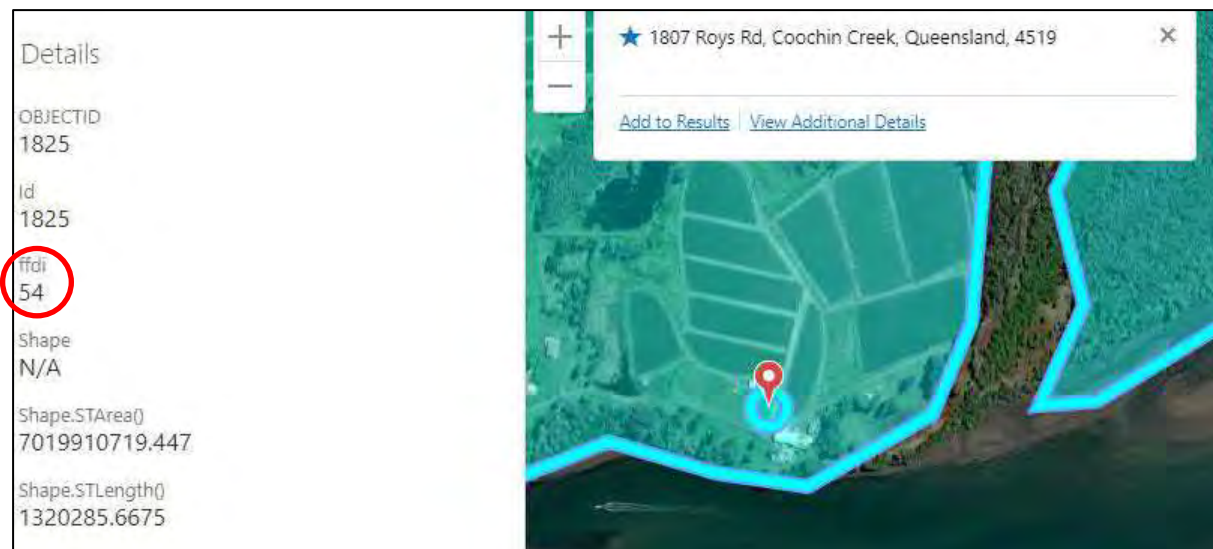


Plate 12 - FFDI (Source: QFES Redi Map)

The Flamesol output results are shown in Plates 13 & 14.

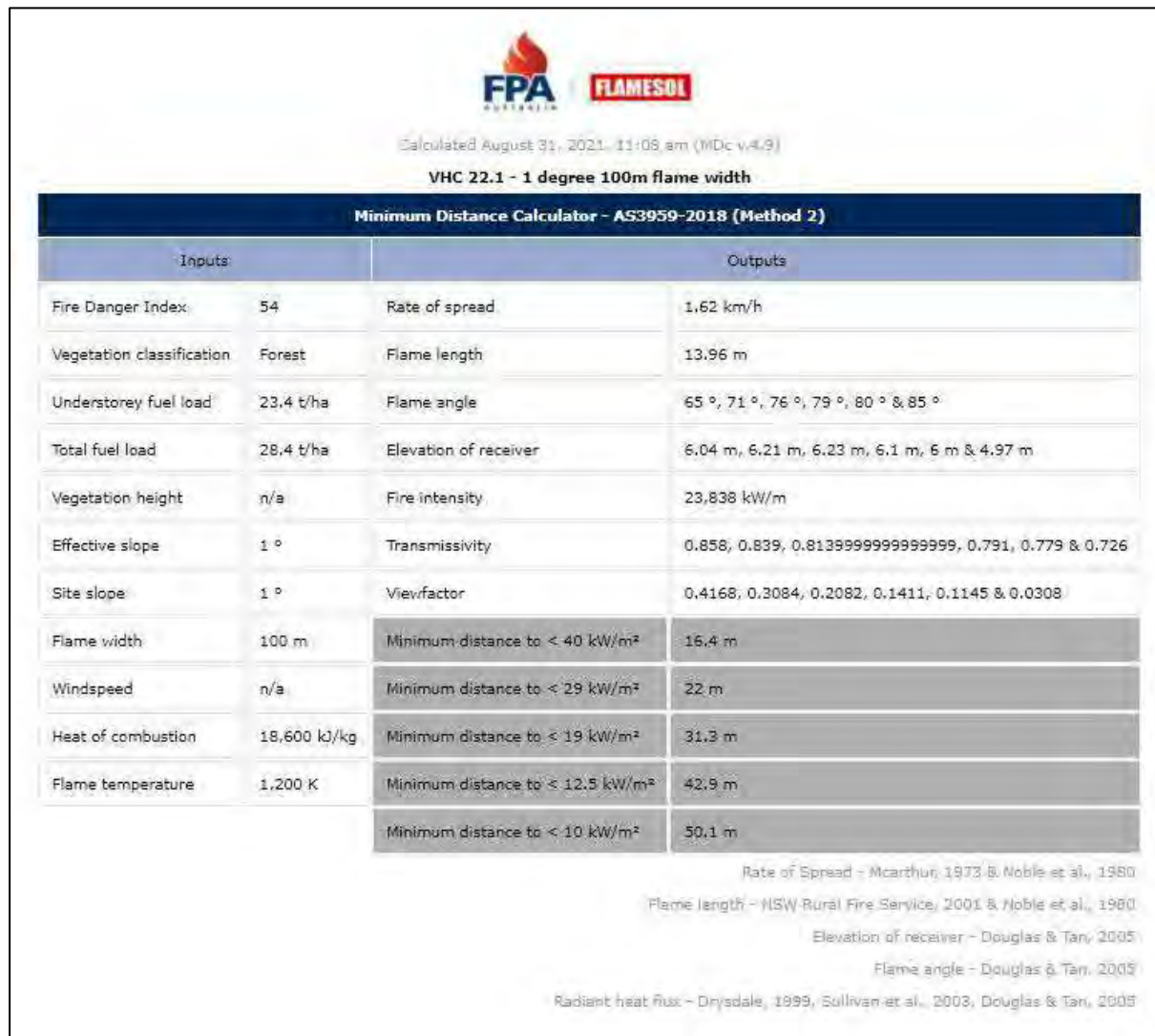


Plate 13 – VHC 22.1 (Melaleuca open forests on seasonally inundated lowland coastal swamps) - 1° 100m



Plate 14 – VHC 22.1 (Melaleuca open forests on seasonally inundated lowland coastal swamps) - 1° 60m

4 **BUSHFIRE RISK ASSESSMENT**

4.1 **General**

A bushfire risk assessment for the proposed building areas has been prepared generally in accordance with *State Planning Policy – State Interest Guideline – Natural Hazards, Risk and Resilience* (DILGP, 2016) and *AS/NZS ISO 31000:2018 – Risk Management Methodology*.

The bushfire risk assessment details the likelihood that the proposed buildings; admin/reception, maintenance building and stables, adjoining the hazardous vegetation will be exposed to radiant heat impact from the adjacent confirmed Bushfire Potential Intensity areas depicted on Plan No. BF-03. Note the proposed camp sites have not been assessed as they do not represent buildings or other fixed structures hence can be readily evacuated to mitigate impacts.

Plate 15 illustrates the main bushfire attack mechanisms acting on buildings.

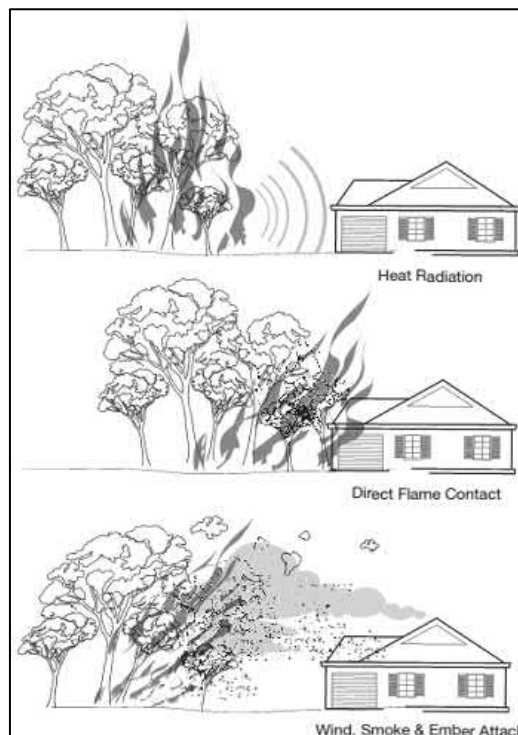


Plate 15 – Figure A 5.1 Bushfire attack mechanisms (Planning for Bush Fire Protection, 2006)

According to AS/NZS ISO 31000:2018, a 'hazard' is defined as a source of potential harm or a situation with a potential to cause loss, whereas a 'risk' is the chance of something happening that will have an impact on objectives measured in terms of consequences and likelihood. The *State Planning Policy – State Interest Guideline – Natural Hazards, Risk and Resilience* (DILGP, April 2016) refers to 'acceptable risk', 'tolerable risk', and 'intolerable risk' which are defined below.

- **Acceptable risk**
 - o A risk that, following an understanding of the likelihood and consequences, is sufficiently low to require no new treatments or actions to reduce risk further. Individuals and society can live with this risk without feeling the necessity to reduce the risks any further.
- **Tolerable risk**
 - o A risk that, following an understanding of the likelihood and consequences, is low enough to allow the exposure to continue, and at the same time high enough to require new treatments or actions to reduce risk. Society can live with this risk but believe that as much as is reasonably practical should be done to reduce the risks further.

- **Intolerable risk**

- o A risk that, following an understanding of the likelihood and consequences, is so high that it requires actions to avoid or reduce the risk. Individuals and society will not accept this risk and measures are to be put in place to reduce risks to at least a tolerable level.

Section 9.4 of the QFES Bushfire Resilient Communities 2019 references radiant heat flux exposure of $<10\text{kW/m}^2$ on the development footprint plan as generating an Acceptable to Tolerable level of risk for vulnerable uses.

AS/NZS ISO 31000:2018 defines 'Likelihood' as the chance that something might happen. Likelihood can be defined, determined, or measured objectively or subjectively and can be expressed either qualitatively or quantitatively (using mathematics). The following 'likelihood' categories for the probability of the assessed bushfire attack mechanisms impacting the assessment area have been adopted within this assessment:

- Likely - Will probably occur
- Unlikely - Could occur but doubtful

The determination of whether a bushfire event is likely or unlikely to occur (i.e., impact the site) has been based on the relative position of hazardous vegetation to the site. Hazardous vegetation located upwind of a site under typical south-east Queensland (SEQ) seasonal fire winds from the north to north-west to west to south-west is deemed to expose a site to a 'likely' probability of impact. Hazardous vegetation located downwind of the site under typical SEQ seasonal fire winds is deemed to expose a site to an 'unlikely' probability of impact.

4.2 Risk from Identified Hazardous Vegetation

The Plan of Development depicts the proposed development adjacent to the identified hazardous vegetation to the north, northeast, and northwest of the site. The likelihood of a fire approaching from the north to northwest is considered *likely*, given dominant regional fire weather winds are derived from the north-west to west to south-west. The likelihood of a fire approaching from the northeast is considered *unlikely*, given north-east winds are rarely associated with fire events in SEQ.

The degree of separation offered to the adjoining vegetation is the primary driver of the assigned level of risk and was determined with consideration to the Flamesol modelling output presented in Section 3.3.

The following minimum separation distances are required to the identified hazardous vegetation to ensure the proposed development is exposed to $<10\text{kW/m}^2$ radiant heat flux as per the Flamesol modelling presented herein:

- 43m to the northern most unit of Sub unit 2 (VHC 22.1); and
- 50.1m to the north, northeast, and northwest units of Sub unit 2 (VHC 22.1).

The development footprint boundary is proposed to be separated from adjacent hazardous vegetation to the north, east and north-west by a 50m open space low threat bushfire buffer inclusive of a road formation which doubles as a firebreak trail for emergency purposes (Refer Appendix 1).

It is noted $>100\text{m}$ separation is proposed for the admin/reception building, the maintenance buildings and the 24/7 onsite managers residence. The extent of separation facilitates an acceptable risk of radiant heat impact for vulnerable uses in accordance with Section 9.4 of the QFES Bushfire Resilient Communities 2019.

5 BUSHFIRE IMPACT REDUCTION MEASURES

5.1 General

The following section describes bushfire impact reduction measures to be incorporated into the proposed development to reduce the risk of bushfire impacts to people and property. Implementation of the identified measures is not implied nor intended to advocate that building occupants remain on the site during a bushfire event, nor that people and property will be protected from bushfire impacts. The measures are intended to reduce the potential severity of bushfire impact to the development and not prevent bushfire impact. The bushfire mitigation measures have been derived from:

- Department of State Development, Manufacturing, Infrastructure and Planning's *State Planning Policy – State interest guidance material – Natural hazards, risk and resilience – Bushfire (December 2019)* (referenced herein as SPP (Bushfire) 2019); and
- Queensland Fire and Emergency Services. (2019). *Planning for Bushfire Resilient Communities*.

5.2 Asset Protection Zones

5.2.1 General

Asset Protection Zones (APZ) provide a defensive tool to assist in the reduction of potential bushfire impact to people and property situated in bushfire prone areas. For illustrative purposes, Plate 16 depicts the concept of an APZ surrounding a dwelling in a bushfire prone areas.

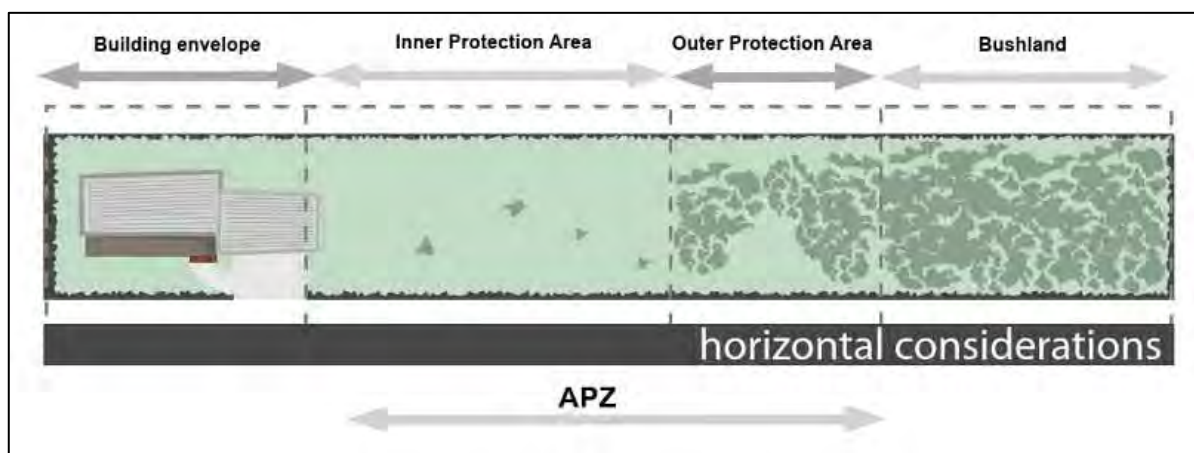


Plate 16 – Asset Protection Zones

The proposed use is for a campsite (i.e., tents) and no permanent or mobile habitable buildings are proposed such as cabins or RV's/motor homes other than a manager's residence. Therefore, the components of the development that require an APZ comprise the individual camp sites, main admin/reception, maintenance buildings, and manager's residence.

This assessment inherently assumes the camp grounds will be landscaped to reflect low threat vegetation conditions (i.e., generally lawn + / - scattered shrubs and trees and gardens).

5.2.2 Nature Based Tourism – 'Vulnerable Uses'

There are no specific setback criteria for a Material Change of Use development application under the SCC Bushfire Hazard Overlay Code 2014.

State Planning Policy – State interest guidance material for natural hazards, risk and resilience for bushfire considers nature-based tourism a 'vulnerable use'. Therefore, as stipulated in Section 9.4 of the *Technical Reference Guide for the State Planning Policy State Interest 'Natural Hazards, Risk and Resilience - Bushfire'*, the applicable assets in the development footprint must be separated from the closest edge of an adjacent mapped medium, high or very-high potential bushfire intensity area by a distance (APZ width) that achieves a radiant heat flux level of 10 kW/m² or less at all development footprint boundaries.

The risk assessment performed in Section 4.2 herein identifies that the entire development footprint boundary is separated by sufficient distance to achieve $<10\text{kW/m}^2$ RHF from the High Potential Intensity Areas associated with the VHC 22.1 vegetation hence satisfy the vulnerable use setback criteria.

Any land that falls within the $<10\text{kW/m}^2$ radiant heat flux setback requirements identified in Section 4 should be designed to comprise low threat conditions as referenced in Section 5.6 Landscaping and Regrowth.

5.3 Water Supply

The availability of a reliable water supply for firefighting purposes is a vital tool in the defence of bushfire impact. Reticulated water supply is currently not available within the site. The proposed development will therefore require provision of a readily accessible on-site emergency static water supply in accordance with Assessment Benchmark 4 of the SPP Bushfire 2019. Assessment Benchmark 4 references the QFES 2019 *Bushfire resilient communities* document for information regarding appropriate static water supply. Section 9.1 of *Bushfire resilient communities* states:

An appropriate static water supply (in bushfire prone areas where reticulated supply is not provided) to support effective emergency services response includes a water tank that is available solely for firefighting purposes and can be accessed by firefighting appliances. The water tank is to be provided within 10 metres of each building (other than a class 10 building), which:

- a) is either below ground level or of non-flammable construction;*
- b) has a take-off connection at a level that allows the following dedicated, static water supply to be left available for access by firefighters:*
 - i. 10,000 litres for residential buildings;*
 - ii. for industrial, commercial and other buildings, a volume specified in AS 2304–2011 Water storage tanks for fire protection systems;*
- c) is protected from bushfire attack, including shielding of tanks and pump in accordance with AS2304–2011 Water storage tanks for fire protection systems;*
- d) allows medium rigid vehicle (15 tonne fire appliance) clear access within six metres of the tank*
- e) if serviced by a rural fire brigade, i provided with rural fire brigade tank fittings of a 50-millimetre ball valve and male camlock coupling and, if underground, an access hole of 200 millimetres (minimum) to accommodate suction lines;*
- f) is clearly identified by directional signage at the street frontage.*

It is noted there are actually no water supply volumes nominated in AS 2304–2011. Therefore, it is recommended a dedicated 10,000 litres should be supplied to the following assets:

- The admin building;
- The maintenance sheds (shared 10kL acceptable); and
- Adjacent to the easternmost amenities block which is positioned next to Pumicestone National Park to assist with defending a fire from the north-east or which commences on the edge of the Park from site activities.

Note that the above recommended water supply volumes are to be explicitly reserved for firefighting purposes only. Plate 17 outlines an example of how this can be achieved.

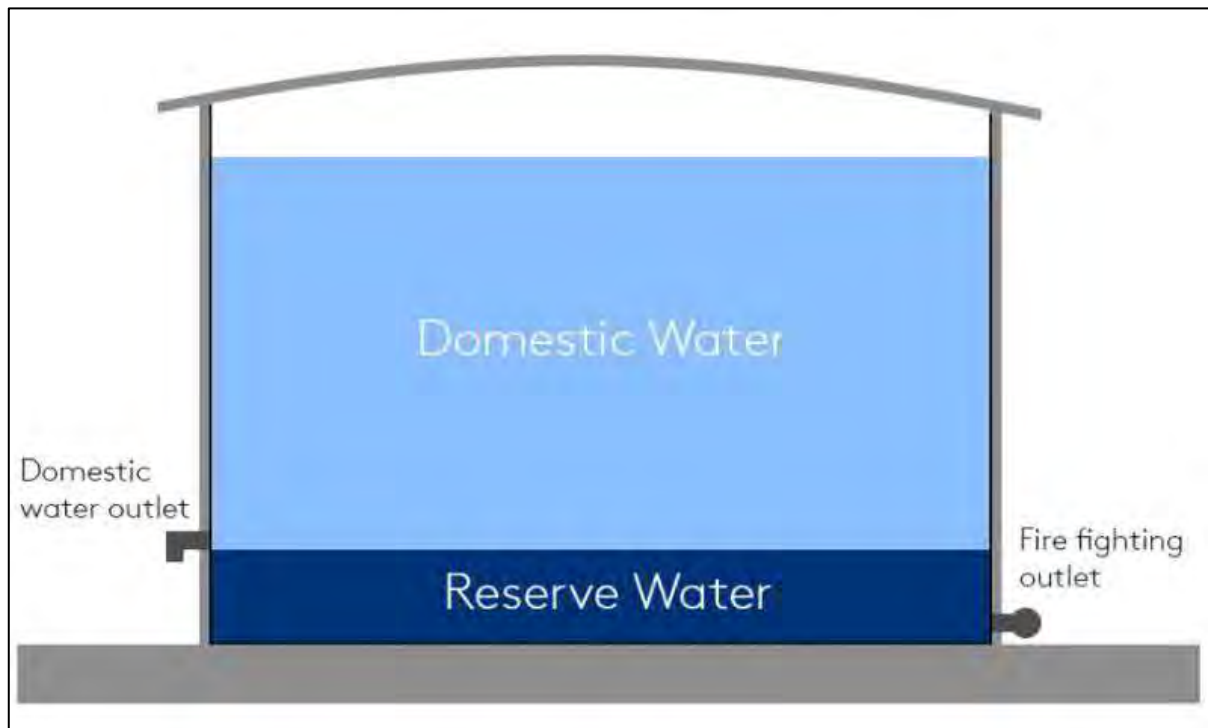


Plate 17 – Example Static Water Supply tank design for fire fighting purposes (Source: Kingspan Group 2021)

5.4 Fire Breaks

The provision of fire breaks and fire trails within a site located in a bushfire prone area offers an important bushfire defence measure to assist in reducing the risk and severity of bushfire ingress onto and through a site. Plate 18 outlines the SPP benchmark design parameters for a fire trail that allows for safe access and egress and operational space for rural fire-fighting vehicles.

Parameter	Provisions
Width	<p>Contains a width of at least 20 metres including:</p> <ol style="list-style-type: none"> 1. A trafficable area (cleared and formed): <ol style="list-style-type: none"> a. with a minimum width of 4 metres that can accommodate a rural firefighting vehicle b. with no less than 4.8 metres vertical clearance from canopy vegetation c. with no adjacent inhibiting embankments or retaining walls 2. A working area each side of the trafficable area: <ol style="list-style-type: none"> a. with a minimum width of 3 metres each side b. cleared of all flammable vegetation greater than 0.1 metre in height 3. The balance (i.e. 10 metres width) managed vegetation area: <ol style="list-style-type: none"> a. sited to separate the trafficable area from adjacent mapped medium, high or very high potential bushfire intensity areas managed vegetation b. comprising managed vegetation clear of major surface hazards.
Access	<p>Access is granted in favour of the local government and Queensland Fire and Emergency Services</p> <p>Note – This access is commonly granted in the form of an easement that is to be maintained by the grantor.</p>
Egress	Contains trafficable vehicle routes in to low hazard areas, every 200 metres

Plate 18 – Fire trail and working area design parameters (Source: SPP Natural hazards, risk and resilience – Bushfire Table 4)

It is recommended that the internal road network positioned directly adjacent to the mapped high potential bushfire intensity areas meet the SPP fire trail requirements shown in Plate 18. It is assumed that the *balance* area will contain maintained lawn and it is imperative that the *working area* should be perpetually available and not contain obstructions (i.e., tents, cars, guy ropes etc.). Plate 19 outlines the sections of internal road that are adjacent to the mapped

high potential bushfire intensity areas and should meet the requirements stated in Plate 18.



Plate 19 – Fire break alignment (Source: POD)

5.5 Vehicular Access

Development in bushfire prone areas should be serviced by safe access/exit points for both occupants and emergency services personnel. Access to the proposed development is via the existing access point in the south-west corner of the site (i.e., Roys Road). The access is located within a low threat area comprised of cleared areas and thin patches of riparian vegetation hence the risk of access/egress to the site becoming constrained during a bushfire event is deemed low.

To ensure the development can support accessibility and manoeuvring for firefighting and emergency services during a bushfire event it is recommended that the driveway design satisfies Section 5 of the QLD Fire Hydrant and Vehicle Access Guidelines for Residential Commercial and Industrial Lots 2019 (Fire Hydrant Guidelines 2019) which provides 4 main specifications for accessibility and manoeuvring for firefighting and emergency services as follows:

- 5.1 Road Width and Height;
- 5.2 Road Construction;
- 5.3 Road Grades; and
- Turning Bays.

Road Width and Height

Section 5 states '*Fire service vehicular access is to enable the service to intervene to fight the*

fire, assist with evacuation and stop the spread of fire to another building. A minimum roadway clearance of 3.5m wide by 4.8m high is required for a fire truck. Constructed roads must comply with Government legislation as specified in the “Road Planning and Design Manual”.

Road Construction

The Performance Outcome in Section 5.2 seeks that *Roads must be constructed to facilitate the safe passage of a laden fire truck in all weather conditions.*

The nominated acceptable outcome is that *Roads must be constructed to a standard so that they are accessible in all weather conditions and capable of accommodating a vehicle of 15 tonnes for the trafficable road width as specified in the “Road Planning and Design Manual”.*

It is recommended the internal road network to service the development comply with this Acceptable Outcome and such can be set as a condition of approval.

Road Grades

The Performance Outcome in Section 5.3 seeks that *Grades of roads must facilitate the safe passage of fire trucks.*

The nominated acceptable outcome is that *The average grades, dips, and exit angles must be addressed as specified in the “Road Planning and Design Manual”.*

It is recommended the internal road network to service the development comply with this Acceptable Outcome and such can be set as a condition of approval.

Turning Bays

The Performance Outcome in Section 5.4 seeks that *Provision is made for fire trucks to turn at the end of dead-end roads.* The nominated acceptable outcome is that *Constructed roads more than 60m in length from the nearest intersection must have a turning circle with a minimum radius of 8m (including roll-over kerbs if they are provided). Other solutions using T or Y heads of specified dimensions are also appropriate. See figure 2 in the “Road Planning and Design Manual”.*

The rationale for turning bays is stated as:

It is dangerous for emergency vehicles to be required to reverse along roads for excessive distances in urban areas. Turning is normally carried out after the incident is under control when emergency movement is not required. Even then, large trucks reversing in residential areas create safety concerns. Fire trucks occasionally need to seek an alternative route necessitating a 180 degree turn in emergency

conditions. Using a three-point turn, fire trucks require a turning circle radius of 8m to turn safely. Alternative designs using specified T or Y heads are also appropriate. This area needs to be clear of obstructions.

The proposed development access utilises a large network of internal roads, it offers multiple connecting routes to traverse the site, with no *dead-end roads*. Therefore, installation of a specific turn around point for emergency service vehicles is deemed unnecessary.

5.6 Landscaping and Regrowth

Existing and future landscaping within the site should avoid increasing the potential for bushfire hazard. Assessment Benchmark 5 of the SPP Bushfire 2019 seeks that the site layout places the landscape and open spaces within the site between premises and adjacent mapped medium, high or very high potential bushfire intensity areas. This landscaping and open space comprises protective landscape treatments that:

- 1. Comprise only low threat vegetation (for example grassland managed in a minimal fuel condition, maintained lawns, golf courses and cultivated gardens); or*
- 2. Are designed to ensure a potential available fuel load is maintained at less than 8*

tonnes/hectare in aggregate and with a fuel structure that remains discontinuous.

To reduce the potential for bushfire impact to buildings, structures and occupants as a result of future regrowth and landscaping works within the site, it is recommended:

- The development footprint be landscaped so as to present low threat vegetation conditions across the site, dominated by lawn, scattered trees and discrete gardens;
- Installation of new landscaping maximises low flammability species, satisfies Assessment Benchmark 5 of the SPP Bushfire 2019 and is arranged in clumps and or linear screening treatments that do not offer a continuous within 3m of buildings.

The low threat conditions are to be maintained by the property manager for the life of the development.

5.7 General Property Maintenance

The undertaking of an appropriate level of property maintenance throughout the year, and in particular prior to the fire season, can significantly reduce the severity of fire impact upon a site. Queensland Fire and Emergency Services recommend the following general actions be undertaken to prepare for the fire season:

Structure

- Clear leaves, twigs, bark and other debris from the roof and gutters.
- Purchase and test the effectiveness of gutter plugs.
- Enclose open areas under decks and floors.
- Install fine steel wire mesh screens on all windows, doors, vents and weep holes.
- Point LPG cylinder relief valves away from the house.
- Conduct maintenance checks on pumps, generators and water systems.
- Seal all gaps in external roof and wall cladding.

Access

- Display a prominent house or lot number, in case it is required in an emergency.
- Ensure there is adequate access to your property for fire trucks - 4 metres wide by 4 metres high, with a turn-around area.

Vegetation

- Reduce vegetation loads along the access path.
- Mow your grass regularly.
- Remove excess ground fuels and combustible material (long dry grass, dead leaves and branches).
- Trim low-lying branches two metres from the ground surrounding your home.

Note the above recommendations are that of QFES and are offered herein for advisory purposes. They have not been set as recommendations for certification purposes.

5.8 Bushfire Evacuation

Given the extent of hazardous bushland in the vicinity of the site there is an inherent risk that an evacuation of the site may be required to mitigate serious risk of impact to site occupants should a significant fire threaten the site. A Bushfire Emergency Response Plan has therefore been prepared to direct the evacuation of the site (refer Appendix 2) and comprises an integral component of the measures prescribed herein to manage bushfire safety on the site.

6 AUSTRALIAN STANDARD 3959:2018 CONSTRUCTION OF BUILDINGS IN BUSHFIRE PRONE AREAS (AS 3959:2018) SETBACKS

The Manager's residence is anticipated to be the only Class 1 habitable dwelling and/or include a Class 10 shed associated with Class 1 dwelling as a part of the development. The location of the Manager's residence is positioned external of a Designated Bushfire Prone Area under the SCC Planning Scheme and the SPP. Therefore, the provisions of AS3959 2018 do not apply.

7 **LEGISLATION AND OVERLAYS**

7.1 **Sunshine Coast Planning Scheme 2014**

The SCC Bushfire Hazard Overlay Code applies to self-assessable and assessable development that is:

- Subject to the bushfire hazard overlay shown on the overlay maps contained within Schedule 2 (Mapping) of the SCC Planning Scheme; and
- Identified as requiring assessment against the Bushfire Hazard Overlay Code by the tables of assessment in Part 5 (Tables of assessment) of the SCC Planning Scheme.

The purpose of the Bushfire Hazard Overlay Code is to ensure that development avoids or mitigates the potential adverse impacts of bushfire on people, property, economic activity and the environment.

The proposed development is considered *assessable development* and therefore is assessable against the assessment criteria contained within Table 8.2.4.3.2 of the Bushfire Hazard Overlay Code which has been reproduced as Table 4.

Note - Under Chapter 2, Part 1, Section 8, Item 4(a) of the *Planning Act 2016*, where there is an inconsistency between a State planning policy and local government planning instrument, a State planning policy applies instead of a regional plan or local planning instrument. Therefore, the State Planning Policy – Natural Hazards, Risk and Resilience assessment benchmarks prevail over those prescribed in the SCC Bushfire Hazard Overlay Code where they involve the same design elements (i.e., the SPP separation requirements prevail over SCC requirements etc).

Table 4 – Table 8.2.4.3.2 of the Bushfire Hazard Overlay Code

PERFORMANCE OUTCOMES		ACCEPTABLE OUTCOMES		PROPOSAL COMPLIANCE SUMMARY
BUSHFIRE HAZARD ASSESSMENT AND MANAGEMENT				
PO1	Bushfire mitigation measures are adequate for the potential bushfire hazard level of the site, having regard to the following: - (a) vegetation type; (b) slope; (c) aspect; (d) on-site and off-site bushfire hazard implications of the particular development; (e) bushfire history; (f) conservation values of the site; and (g) ongoing maintenance. Note—where a bushfire hazard assessment and management plan has previously been approved for development proposed on the site (e.g., as part of a prior approval), design of the proposed development in accordance with that plan shall be taken as achieving compliance with this performance outcome.	AO1.1	The level of bushfire hazard shown on a Bushfire Hazard Overlay Map is confirmed through the preparation of a site-specific bushfire hazard assessment and management plan, prepared in accordance with the Planning scheme policy for the bushfire hazard overlay code.	The preparation of this Bushfire Hazard Assessment and Management Plan satisfies AO1.1.
		AO1.2	Development is located, designed and operated in accordance with a Council-approved bushfire hazard assessment and management plan, prepared in accordance with the Planning scheme policy for the bushfire hazard overlay code.	The proposed development has been located, designed and shall be operated in accordance with this Bushfire Hazard Assessment and Management Plan and therefore complies with AO1.2.
IMPACT OF BUSHFIRE MITIGATION MEASURES ON ECOLOGICALLY IMPORTANT AREAS				
PO2	Bushfire mitigation measures do not adversely impact on: - (a) biodiversity values and functionality; and (b) the long-term physical integrity of waterways, wetlands and native vegetation areas.	AO2	No acceptable outcome provided.	The proposed development footprint boundary has been located with enough separation to satisfy the <10kW/m² radiant heat flux exposure SPP requirement. No clearing of mature vegetation is required for bushfire mitigation measures.
SAFETY OF PEOPLE AND PROPERTY				
PO3	Development maintains the safety of people and property from the adverse impacts of bushfire.	AO3	Development which will materially increase the number of people living or congregating on premises, including reconfiguring a lot, is not located or intensified within a confirmed medium or high bushfire hazard area. This includes, but is not limited to, the following uses: - (a) child care centre; (b) community care centre; (c) community residence; (d) community use; (e) educational establishment; (f) emergency services; (g) hospital; (h) indoor sport and recreation; (i) nature-based tourism; (j) outdoor sport and recreation; (k) relocatable home park; (l) resort complex; (m) short-term accommodation; (n) residential care facility; (o) retirement facility; (p) short-term accommodation; (q) tourist attraction; and (r) tourist park. Note—the level of bushfire hazard shown on a Bushfire Hazard Overlay Map is to be confirmed through the preparation of a site-specific bushfire hazard assessment and management plan, prepared in accordance with the Planning scheme policy for the bushfire hazard overlay code.	This Bushfire Hazard Assessment and Management Plan has been prepared to maintain the safety of people and property from the adverse impacts of bushfire.
ESSENTIAL COMMUNITY INFRASTRUCTURE				

PERFORMANCE OUTCOMES		ACCEPTABLE OUTCOMES		PROPOSAL COMPLIANCE SUMMARY
PO4	Essential community infrastructure is able to function effectively during and immediately after bushfire events.	AO4	Development involving essential community infrastructure is not located within a confirmed medium or high bushfire hazard area. OR Where located in a confirmed medium or high bushfire hazard area, development involving essential community infrastructure is designed to function effectively during and immediately after bushfire events in accordance with a Bushfire Hazard Assessment and Management Plan prepared in accordance with the Planning scheme policy for the bushfire hazard overlay code.	The proposed development does not involve essential community infrastructure.
HAZARDOUS MATERIALS				
PO5	Public safety and the environment are not adversely affected by the detrimental impacts of bushfire on hazardous materials manufactured or stored in bulk.	AO5	Development involving the manufacture or storage of hazardous materials in bulk is not located within a confirmed medium or high bushfire hazard area.	The proposed development does not involve the manufacture or storage of hazardous materials in bulk.
ACCESS AND EVACUATION ROUTES				
PO6	Where development involves provision of a new public or private road, the layout, design and construction of the road: - (a) allows easy and safe movement away from any encroaching fire; (b) allows easy and safe access for fire-fighting and other emergency vehicles; and (c) provides for alternative safe access and evacuation routes should access in one direction be blocked in the event of a fire.	AO6.1	The road layout provides for “through roads” and avoids cul-de-sac and “dead end roads” (except where a perimeter road isolates the development from hazardous vegetation, or the cul-de-sac are provided with an alternative access linking the cul-de-sac to other through roads).	Access to the proposed development is via the existing access point. The access is located within low threat area comprised of cleared areas and thin patches of vegetation hence the risk of access/egress becoming constrained during a bushfire event is deemed low. The proposed internal road network provides no <i>dead-end roads</i> and offers multiple looping connections for each section of the site.
		AO6.2	Roads have a maximum gradient of 12.5%.	The roads will utilise a grade less than 12.5%.
FIRE BREAKING TRAILS				
PO7	Fire breaking trails are located, designed and constructed to mitigate against bushfire hazard by: - (a) ensuring adequate access for fire-fighting and other emergency vehicles; (b) ensuring adequate access for the evacuation of residents and emergency personnel in an emergency situation, including an alternative safe access routes should access in one direction be blocked in the event of fire; and (c) providing for the separation of developed areas and adjacent bushland.	AO7	Where development involves the creation of a new road, fire breaking trails are provided between the development site and hazardous vegetation. Such fire breaking trails: - (a) are located along and within a cleared road reserve having a minimum width of 20 metres; and (b) have a maximum gradient of 12.5%. OR Where development does not involve the creation of a new road, fire breaking trails are provided between the development site and hazardous vegetation. Such fire breaking trails: - (a) have a cleared minimum width of 6 metres; (b) have a maximum gradient of 12.5%; (c) provide continuous access for fire fighting vehicles; (d) allow for vehicle access every 200 metres; (e) provide passing bays and turning bays every 400 metres; and (f) are located within an access easement that is granted in favour of Council and Queensland Fire and Rescue Service.	Plate 18 outlines the design parameters for a fire trail that allows for safe access and egress and operational space for rural fire-fighting vehicles. It is recommended that the internal road network directly adjacent to the mapped high potential bushfire intensity areas meet the requirements stated in Plate 18. It is assumed that the balance area will contain lawn and that the working area will be perpetually available and not contain obstructions (i.e., tents, cars, guy ropes). Plate 19 outlines the sections of internal road that are adjacent to the mapped high potential bushfire intensity areas and should meet the requirements stated in Plate 18.
LOT LAYOUT				
PO8	The lot layout of development is designed to: - (a) mitigate any potential bushfire hazard; and (b) provide safe building sites.	AO8.1	Residential lots are designed so that their size and shape allow for efficient emergency access to buildings and for fire fighting vehicles (e.g., by avoiding battle-axe/hatchet lots and long narrow lots with long access drives to buildings).	N/A – The application is not for new residential lots.

PERFORMANCE OUTCOMES		ACCEPTABLE OUTCOMES	PROPOSAL COMPLIANCE SUMMARY
		AO8.2 Residential lots are designed so that their size and shape ensure buildings and structures: - (a) are sited in locations of lowest hazard within the lot; (b) achieve setbacks from hazardous vegetation of 1.5 times the height of the predominant mature tree canopy or 10 metres, whichever is greater; (c) achieve a setback of 10 metres from any retained vegetation strips or small areas of vegetation; and (d) are sited so that elements of the development least susceptible to fire are sited closest to the fire hazard.	N/A – The application is not for new residential lots.
WATER SUPPLY FOR FIRE FIGHTING PURPOSES			
PO9 Development provides an adequate water supply for firefighting purposes which is reliable, safely located and freely accessible.	AO9. Premises are connected to a reticulated water supply with a minimum pressure and flow of 10 litres a second at 200kPa at all times. OR Where there is no reticulated water supply: - (a) the premises has a minimum water supply capacity of 5,000 litres dedicated for firefighting purposes; and (b) the water supply dedicated to fire fighting purposes is sourced from: - (i) a separate tank; (ii) a reserve section in the bottom part of the main water supply tank; (iii) a swimming pool installed immediately upon construction of the development; or (iv) a permanent dam. Note—due consideration should be given to the location of the water storage in relation to the most likely fire fronts on the site, as well as to the resistance of the water storage to the effects of radiant heat and direct flame.		No reticulated water is currently available to the site. The water supply requirements of SPP Assessment Benchmark 5 prevails and can be conditioned with an approval. Note the reliance upon dams or pools for water storage is not an acceptable solution under the SPP.
	AO9.2 The water supply outlet for firefighting purposes is: - (a) located remote from any potential fire hazards, such as venting gas bottles; (b) provided with a pipe 50mm in diameter and fitted with a 50mm female camlock (standard rural fire brigade fitting); and (c) provided with a hardstand area within 6 metres of the outlet for fire vehicles.		AO9.2 recommended to be adopted and can be conditioned with an approval.
	AO9.3 The pumps that pressurise water output from the tank, swimming pool or drain are able to be operated without reticulated power.		AO9.3 recommended to be adopted and can be conditioned with an approval. A diesel-powered Honda fire fighter pump or similar is recommended.
	AO9.4 Fire hydrants along perimeter roads adjacent to National Parks and other conservation reserves are located not more than 100 metres apart.		No reticulated water is available to the site hence provision of fire hydrants is not practicable. However, it is recommended that an additional 10,000 litre static water supply be provided in a tank located adjacent to the eastern most amenities block.
LANDSCAPE WORKS IN BUSHFIRE HAZARD AREAS			
PO10 Development ensures that landscape treatment and species selection does not exacerbate potential bushfire hazard.	AO10.1 Development provides for road verges and/or nature strips to be landscaped so as to form a swale drain for stormwater run-off with: - (a) low form, non-fire promoting native vegetation; or (b) low form and sparsely planted vegetation. Note—the Planning scheme policy for development works provides guidance on selection of non-fire promoting vegetation species.		All landscape and revegetation work associated with the site are proposed to comply with AO10.2 and can be detailed in a future Landscape Plan for the application where applicable.

PERFORMANCE OUTCOMES		ACCEPTABLE OUTCOMES		PROPOSAL COMPLIANCE SUMMARY
		AO10.2	Development incorporates low form, non-fire promoting native vegetation on areas of the site that are adjacent to or abutting bushland.	All landscape and revegetation work associated with the site are proposed to comply with AO10.2 and can be detailed in a future Landscape Plan for the application where applicable.

7.2 State Planning Policy – Natural Hazards, Risk and Resilience

The Department of State Development, Manufacturing, Infrastructure and Planning's *State Planning Policy – State interest guidance material – Natural hazards, risk and resilience – Bushfire (December 2019)* contains the development assessment benchmarks for natural hazards, risk and resilience - bushfire. The SPP assessment benchmarks prevail over those prescribed in the SCC Bushfire Hazard Overlay Code where they involve the same design elements. The following assessment benchmarks have deemed to be applicable to the proposed development and assessments compliance have been included below.

Assessment Benchmark 3

For development in a bushfire prone area involving vulnerable uses

1. *Vulnerable uses are not established or intensified within the bushfire prone area unless:*
 - a. *there is an overriding need in the public interest for the new or expanded service the development provides*
 - b. *there are no other suitable alternative location within the required service catchment, and*
 - c. *site planning can appropriately mitigate the risk (for example, siting ovals for an educational establishment between the hazardous vegetation and structure).*

The proposed development footprint boundary satisfies the vulnerable use <10kW/m² RHF exposure threshold set under the SPP hence is deemed to be positioned in an acceptable location within the site.

Assessment Benchmark 4

Assessable Development

Development contributes to an effective and efficient emergency response and recovery capabilities. In the first instance, this can be achieved by new or expanded community infrastructure that is providing essential services (emergency services, hospital and educational establishment) not being in a bushfire prone area, as addressed in assessment benchmark 3.

To ensure emergency services can respond effectively, development is located within a reticulated water supply area or includes a dedicated static water supply that is available solely for fire-fighting purposes and can be accessed by fire-fighting vehicles.

Reticulated water supply is not available to the site hence the following dedicated static water supply is recommended:

- 10,000L next to the admin building;
- 10,000L next to the maintenance sheds (shared 10kL acceptable); and
- 10,000L adjacent to the easternmost amenities block which is positioned next to Pumicestone National Park to assist with defending a fire from the north-east or which commences on the edge of the Park from site activities.

The specified volumes should be reserved for fire fighting purposes only (Refer Section 5.3 for an example of a reserve water supply design for fire fighting purposes).

Assessment Benchmark 5

Assessable material change of use

Site layout places the landscape and open spaces within the site between premises and adjacent mapped medium, high or very high potential bushfire intensity areas. This landscaping and open space comprises protective landscape treatments that:

1. *Comprise only low threat vegetation, including grassland managed in a minimal fuel condition¹⁶, maintained lawns, golf courses and cultivated gardens; or*
2. *Are designed to ensure a potential available fuel load is maintained at less than 8 tonnes/hectare in aggregate and with a fuel structure that remains discontinuous.*

Note – The landscape or open space may be located within the mapped medium, high and very high intensity areas to create a separation between the development and the balance of the bushfire prone area.

The proposed development footprint boundary is separated from the hazardous vegetation areas. It is recommended that any new landscaping associated with the proposed works maximises the use of low-flammability species and or avoids clustering of flammable species.

Where involving a requirement for revegetation or rehabilitation outside of bushfire prone areas

1. Revegetation or rehabilitation areas contain patches of less than one ha of continuous fuel (i.e., surrounded by either no fuel or non-continuous fuel) and are further than 100 metres from the interface with mapped medium, high or very high potential bushfire intensity patches greater than two hectares in size. Vegetation corridors in these areas with continuous fuel, should be less than 50 metres in width and isolated patches of continuous fuel, should be less than 0.5 hectare.

No revegetation or rehabilitation areas are currently proposed. It is recommended that any landscaping undertaken within the site facilitates conditions which satisfy Assessment Benchmark 7 below.

Assessment Benchmark 7

Where a requirement for an asset protection zone (or similar) exists

Landscaping treatments comprise only low threat vegetation, including grassland managed in a minimal fuel condition, maintained lawns, golf courses, maintained public reserves and parklands, vineyards, orchards, cultivated gardens, commercial nurseries, nature strips and windbreaks.

OR

Landscaping management maintains a potential available fuel load which is less than eight tonnes/hectare in aggregate, and fuel structure which is discontinuous.

OR

Development includes a bushfire management plan for the maintenance of any identified asset protection zone, including landscape design and ongoing vegetation management.

This document includes a Bushfire Management Plan which addresses *Landscaping treatments*.

8 **CONCLUSIONS**

This Bushfire Hazard Assessment and Management Plan has been prepared to assess and manage the degree of potential bushfire risk associated with a Material Change of Use application for Lot 10 on SP132272 and Lot 6 on SP184133 located at 1807 Roys Road, Coochin Creek.

A Local Hazard Map has been prepared for the site consistent with the *State Planning Policy – Natural Hazards, Risk and Resilience – Technical Manual – A ‘fit for purpose’ approach in undertaking natural hazard studies and risk assessments*. The Local Hazard Map has identified that the central to northern site extent is located within a Potential Impact Buffer associated with the High Potential Bushfire Intensity positioned to the north, northeast, and northwest of the development footprint.

A bushfire risk assessment has been undertaken in general accordance with *AS/NZS ISO 31000:2018 – Risk Management Methodology*. The risk assessment identified that the proposed development footprint boundary is exposed to an acceptable level of radiant heat impact risk as defined in Section 9.4 of the QFES Bushfire Resilient Communities 2019.

Overall, the development proposed for the site, in combination with recommendations referenced herein, is deemed suitable with respect to providing a reasonable level of protection for people and property within the site.

Bushfire is an extremely serious and often unpredictable phenomenon that requires serious preparatory planning and decision making to avoid potential damage to infrastructure and or loss of life. All recommendations made herein have been formulated based on site conditions at the time of writing and therefore may not be appropriate in the event site conditions change over time.

Implementation of the bushfire mitigation measures referenced herein is not implied nor intended to advocate that site occupants remain on the site during a bushfire event, nor that people and property will be protected from bushfire impact. The measures are intended to reduce the potential severity of bushfire impact to persons and property and not prevent actual bushfire impact.

The landowners and site managers are to be responsible for ensuring the measures prescribed herein are applied and stay up to date with site conditions and industry standards. Landholders/managers should therefore liaise with Queensland Fire and Rescue Services at regular intervals (e.g., recommended at least every 5 years).

The first call in the event of a bushfire emergency should always be ‘000’.

9 REFERENCES

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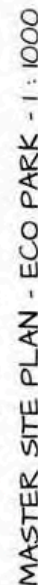
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APPENDIX 1 – SITE LAYOUT



APPENDIX 2 – BUSHFIRE EMERGENCY RESPONSE PLAN

BUSHFIRE EMERGENCY RESPONSE PLAN_{v5}

LOT 10 ON SP132272 & LOT 6 ON SP184133

1807 ROYS ROAD

COOCHIN CREEK



**FOR
COMISKEY GROUP
MARCH 2023**

Table 1 - Bushfire Emergency Response Summary

Trigger	Response Action
Uncontrolled bushfire in the Fire Risk Catchment	Access gate is locked and Site's visitor management system is triggered to text all checked-in guests to be ready for evacuation to the on-site evacuation centre. All not checked-in guests notified that the site is not accepting new guests while the uncontrolled fire is active. Implement shelter in place unless otherwise directed by the relevant emergency service (depending on position of fire and projected burn pathway).
Catastrophic Fire Danger Rating	No new guests permitted to access the site. Site's visitor management system is triggered to text all booked but not checked-in guests notice that the site is not accepting new guests while the catastrophic fire danger rating is active. Site's visitor management system is triggered to text all checked-in guests notice that they have the option to self-evacuate the site or stay with the knowledge that if an uncontrolled bushfire does commence anywhere in the fire risk catchment, the access gate will be locked and they will not be allowed to leave, unless directed otherwise by QFES or QPS.
Extreme Fire Danger Rating	Site's visitor management system is triggered to text all checked-in guests that an Extreme Fire Danger Rating is active and they have the option to self-evacuate the site or stay with the knowledge that if an uncontrolled bushfire does commence anywhere in the fire risk catchment, the access gate will be locked and they will not be allowed to leave, unless directed otherwise by QFES or QPS. Site's visitor management system is triggered to text all booked but not checked-in guests notice that the new guests are permitted to gain access to the site with the knowledge that if an uncontrolled bushfire does commence anywhere in the fire risk catchment, the access gate will be locked and they will not be allowed to leave, unless directed otherwise by QFES or QPS.
High Fire Danger Rating	Staff to be warned of the potential risk and be aware of evacuation procedures. Ensure internal access roads are maintained and can accommodate the expected traffic. Ensure that water points are functional. Ensure that signage informing personnel of the evacuation procedures in the event of a bushfire are provided on site.

DOCUMENT CONTROL

Document Bushfire Emergency Response Plan
Client: Comiskey Group
Project Number: J000923
Project: Material Change of Use
Site: Lot 10 on SP132272 & Lot 6 on SP184133
1807 Roys Road, Coochin Creek

Version	Date	Distribution	Author/s	Approved
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1. INTRODUCTION

This Bushfire Emergency Response Plan (BERP) has been designed to assist management to protect life and property in the event of a bushfire or a pending bushfire on the proposed Eco Park (the site). The site is formally described as Lot 10 on SP132272 & Lot 6 on SP184133 and is located at 1807 Roys Road, Coochin Creek. The site is the subject of a proposed Material Change of Use (Eco-tourism) development application to be submitted to Sunshine Coast Council. The applicant is seeking to secure a Material Change of Use (MCU) permit for the construction of a fully functional camping ground. The proposed development will occupy the southern extent of the site.

The BERP aims to establish pre-planning guidelines for an evacuation of the premises where there is a need to relocate personnel from one place to another to enhance the protection of those people. This evacuation plan forms part of a more comprehensive report undertaken over the subject area to assess and recommend fire mitigation measures for bushfire protection; Bushfire Hazard Assessment & Management Plan by North Coast Environmental Services. Application of this evacuation plan does not specifically require reference to the above document however it is recommended both documents be stored together.

The proposed development will increase the number of people within the site. The decision to enact a bushfire evacuation is generally a managerial decision until the point that an official evacuation recommendation is issued by QFES and/or QLD Police.

During a bushfire in the fire risk catchment, guests and employees will firstly shelter in place on site and be directed not to leave the site until if and when instructed to do so by QFES and/or QLD Police. The 500sq.m admin/reception building is to be used as the shelter in place location for such purposes. It is envisaged that during a bushfire emergency the booking management system that requires records of mobile numbers of guests will be utilised to send text messages to all recorded mobile numbers and also allow guests to reply back.

QFES currently offer advice via Twitter, Facebook, QLD Police and local radio stations. The current QFES warning / evacuation categories are shown in Plate 1.



Plate 1 – QFES warning / evacuation categories

2. DETAILS OF PREMISES

Lot 10 on SP132272 and Lot 6 on SP184133

1807 Roys Road, Coochin Creek

Type of facility: Eco Park (camping ground)

Type of building (Class): Varies, no class 1 habitable buildings are proposed.

3. ROLES AND RESPONSIBILITIES

CHIEF FIRE WARDEN

- Ascertain the nature of the emergency and determine appropriate action.

- Once notified of the possibility of a fire, ascertain the nature of the emergency and determine appropriate action to ensure the safety of occupants, staff and visitors.
- Ensure that the appropriate emergency service has been notified.
- Go to the designated assembly site and take charge.
- Check on progress of movement of occupants, staff and visitors.
- Allocate any extra staff required to assist in any searches for missing occupants, staff or visitors.
- Instruct the management team where additional staff are required for supervisory or support duties.
- Liaise with Emergency Services personnel.

4. BOOKING MANAGEMENT SYSTEM

The Booking Management System (BMS) will form an integral management measure to address the bushfire safety preparedness on the site. The BMS will record the contact details for at least one contact per family group. For large bookings involving more than one family group on an individual site, contact details will be recorded for at least one contact in each family group. The BMS will be utilised to send text messages informing both 'checked in' guests and yet to be 'checked in' guests of any bushfire emergency provisions that have been enacted on the site which may impact their stay. This will include advising guests of the Bushfire Evacuation Response Protocol status of the site on any given day when the Bushfire Evacuation Response Protocols are triggered (refer Section 8), which will be a function of the daily and projected Fire Behaviour Index and the presence vs absence of an uncontrolled fire in the Fire Risk Catchment.

5. CONTACT DETAILS OF EMERGENCY SERVICES

Name of Organization	Name/ Place of Contact Phone Number
Beerwah Fire Station	23A Beerwah Parade, Beerwah QLD 4519 (07) 5494 6790 Emergency 000
Beerwah Police Station	15 Beerwah Parade, Beerwah QLD 4519 (07) 5436 5222: Emergency 000
Beerwah Ambulance Station	23 Beerwah Parade, Beerwah QLD 4519 (07) 5420 9991: Emergency 000
Sunshine Coast Council	(07) 5475 7272 (including after-hours emergency service)
State Emergency Service	132 500
QLD Ambulance Service	000
Caloundra Hospital	West Terrace, Caloundra QLD 4551 (07) 5436 8500

All fires to be reported to 000

5. EVACUATION LOCATION

In the event of a bushfire, guests and employees will shelter in place within the large 500sq.m admin/reception building (refer Building No.1 on the plan of development). This building is positioned near the entry to the site, 250m from the eastern boundary and 330m from the northern mapped wetland/vegetation area, and approximately 60-70m from the safety of the broad Coochin Creek waterbody to the south.

The building is effectively removed from bushland hazards, including associated risk of direct flame contact, radiant heat and severe ember attack. A minimum reserve of 10,000 litres of water will be available at the admin building for use during a bushfire event. Noting, an

additional minimum of 10,000 litres of water of fire-fighting purposes will also be available from the maintenance sheds & easternmost amenities block. Given the available separation between the proposed shelter in place location (admin/reception building) and adjacent bushland, the amount of dedicated water for fire-fighting purposes is deemed adequate.

A total of 100 camp sites are currently proposed and the average park occupancy is reported to be approximately 325 people including staff. Commonly used emergency shelter in place requirements is 1.5m²/person hence the admin/reception building can adequately cater for shelter in place numbers. It is further noted that the reception building will offer food and amenities thereby ensuring the comfort of patrons during an emergency.

In the event that additional shelter in place capacity is required, the large maintenance sheds on the western site boundary can be used as they are located in a confirmed non-bushfire prone area (i.e., located external of a Potential Impact Buffer and hence >100m from the nearest confirmed unit of hazardous vegetation) and will be provided with amenities. The use of the sheds will more than double the shelter in place capacity of the park.

In the event of a shelter in place directive being issued, the 24/7 onsite manager conduct the following:

- Utilise the booking management system to send a text message to all current visitors directing them to the shelter in place location. This will initially be the reception building followed by the maintenance sheds if required.
- The entry/exit boom gate is to be locked to prevent any site occupants from ignoring the advice and fleeing the site.
- Ensure all occupants, staff and visitors have taken refuge in the admin/reception building (i.e., conduct a lap of the park to ensure all occupants have taken up shelter) with a record of such made in a residents and visitors register to be kept in the admin/reception building.
- Ensure communications are maintained between staff in the reception building and the maintenance sheds.

Site occupants are to remain in the shelter in place location until it is advised that it is safe to leave by QFES and/or QPS.

6. TRANSPORTATION

Visitors and staff are to either walk or use personal vehicles to gain access to the admin/reception building and vehicles are to be parked in convoy along the roadside in case a site evacuation order is issued.

Under such circumstances visitors and staff personal vehicles are to be used to evacuate the site. Road access for emergency evacuation is to be from the main entry exit in the southwest corner of the site. If instructed by QFES to evacuate the site, the fire warden will release guests from the site in a controlled, staged manner so as not to congest the external roads.

7. EVACUATION ROUTES

The available evacuation routes to the admin/reception shelter in place location within the site comprise the internal road network. This road network will be flanked by low threat lawn/landscaping, camp sites and cleared fire breaks host to negligible fuel loads. The risk of the access routes to the shelter in place location becoming blocked during a wildfire is therefore unlikely. Numerous through roads have been incorporated into the design of the Park hence evacuation routes do not rely on using routes which flank the development footprint boundaries and nearby bushland. The evacuation route chosen will be dependent on the location of the fire front. The available evacuation routes within the site to the shelter in place location are identified in Plate 2.

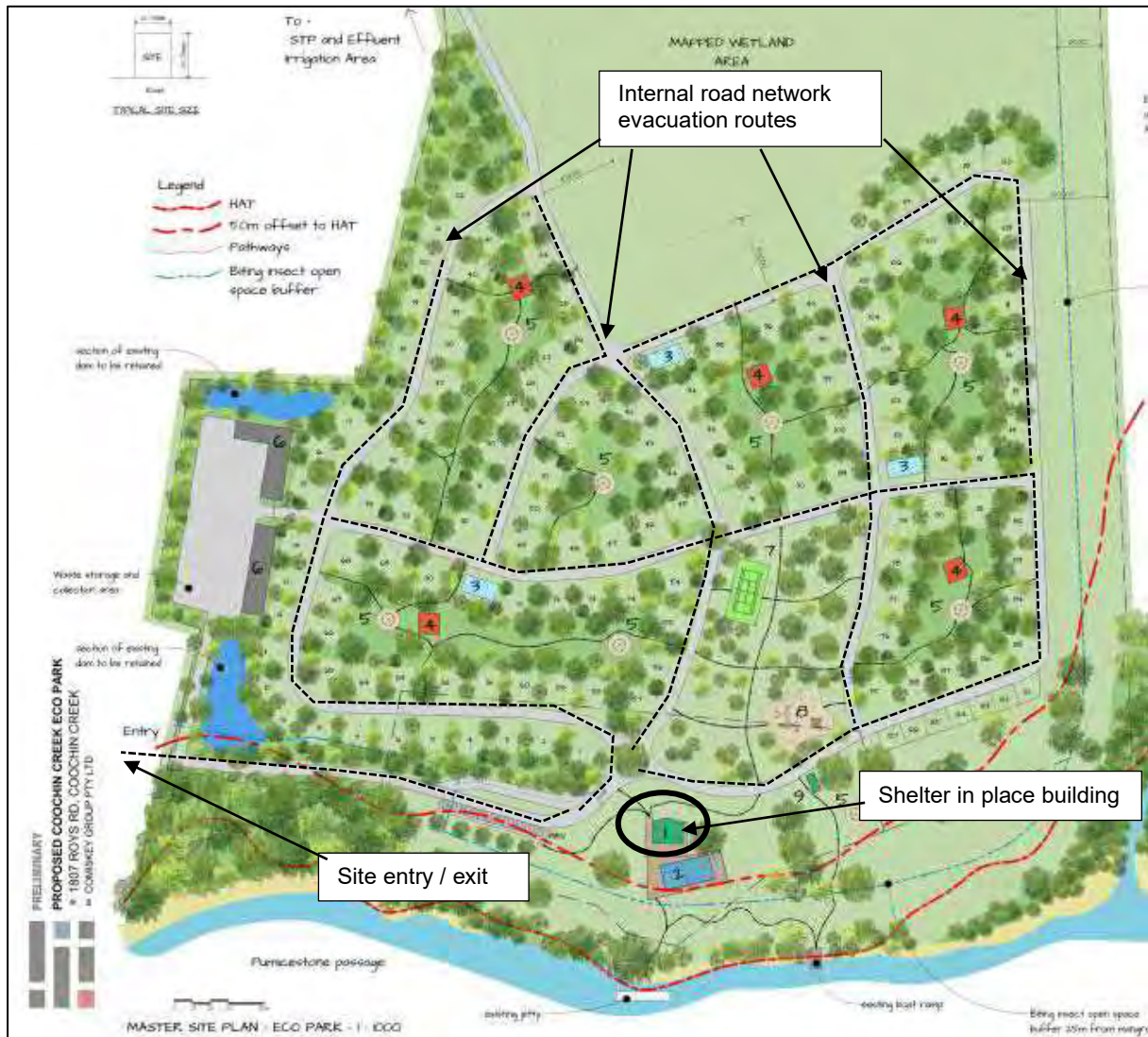


Plate 2 – Available evacuation routes to shelter in place building (Source: Queensland Globe)

The available evacuation routes beyond the site through the local landscape are flanked by a mosaic of fuel laden bushland and scattered cleared to semi cleared rural properties host to low to moderate fuel loads. The risk of entrapment external of the site is therefore real and strategic selection of the most suitable external evacuation route during a bushfire event will be a critical decision. Note, given the extent of cleared land between the shelter in place location and adjacent bushland areas, it is expected that the shelter in place policy will stand for the majority of bushfire events. If a bushfire is located to the west of the site preventing safe passage along the Bruce Highway or Roys Road, the shelter in place location should be utilised until advised it is safe to evacuate by QFES and/or QPS. In this instance, the entry/exit boom gate is to be locked to prevent patrons ignoring the advice and fleeing the site towards the fire front.

In the instance where QFES confirms that the site is to be fully evacuated it is expected directives would be given for site occupants to travel to the township of Beerwah or to the Bruce Highway interchange and then head north or south depending on the projected path of the fire front. The available evacuation routes from the site to Beerwah and the Bruce Highway are identified in Plate 3. The available evacuation routes comprise:

- Head West along Roys Road, North along Coochin Road, West along Bells Creek Road

then either:

- o North along the Bruce Highway; or
- o South along the Bruce Highway; or
- o West along Roys Road.

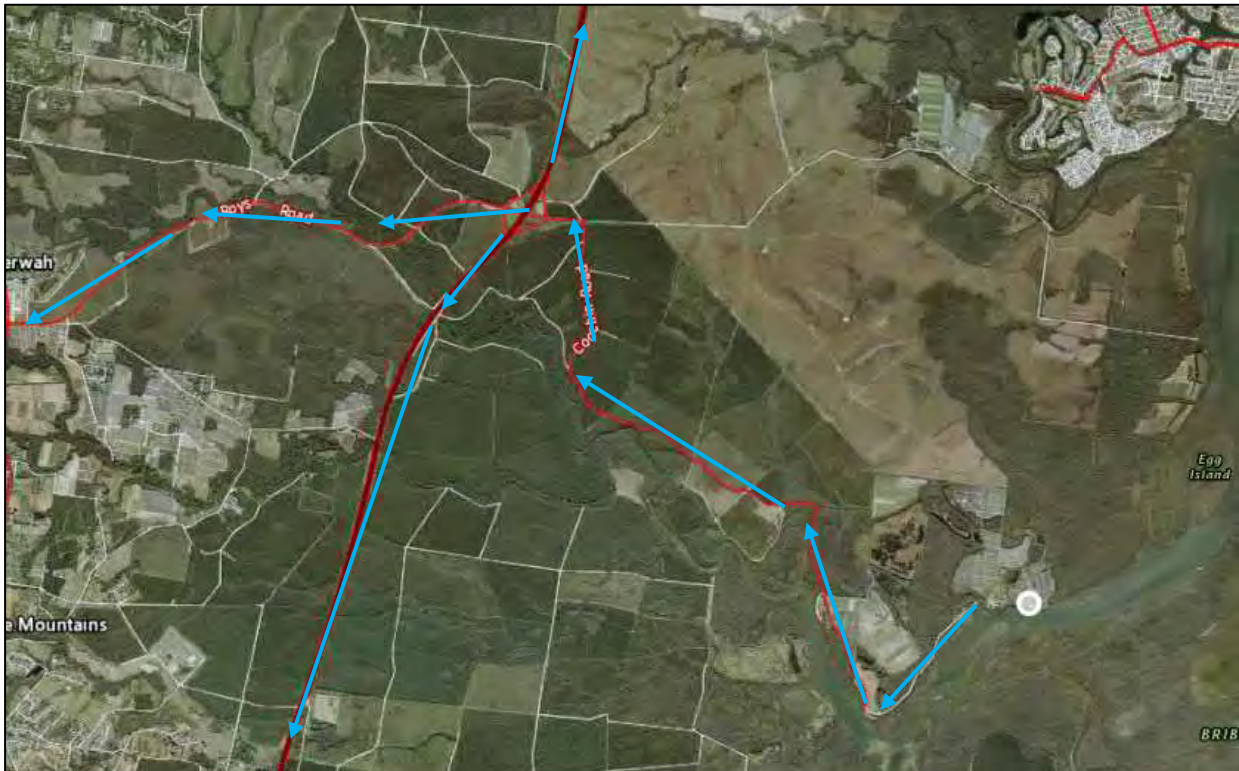


Plate 3 – External available evacuation routes (Source: Queensland Globe)

The evacuation route chosen will be dependent on the location of the fire front. In most instances it is anticipated that the safest evacuation route will be west along Roys Road, then north along Coochin Road, then west along Bells Creek Road, then West along Roys Road towards the Beerwah Township. A transit time of approximately 15minutes should be allowed to reach the Bruce Highway and 25 minutes should be allowed to access the township of Beerwah. Determination of the most suitable evacuation route for a specific fire event should be made with consideration to the relevant advice issued by QFES. Given the extent of hazardous vegetation in the vicinity of the site and along the available evacuation route, the decision to evacuate the site must be made very early to ensure enough time is available to safely transit to the Bruce Highway and then to Beerwah or the safe location designated by QFES and/or QLD Police.

8. FIRE RISK CATCHMENT

The principal of a Fire Risk Catchment is to be used to provide a clearly defined geographic boundary about the site which can be used to initiate bushfire response actions on the site under various bushfire risk conditions. The identification/awareness of an uncontrolled bushfire within the defined Fire Risk Catchment will trigger, unless directed otherwise by QFES or QPS, a site lock down and likely evacuation of all people on the site to the designated shelter in place building/s.

The 'Fire Risk Catchment' for the Eco Park is defined in Plate 4.

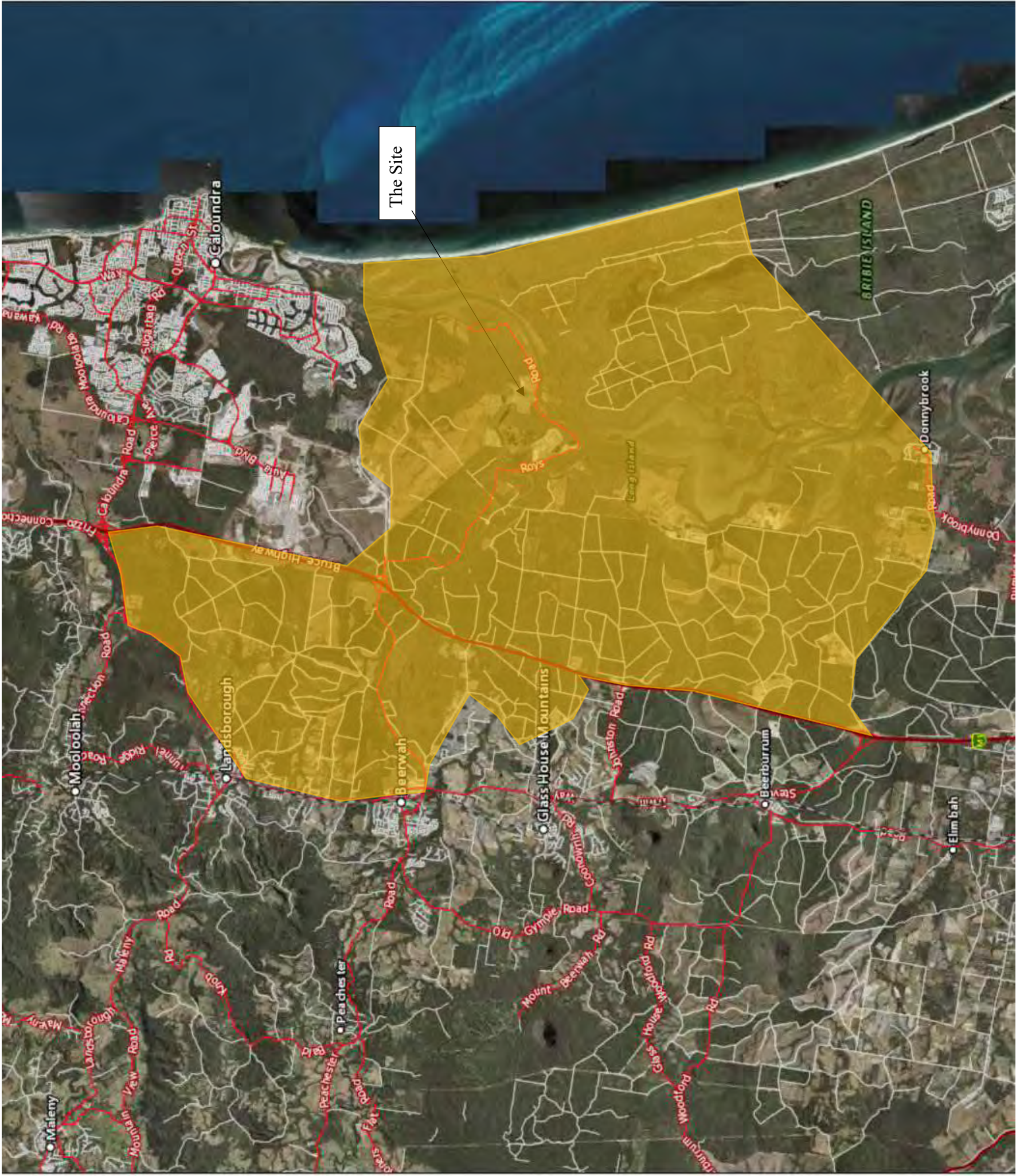


Plate 4 – Eco Park Fire Risk Catchment (Image Source: Queensland Globe)

9. RESPONSE TRIGGERS

The response ‘triggers’ which initiate emergency actions on a site should be devised with consideration given to numerous factors including the proximity of the bushfire to the site, advice regarding the matter issued by QFES and the status of the current National Fire Danger Rating System (FDRS). Fire danger ratings describe the potential level of danger should a bushfire start. They are important because they provide people with information to take action to protect themselves and others from the potentially dangerous impacts of bushfires. They do not indicate the chance of a fire occurring, although this is a common misconception. Ratings are calculated via the Fire Behaviour Index (FBI) which uses a combination of weather forecasting and information about vegetation that could fuel a fire (AFAC 2023). The FBI index ranges from 0 through to a maximum of 100+ which co-coincides with a Catastrophic fire danger rating category. A guide to understanding the FDR system and associated fire behaviour potential is presented in Plate 5 (QFES, 2023)

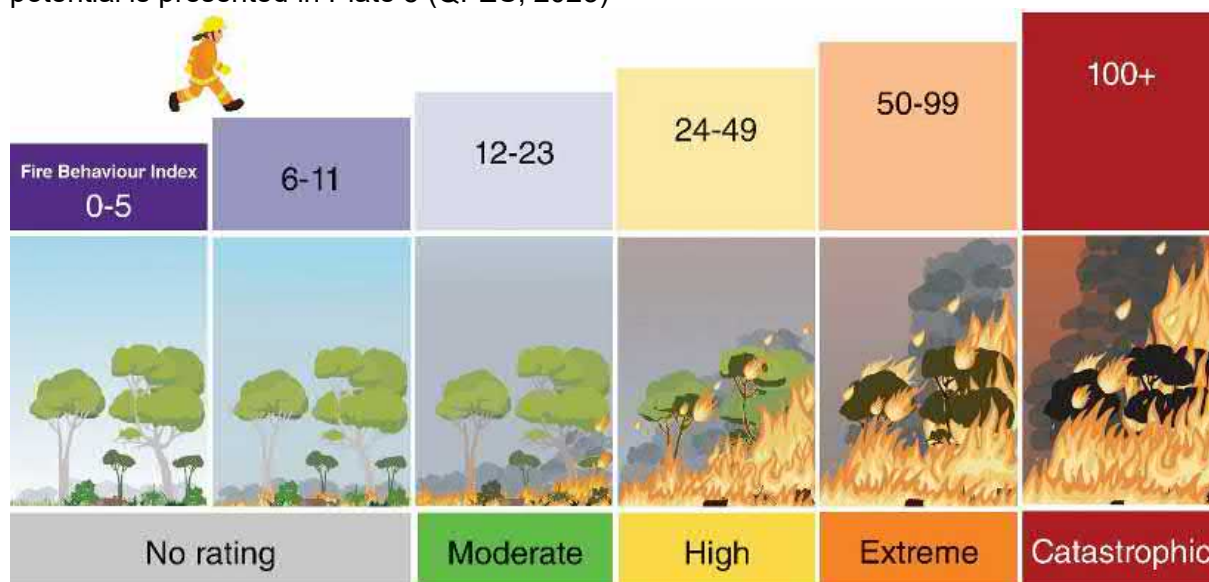


Plate 5 – National Fire Danger Rating System

The following section outlines the steps to be taken as the FBI increases; however, an earlier evacuation may be triggered by other circumstances such as thick smoke causing medical problems for occupants of the site. It should be noted that in the event of a bushfire emergency, designated and appropriately qualified and trained staff are to remain onsite to assist with shelter in place activities and QFES personnel responding to a bushfire emergency.

1. Precautions for a prevailing **No Rating – Moderate fire danger rating**.

- Staff are aware of evacuation procedures.
- Ensure internal access roads are maintained and can accommodate the expected traffic.

2. Precautions for a prevailing **High fire danger rating**.

- Staff are aware of evacuation procedures.
- Ensure that water points are functional.
- Ensure internal access roads are unobstructed and can accommodate the expected traffic.
- Staff to be warned of the potential risk.
- Ensure that signage informing personnel of the evacuation procedures in the event of a bushfire are provided on site.

4. Precautions for a prevailing **Extreme fire danger rating**.

- All guests are given the option to self-evacuate the site or stay with the knowledge that if an uncontrolled bushfire does commence anywhere in the fire risk catchment, the access gate will be locked and they will not be allowed to leave, unless directed otherwise by QFES or QPS. This means that the site's visitor management system is triggered to text all checked-in guests a warning about the risk.
- New guests are permitted to gain access to the site with the knowledge that if an uncontrolled bushfire does commence anywhere in the fire risk catchment, the access gate will be locked and they will not be allowed to leave, unless directed otherwise by QFES or QPS. This means that the site's visitor management system is triggered to text all booked but not checked-in guests a warning about the risk.
- Staff, occupants and visitors are aware of evacuation procedures.
- Ensure that water points are functional.
- Ensure internal access roads are unobstructed and can accommodate the expected traffic.
- Ensure that vehicles are parked in such a way as to facilitate the prompt and safe egress of vehicles to the shelter in place location and if need be from the site (i.e., vehicles not being parked or positioned in a manner which impedes traffic flow.
- Staff, occupants and visitors to be verbally warned by Fire Wardens of the potential risk.
- Ensure that signage informing personnel of the evacuation routes in the event of a bushfire are provided on site.
- Stay informed of any local bushfires and determine the level of threat to the site by contacting the local Fire Brigade.
- Monitor relevant websites, local media and public service announcements regarding the fire situation.

5. Precautions for a prevailing **Catastrophic fire danger rating**.

- No new guests will be permitted to access the site. This means that the site's visitor management system is triggered to text all booked but not checked-in guests notice that the site is not accepting new guests while the catastrophic fire danger rating is active.
- If there is no uncontrolled fire within the fire risk catchment, all guests are given the option to self-evacuate the site or stay with the knowledge that if an uncontrolled bushfire does commence anywhere in the fire risk catchment, the access gate will be locked and they will not be allowed to leave, unless directed otherwise by QFES or QPS. This means that the site's visitor management system is triggered to text all checked-in guests a warning about the risk.
- Staff, occupants and visitors are aware of evacuation procedures.
- Ensure that water points are functional.
- Ensure internal access roads are unobstructed and can accommodate the expected traffic.
- Ensure that vehicles are parked in such a way as to facilitate the prompt and safe egress of vehicles to the shelter in place location and if need be from the site (i.e., vehicles not being parked or positioned in a manner which impedes traffic flow.
- Staff, occupants and visitors to be verbally warned by Fire Wardens of the potential risk.

- Ensure that signage informing personnel of the evacuation routes in the event of a bushfire are provided on site.
- Stay informed of any local bushfires and determine the level of threat to the site by contacting the local Fire Brigade.
- Monitor relevant websites, local media and public service announcements regarding the fire situation.

Precautions where an uncontrolled fire occurs within the fire risk catchment.

- If an uncontrolled fire is burning within the fire risk catchment, the access gate is locked and guests are readied for evacuation to the on-site evacuation centre unless otherwise directed by QFES or QPS. This means that the site's visitor management system is triggered to text all checked-in guests to be ready for evacuation to the on-site evacuation centre, and all not checked-in guests notice that the site is not accepting new guests while the uncontrolled fire is active.
- Stay informed of the fire's progress and determine the level of threat to the subject site by contacting the local Fire Control Staff (i.e., the Beerwah Fire Station) and monitor announcements regarding the fire situation via QFES public notifications.
- Alert staff and site occupants to the presence of a fire and advise them to pack up their belongings in preparation for imminent shelter in place action or evacuation as directed by the relevant emergency service (depending on position of fire and projected burn pathway).
- Implement shelter in place as directed by the relevant emergency service (depending on position of fire and projected burn pathway).
- Advise the relevant emergency services of the instigation of shelter in place and the numbers involved.

A copy of the QFES Get Ready Guide is provided as Appendix 1 and the management measures described therein form a component of the general evacuation protocols to be employed during a bushfire emergency and as part of general preparedness for such an emergency.

APPENDIX 1 – GET READY GUIDE

get ready

GUIDE



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QUEENSLAND FIRE AND EMERGENCY SERVICES

The purpose of this booklet is to assist all Queenslanders to understand the types of disasters that may affect their area and what they need to do in order to prepare for these events.

Queenslanders each year face a range of hazards, including bushfires, cyclones, floods and severe storms. All Queenslanders share responsibility for not just being prepared for disasters, but also building a community that is resilient to nature's ongoing challenges.

That's why Queensland Fire and Emergency Services (QFES) work closely with residents, councils, other government agencies, community groups and business, to encourage and help everyone to *Get Ready*.

QFES' operational arms are also on standby around the clock to respond to incidents such as structure fires, chemical spills and a wide range of rescues from swift flowing water, road crashes, or in remote or dangerous situations.

Alongside the paid emergency services workforce, close to 40,000 trained QFES volunteers give their time to local communities across the state as part of the Rural Fire Service (RFS) and the State Emergency Service (SES).

RFS volunteers help landowners manage fire risk on properties through hazard reduction burns and turn out around the clock to fight bushfires wherever they start.

SES volunteers are best known for their work helping communities respond to severe weather events and assisting police and other agencies with searches.

4-STEP PLAN

Don't wait for a disaster to happen before you think about how you and your family are going to survive...

In a major disaster, high winds, fire, or rising floodwaters can prevent emergency services from reaching you. Debris and damage can cut road access. Your community and your family could become isolated for up to three days or more.

Even if you live just around the corner from a shopping centre, you may not be able to get there. And even if you could, the shops may be closed due to damage, lack of electricity, staff not being able to get there or being out of stock.

After a disaster has passed, roads can be closed and essential services disrupted, such as power, gas and water supply, and phone communications. Emergency Services will be focused on assisting the most vulnerable in the community during an event where a large number of people are affected.

Depending on your circumstances, you may not have immediate access to the support provided and will need to rely on the supplies and equipment you have on hand at home.

If you were isolated by a disaster right now, are you prepared? Do you have enough food, water and equipment to sustain your family for three days or more?

The following four simple steps will ensure you and your family are as prepared as possible.

Step 1

Prepare your emergency plan

Step 2

Prepare your emergency and evacuation kits

Step 3

Prepare your home

Step 4

Tune in to warnings

STEP 1 - PREPARE YOUR EMERGENCY PLAN

Take the time now to prepare an Emergency Plan.

Develop your Emergency Plan with the entire household. It is an important step to prepare for what can happen and to stay safe.



» **Research hazards and disaster management arrangements in your community:**

- » Check with council if your area is prone to bushfire, cyclone, storm, flood or tsunami.
- » Ask about local emergency plans, evacuation zones and nominated evacuation routes for where you live and work.
- » Ask about evacuation centres and Neighbourhood Safer Places.
- » Ask about details in emergency and evacuation plans at your workplace, school and childcare provider. Provide them with your household emergency contact details.
- » Find out what sort of support is available to your household via council and local support agencies (if required).

» **Discuss possible scenarios and responses with your household:**

- » What might happen in a bushfire, cyclone, storm, flood or tsunami?
- » What would you all do in the event of each emergency?
- » Where might you be when an emergency occurs? (Home, school, work etc.)
- » How will you stay in contact?
- » Where would you go if you need to evacuate?
- » Are there medical conditions or special needs of household members that require specific consideration?
- » What preparations are required for your pets?

» **Record details on your Emergency Plan:**

- » Two out of town emergency contacts in case you and your family become separated.
- » Two emergency meeting places in case you cannot return home or you need to evacuate. One in your neighbourhood and another further inland and on higher ground that everyone can easily get to.
- » Information on the council evacuation zone you live in and nominated evacuation routes for your area.
- » All householder contact phone numbers.
- » Specific medical conditions, essential medications and dosage.
- » Details for your pets – description, veterinarian contact details and medications.
- » All tasks required prior to evacuating (storing electrical items off the ground, switching off main supplies, sandbagging drains etc.)

» **Ensure everyone is prepared:**

- » Teach children how and when to call Triple Zero (000) in an emergency.
- » Queensland Ambulance Service advises householders to have a sound knowledge of first aid.
- » Ensure everyone knows where, how and when to turn off the main power, water and gas supply in case of emergency and evacuation.
- » Share your emergency plan with family and friends.



STEP 2A - EMERGENCY KIT

Your Emergency Kit contains the provisions for your essential needs in the event of an emergency.

Include items you'd need for several days in case of disruption to essential services (i.e. power and water supplies). Also, include the equipment you'll need to prepare meals with no power. Keep your kit in a waterproof storage container and store in an easy to access location. Check your kit every season to stock up and rotate supplies to ensure provisions are fresh and safe to use.



- » Food and water for at least three days:
 - » 10 litres of water per person as 3 days supply
 - » Non-perishable food
 - » Can opener, cutlery and cooking equipment
- » Medical and sanitation supplies:
 - » First Aid Kit and manual
 - » Essential medications, prescriptions and dosage
 - » Toilet paper and personal hygiene items
 - » Toiletries – toothbrush, toothpaste, soap, shampoo etc.
- » Light:
 - » Battery or wind-up torch/lantern (extra batteries)
- » Communications:
 - » Battery powered or wind-up radio (extra batteries)
 - » Fully charged mobile phone and charger
 - » Prepaid phone cards and coins for phone booth calls
- » Clothing and footwear:
 - » Change of warm protective clothes and shoes for everyone
- » Important documents:
 - » Keep original or certified copies
 - » Scan copies to USB or online storage

☒ CHECKLIST

- ☐ a - fresh water for three days
- ☐ b - three days worth of non-perishable food and can opener
- ☐ c - first aid kit
- ☐ d - portable radio
- ☐ e - torch
- ☐ f - sturdy gloves
- ☐ g - spare batteries for radio, torch and mobile phone
- ☐ h - essential medication
- ☐ i - mobile phone and charger
- ☐ j - important documents in sealed bags + cash

- ☐ k - baby formula + nappies
- ☐ l - waterproof bags
- ☐ m - toiletries

☒ IMPORTANT DOCUMENTS

- ☐ insurance (house, contents, vehicles, life)
- ☐ wills
- ☐ property deeds
- ☐ bank documents
- ☐ passports, birth + marriage certificates
- ☐ medicare, pension, immunisation records
- ☐ emergency plan + contact numbers



STEP 2B - EVACUATION KIT

The potential need to evacuate where you live might happen at short notice. Preparing an **Evacuation Kit** now will save you time and be one less thing to stress about in the event of a disaster.

Note - you may not be able to take your emergency kit into a shelter or evacuation centre. Contact your local council for more information.



When you evacuate, ensure that you take your **Emergency Kit**, **Evacuation Kit** and **Emergency Plan** with you. To help you prepare, download a copy of the Prepare for Evacuation fact sheet from getready.qld.gov.au/be-prepared

☑ CHECKLIST

- ☐ a - blanket
- ☐ b - sleeping bag
- ☐ c - kids toys/entertainment
- ☐ d - pillows
- ☐ e - warm clothes
- ☐ f - valuables + mementos
- ☐ g - essential medication, scripts & eye glasses
- ☐ h - mobile phone + charger
- ☐ i - important documents in sealed bags + cash
- ☐ j - baby formula + nappies
- ☐ k - toiletries



STEP 3 - PREPARE YOUR HOME

General home maintenance:

- » Keep your roof in good condition and check it regularly.
- » Keep gutters and downpipes clear so water can drain away quickly.
- » Trim trees and overhanging branches (be aware of any overhead powerlines).
- » Check and fix any corrosion, rotten timber, termite infestations and loose fittings.

General home preparations:

- » Ensure your home, contents and car insurance is current and adequate. Check your policy includes debris clean up and removal.
- » Identify the strongest room to shelter in place during severe storm or cyclone.
- » Identify where and how to turn off the main supply for water, power and gas.
- » Consider what arrangements need to be made if you have pets.
- » Check with your neighbours in case they need assistance.

If you live in a flood-prone area:

- » Store all poisons and garden chemicals well above ground level.
- » Identify indoor items you will need to raise or empty if flood threatens.
- » Consider alternatives to carpet and relocate power-points to well above previous flood levels (using a licensed contractor).

If you live in a cyclone / severe storm-prone area:

- » Arrange for a professional builder to check your building and identify ways you can increase the structural security of your home to withstand high winds.
- » Fit windows with shutters or metal screens for added protection during high winds.

If you live in a bushfire-prone area:

- » Understand your risk - speak to your local Rural Fire Brigade or Volunteer Community Educator.
- » Prepare your Bushfire Survival Plan
 - » ensure access to your property is easy for fire vehicles.
 - » remove materials that can help fuel a fire (e.g. long dry grass, dead leaves, branches or debris around your home).
 - » check that pumps, generators and water systems are working correctly.

Final home preparations:

- » **For when warnings are issued for cyclone or severe storm**
 - » disconnect electrical appliances and external television / radio aerials and turn off electricity and gas main supplies if instructed to do so.
 - » Secure or put away items (e.g. garden furniture) that can be blown around.
 - » fill buckets and bath with clean water in case of interruptions to water supply.
 - » close windows with shutters or tape windows with strong tape and draw curtains.
- » **For when warnings are issued for flood:**
 - » disconnect electrical appliances.
 - » move outdoor equipment, garbage, chemicals and poisons to a higher location.
 - » empty and raise freezers / refrigerators and stack or move furniture, valuables and electrical items off-site.
 - » sandbag internal drains and toilets to prevent sewage backflow.
 - » move livestock, plant and feed to higher ground.

Be careful using portable generators. Do not use them indoors or in enclosed places such as garages or carports. This can lead to a build-up of carbon monoxide — a colourless and odourless gas that can make you pass out or cause death.

STEP 4 - TUNE INTO WARNINGS

Ensure everyone knows how to
Tune In, Log On, Listen Out and Act:

TUNE IN:

- » To your local radio and TV station to listen for warnings and weather updates and local community safety announcements.

LOG ON:

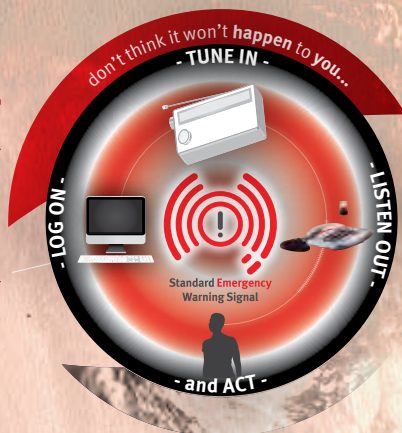
- » To the Bureau of Meteorology (www.bom.gov.au) for weather warnings.
- » To www.qld.gov.au/alerts for information on current disasters.
- » To your council website (www.lgaq.asn.au) for:
 - » local information on the emergency
 - » information on evacuation centres and evacuation routes
 - » information on assistance after a disaster event.

LISTEN OUT:

- » For the Standard Emergency Warning Signal (SEWS) - the siren sound used at the beginning of serious warnings on radio and television. Pay careful attention to the message that follows SEWS and act immediately on the advice given.
- » For Emergency Alert voice messages to your landline and text messages to your mobile telephone.
- » For sirens and loud-hailer announcements that Emergency Services may use.
- » For Emergency Services personnel who may door-knock your local area to pass on warnings.

ACT:

- » Act quickly on the advice provided.
- » Ensure all householders are aware of the warning and advice provided.
- » Check on neighbours and friends who may need special assistance.
- » Activate your **Emergency Plan** and locate your **Emergency Kit**.
- » Activate your evacuation arrangements if required.



When warnings are issued you may be directed to:

- » finalise preparations and secure items around your home
- » activate your **Emergency Plan** and shelter in place, or
- » evacuate to your predetermined safer location.



facebook.com/QldFireandEmergencyServices

facebook.com/QueenslandPolice



twitter.com/QldFES or @QldFES

twitter.com/qpsmedia



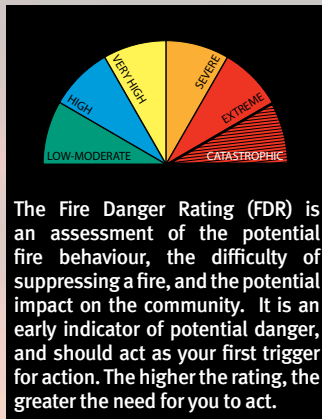
BUSHFIRE

You don't have to live in the bush to be threatened by bushfire, just close enough to be affected by burning material, embers, and smoke.

PREPARE

Planning and preparing for bushfire is essential to your survival in a bushfire – people who plan and prepare for bushfires are more likely to survive than those that do not.

- » Prepare your Bushfire Survival Plan (BSP)
 - » contact your local fire station for a copy or download one at www.ruralfire.qld.gov.au.
- » Decide NOW if you will prepare to stay or prepare to leave.
- » Share your Bushfire Survival Plan with your family and friends.
- » Practise your Bushfire Survival Plan regularly.



ACT

Take Action to save your life.

- » Refer to your prepared Bushfire Survival Plan.
- » If you are going to **prepare to leave**.
 - » Notify your family and friends that you are leaving.
 - » Tell them where you are going.
- » If you are going to **prepare to stay**.
 - » Follow the plans you have made in your Bushfire Survival Plan to prepare your home.
 - » Notify your family and friends that you are staying.
- » Tune in to bushfire warnings via your local radio station, QFES websites and social media.

SURVIVE

Follow your plan (or BSP) to stay alive.

If you have left early

- » Don't return to your home until you are advised it is safe to do so.
- » Remember to look out for dangers as you return home including:
 - » Emergency Crews working around the area.
 - » Animals not behaving normally.
 - » Trees that may have been weakened by the fire and can fall at any time.
 - » Power lines that have come down or may fall.
 - » Water and other infrastructure that may not be working.

If you have stayed

- » As the fire passes.
 - » Stay inside your home until the fire has passed.
 - » Keep hydrated.
 - » Check around your home for possible embers.
 - » Check on everyone in your home and make sure they are ok.
- » Once it has passed.
 - » Check around the outside of your house for spot fires.
 - » Drink plenty of water.
 - » Stay at your home until it is safe.
- » Stay tuned in for bushfire warnings and messages.

For more information, visit www.ruralfire.qld.gov.au or read other PREPARE.ACT.SURVIVE. resources.



HOUSEHOLD EMERGENCY PLAN

Circle the hazards in our area:



BUSHFIRE



STORM



CYCLONE



COASTAL
INUNDATION



FLOOD

Evacuation destination	
Place to meet:	
Address:	
Phone number:	
Email address:	
Out of town emergency contact	
Name:	
Address:	
Phone number:	
Email address:	
Main service supplies	Location/switch off
Electricity:	
Gas:	
Water:	
Vehicle registration	Vehicle description
Our strongest room is	
Medical conditions	Essential medication /dosage
Pets	Pet requirements (including vet details)





Householder	Special needs
Householder contact details	
Emergency contacts	
Triple Zero (000)	Life threatening emergencies: Police - Fire - Ambulance
132 500	Storm damage and rising flood water - SES
	Local Council
	Doctor/hospital
	Chemist
	Insurance supplier
Emergency / Bushfire Survival Plan activation	
☐ Contact all householders ☐ Check on our neighbours ☐ Locate Emergency Kit	☐ Make final preparations ☐ Tune into Warnings ☐ Shelter in our strongest room (unless instructed to evacuate)
Evacuation checklist	
Prior to evacuation:	
☐ Ensure vehicle is full of fuel ☐ Know the location of evacuation meeting place	☐ Check on our neighbours ☐ Know the preferred evacuation routes
When evacuating:	
☐ Pack Emergency Kit, Evacuation Kit , a copy of our Emergency Plan , important documents and valuables, medications and water supplies ☐ Turn off mains supply for power, gas and water	☐ Contact our out of town emergency contact before we leave and once we arrive at our evacuation destination ☐ Secure and lock our home and proceed to our predetermined evacuation destination
If flooding or storm surge is imminent:	
☐ Sandbag internal drains and toilets to prevent backwash	☐ Store electrical items off the ground

DISPLAY YOUR EMERGENCY PLAN ON THE FRIDGE. PROVIDE COPIES TO HOUSEHOLD MEMBERS, RELEVANT FRIENDS, FAMILY AND NEIGHBOURS AND KEEP A COPY IN YOUR EMERGENCY KIT.

In the Planning and Environment
Court
Held at: Brisbane

No. 1836 of 2022

Between: **COMISKEY MANAGEMENT SERVICES PTY LTD**
(ACN 115 254 307)

Appellant

And: **SUNSHINE COAST REGIONAL COUNCIL**

Respondent

JUDGMENT

VOLUME 3 OF 3

PROJECT

**ADDENDUM VOLUMETRIC
WATER SUPPLY
ASSESSMENT
PROPOSED ECO-HOLIDAY
PARK, LOT 10 SP132272 AND
LOT 6 SP184133
1807 ROYS ROAD
COOCHIN CREEK,
QUEENSLAND**

PREPARED FOR
COMISKEY GROUP

DATE
APRIL 2023

DOCUMENT CONTROL

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Proposed Eco-Holiday Park, Lot 10 SP132272 and Lot 6 SP184133
1807 Roys Road, Coochin Creek, Queensland
PROJECT MANAGER G. Holland
AUTHOR(S) D Klaas / G. Holland
CLIENT Comiskey Group
CLIENT CONTACT Mark Wiebusch
CLIENT REFERENCE

SYNOPSIS This report details an Addendum Volumetric Water Supply Assessment for Lot 10 SP132272 and Lot 6 SP184133 located at 1807 Roys Road, Coochin Creek, in support of a development application for a Material Change of Use (MCU).

REVISION HISTORY

REVISION #	DATE	EDITION BY	APPROVED BY
1	03/23	D. Klaas / G. Holland	G. Holland / P. Matthew
2	03/23	D. Klaas / G. Holland	G. Holland / N. Sutherland
3	04/20	D. Klaas / G. Holland	G. Holland / N. Sutherland

DISTRIBUTION

	REVISION NUMBER									
Distribution	1	2	3	4	5	6	7	8	9	10
Comiskey Group	1	1	1							
G&S library & file	1	1	1							

SUMMARY

Comiskey Group (Comiskey Group) commissioned Gilbert & Sutherland Pty Ltd (G&S) to prepare an Addendum Volumetric Water Supply Assessment (WSA) regarding the proposed Eco-Tourist Park located at 1807 Roys Road, Coochin Creek, Sunshine Coast, Queensland (the 'Site') in response to an information request issued by Sunshine Coast Council.

In responding to Council's Information Request G&S completed a desktop assessment and additional site investigations and modelling to confirm potential water supply sources for use in the proposed development.

The confirmed water sources identified onsite are as follows:

- Groundwater well located in SW corner of the site
- Rainwater harvesting from proposed roof areas
- 2 x onsite dams in North-East corner of the site
- ~250 kL water tank storage as additional water storage

A 72 hour pump test of the existing groundwater well indicated a sustainable flow rate of 0.12 L/s or 10,369 L/day (3.78 ML/yr).

Based on calculations of the rooftop area of the proposed Eco-Park and rainfall data provided by SILO, captured rainfall from roofed areas was estimated to be 4.02 ML/year at an 80% capture rate, 4.52 ML/year at a 90% capture rate and 5.02 ML/year at a 100% capture rate.

Water consumption rates have been based partly on the Queensland Government's Planning Guidelines for Water Supply and Sewerage (2010), and partly on real water usage data for an existing holiday park located at Sandstone Point, QLD, supplied by Comiskey Group.

A demand vs supply analysis based on a water balance model simulation over a 108-year hydrologic data set obtained from Peachester Station indicated that, applying a 10% dam storage cut off scenario, the reliability of the overall onsite water resources, consisting of two dams and two water tanks (with a total capacity of ~250 kL to store water from roof areas and the onsite bore) to

supply maximum daily demand is 95%. This exceeds the 75% water reliability standard within the Dutch guidelines.

In the period of low flow when water demand exceeds supply, a set of appropriate measures including use of the stored tank water supply, trucking in water from external sources and applying temporary water restrictions is provided.

In terms of potential impacts from on-site effluent disposal on the proposed water sources (dams and existing groundwater well), given the proposed quality of treatment (advanced secondary), proposed wet weather storage measures, setback distance analysis, and proposed treatment of the onsite water supply, no impacts on the water supply are envisaged.

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LIST OF DRAWINGS

DRAWING NO.	DESCRIPTION
12139 WSA_001	Site location
12139 EEC-001	Site location (zoomed in)
12139 EEC-002	Dams catchment area
12139 EEC-003	On-site effluent disposal irrigation area, soil investigation location and existing well
12139 WSA_002A	Proposed water supply sources in relation to onsite effluent irrigation area (existing GW well and on-site dams)
S 01-02 P	Development layout by Valentine Building Design

1 Introduction

Comiskey Group engaged Gilbert & Sutherland Pty Ltd (G&S) to prepare an Addendum Volumetric Water Supply Assessment (AWSA) in response to an information request issued by Sunshine Coast Council regarding the Preliminary Volumetric Water Supply Assessment dated September 2021 prepared in support of a Material Change of Use (MCU) application for a proposed Eco-Holiday Park located at 1807 Roys Road, Coochin Creek, Queensland (herein referred to as 'the site').

The information requested by Council is included below in italic text:

Water/Effluent disposal

The application is considered to be non-compliant in respect of both water supply and sewerage facilities, but particularly for water supply. Based on the location of the site, the application specifies that water supply will be achieved from on-site sources, i.e. no connection to Council's municipal water reticulation network. The Gilbert & Sutherland report (Appendix E) states that the development will require an annual supply of 34.27 ML for potable water purposes. However, the volume which can be derived from roof water tanks has been calculated to be only 3.81 ML at a 100% capture rate (which is not practically achievable). The report states that additional supply may be met from groundwater, based only on anecdotal information about the likely sustainable yield from the site. No groundwater investigation in respect of either quality or quantity

of the available water has been undertaken, and it is simply stated that a pump test will be undertaken to verify the outcomes.

In relation to effluent treatment and disposal (Appendix D), the applicant has relied on MEDLI modelling to indicate that effluent can be suitably disposed of by on-site irrigation. Any proposal to use on-site irrigation on a site where groundwater is also proposed to be used for potable purposes is strongly contra-indicated, and fundamentally very unlikely to be approved or even approvable. Normally the possibility of short-circuiting and contamination of the water supply would be so great that the option of on-site irrigation would simply be unacceptable.

Our response to Council's information request is presented in the following sections.

1.1 Scope of works

The scope of works for this addendum assessment included:

- Review of the estimated water usage for the proposed facility
- Review and recalculation of the water supply for the proposed facility based on the on-site dams, rainfall, groundwater supply (existing well) and additional water storage (tanks)
- Review the current water quality of the on-site dams and bore
- Review of on-site effluent treatment and disposal methodology in terms of human health risk

2 The proposal

Formally described as Lot 10 on SP132272 and Lot 6 SP18433, the site has a total area of 43.11 hectares (ha) and is located as shown on Drawing No. 12139 WSA_001 and Drawing No. 12139 EEC-001 (Appendix 1).

The site has been historically utilised for horticultural purposes including cropping of pineapples and citrus trees, and most recently cropping of strawberries.

The proposed development will incorporate 100 camp sites with associated infrastructure and facilities including:

- Reception/Admin/Education Centre/Shop/Caretakers Residence
- Pool
- Amenities blocks (x 3)
- Camp Kitchen (x 5)
- Tennis Court
- Playground

The proposed development layout is shown on Drawing S 01-02 P by Valentine Building Design (Appendix 1).

3 Water demand

The list below includes the possible water users at the proposed Eco-Park:

- Reception/Admin/Education Centre/Restaurant/Shop
- Weekly pool backwash
- 100 sites
- 12 Non-resident staff
- 2 resident staff
- 1 laundromat (4 x washing machines)

Total annual water usage was determined by taking into consideration all possible water demands on-site at maximum (100%) capacity.

3.1 Water demand projections

To estimate the projected water demands for the proposed development, the Queensland Government's, Planning Guidelines for Water Supply and Sewerage (2010) were consulted, in addition to actual figures supplied by Comiskey Group for their other facility at Sandstone Point, Qld.

Table 3.1 summarises the estimated maximum daily water demands for the proposed use based on the calculated loadings for the proposed site facilities and staff, and the real usage figures from Sandstone Point Holiday Park, which indicates a conservative average water consumption of 60L per person per day. To be conservative and allow for possible future expansion, Table 3.1 assumes there are 100 sites and an average of 4 people per site using 80 L per person per day.

Table 3.1 Amended assumed maximum daily water demands

Development	Water Demand (L)
Reception/Admin/Education Centre/Restaurant/Shop (500 m ²)	3,000 L (based on 600 L per 100 m ² gross floor area (GFA) per day)
Non-resident Staff (assume 12 staff)	360 L (based on 30 L per person per day)
Resident Staff (assume 2 staff)	240 L per day
Pool Backwash	104.30 L (based on 730 L per week)
Laundromat (4 units)	1,200 L (based on 50 L/wash and 6 x wash/unit/day)
Sub-Total	4,904.29 L/day
100 sites @ 4 people per site and 80 L per person	32,000 L/day
Total	36,904.29 L/day

The usage figures for Sandstone Point facility are provided in Appendix 5.

4 Water supply

An updated assessment was conducted to address Council's Information Request and confirm the potential water supply sources for the proposed Eco-Park.

The confirmed water sources identified onsite are as follows:

- Groundwater well located in SW corner of the site
- Rainwater harvesting from proposed roof areas
- 2 x onsite dams in North-East corner of the site

These are discussed further below.

Water gathered from the identified potential water sources would require treatment to meet Australian Drinking Water Guidelines.¹ A commercial water treatment plant would be sufficient for treatment of onsite water.

4.1 On-site groundwater well

The on-site groundwater well has been historically used for domestic purposes. In order to confirm the potential supply characteristics and suitability of the groundwater for the proposed development, pump testing and water quality testing was undertaken.

4.1.1 Pump test

The location of the well can be seen in Drawing 12139_WSA_002 (Appendix 1). A 72 hr pump test of the existing well was undertaken by Australian Groundwater Services between 10 January and 13 January 2023.

From the assessment it was confirmed that the well is wood-lined and a maximum of 5.54 m

deep. Surface water level at the start of the test was measured at 0.82 m below ground level.

The test report and accompanying drawdown graph and spreadsheet results are included as Appendix 6 and show a final sustainable flow rate of 0.12 L/s or 10,369 L/day (3.78 ML/yr).

The results of in-situ water quality testing undertaken by Australian Groundwater Services during the pump test are also included in Appendix 6.

To augment the in-situ water testing, a water sample was retrieved during the pump testing on 11 January 2023 and sent to a NATA accredited laboratory for analysis of relevant drinking water analytes including metals, cations and nutrients. The results are presented in Section 4.4.5.

4.2 Captured rainfall

An updated captured rainfall assessment was completed to ascertain the potential capture and storage of rainfall for use as water supply for the proposed development.

An estimate of the total rooftop area throughout the Eco-Park was determined to be approximately 2,986 m². Based on data from the Bureau of Meteorology (BOM) for Peachester Station, the local average annual rainfall is 1486.51 mm.²

Table 4.3 below presents the approximate rainfall captured at 100%, 90% and 80% of total annual rainfall based on the analyses undertaken using hydrologic data from Peachester Station. As shown, at 100% average capture the amount of water harvested from the proposed roof area would be ~5.02 ML per year.

¹ Australian Drinking Water Guidelines, National Water Quality Management Strategy, Australian Government, National Health and Medical Research Council, Version 3.5, 2011 (Updated August 2018).

² Data obtained from SILO website (<https://www.longpaddock.qld.gov.au/silo/point-data/>) for Peachester Station (Bureau of Meteorology station 40169)

Table 4.2 Potential annual rainfall capture

Capture capacity	Rainfall (ML)
Total annual rainfall captured (ML) 100%	5.02
Total annual rainfall captured (ML) 90%	4.52
Total annual rainfall captured (ML) 80%	4.02

4.3 Dam water storage analysis

A visual and desktop assessment of the area identified several water bodies located on Lot 6 SP18433 and within proximity to the proposed Eco-Park. Two of the onsite dams, identified on Drawing 12139_WSA_002 (provided in Appendix 1) were determined to be a potential water source and were subsequently modelled in terms of potential water supply.

4.3.1 Methodology

Water balance

The overall hydrologic system within the dam catchment area was quantified using the following mass balance equation in which volumetric difference of inputs and output into the system are equivalent to change in water storage:³

$$\frac{\Delta S}{\Delta T} = I - Q$$

where: ΔS = change of storage

ΔT = Time

I = input

Q = output

Input was defined as rainfall (P), whilst output components include hydrologic components that release water from the system, i.e.: evapotranspiration (ET_o), runoff (q_s), and infiltration (F). Therefore, the above equation becomes:

$$\frac{\Delta S}{\Delta T} = P - ET_o - F - q_s$$

The model assumed no leakage or seepage from possible fault or other rock deformation into the system and lateral groundwater inflow from external catchment is considered negligible.⁴

Surface run-off

Surface run-off analysis adopted the well-established Soil Conservation Service (SCS) method given its simplicity and reliability.⁵ The SCS method incorporates several basic elements which mainly refer to natural landcover characteristics, e.g., type of soil and infiltration capacity, and human-induced factors, e.g., land-use.

The formula is as follows⁶:

$$q_s = \frac{(P - 0.2 * S)^2}{P + 0.8 * S}$$

where maximum water storage (S) is defined as:

$$S = \frac{25400}{CN} - 254$$

In the SCS method, dimensionless CN refers to the hydrologic soil type of the area under study which is mainly determined by the topography of the concerning study area as per the guidelines provided by the United States Department of Agriculture (USDA)⁷ presented in Appendix 3 and 4.

³ Bras RL (1990). Hydrology: An introduction to hydrologic science. Addison-Wesley, Reading.

⁴ Szilagyi J, Harvey FE & Ayers JF (2003). Regional Estimation of Base Recharge to Ground Water Using Water Balance and a Base-Flow Index. Ground Water 41(4), 504-513.

⁵ Ponce VM & Hawkins RH (1996). Runoff Curve Number: Has It Reached Maturity? Journal of Hydrologic Engineering 1(1), 11-19.

⁶ Viessman W & Lewis GL (1996). Introduction to Hydrology. HarperCollins College, New York.

⁷ USDA (January 2009). Chapter 7 Hydrologic Soil Groups. In: National Soil Survey Handbook, Part 630 - Hydrology, Natural

Infiltration

The water balance model adopted the empirical method developed by the Soil Conservation Service (USDA, 1971). This method weighs the correlation between direct runoff and precipitation. It does not require a calibration of parameters and uses a set of defined tables. As such, it is suitable to accommodate analysis in watersheds where only limited data are available.⁸

The formula is as follows:

$$F = \frac{(P - I_a) * S}{P - I_a + S}$$

where: I_a = initial abstraction
= $0.2 * S$

4.3.2 Model input data

Dams and catchment areas

The two subject dams equate to a total volume of approximately 47 ML, occupying a total surface area when full of approximately 5.45 hectares (ha) within the site. Based on information supplied by Comiskey Group, the maximum depth for the northern dam (Dam 2) is 4.4 mBGL. The maximum depth of the southern dam (Dam 1) is 2.4 mBGL. Maximum water level for both dams was measured at approximately RL 3.4 m.

The catchment area of the dams was estimated at 8.43 ha based on the 1m grid LiDAR survey and aerial imagery sourced from Nearmap. Drawing No. 12139 EEC-002 (Appendix 1) shows the catchment area of both dams.

Rainfall and evapotranspiration

P and ETo data were acquired from Peachester Station located ~22 km from the site. The data was derived online from SILO climate database hosted by the Queensland Department of Environment and Science (DES) cover 108 years daily observed data (2009-2014) and presented in tables in Appendix 8 and 9, respectively. The average annual rainfall and evapotranspiration within the observed years are 1,681.23 mm and 1,257.96 mm, respectively.

4.3.3 Dam water quality

To characterise the water quality within the onsite dams, water samples were recovered from both dams during a site visit on 22 March 2023 and sent to a NATA accredited laboratory for analysis of relevant drinking water analytes including metals, cations, microbiology and nutrients. The results are presented in Section 4.4.5.

Resources Conservation Service, United States Department of Agriculture.

⁸ Kumar S & Jab SC (1982). Application of SCS Infiltration Model. Journal of the American Water Resources Association 8(3), 503-507

4.4 Results

4.4.1 Temporal hydrologic system

In general, distinct climatic periods were observed in the area under study. Precipitation culminates at around 276 mm in February and is at its lowest around the middle of the year (July to September). The area then experiences a steady increase of rain from August to January after which the rain gradually decreases to June. The month with lowest recorded evapotranspiration is June with approximately 40 mm. The evapotranspiration steadily increases in the following months and peaks in January at around 162 mm before gradually declining. The temporal variation of rainfall and evapotranspiration is presented in Appendix 7.

4.4.2 Dams storage analysis

Whilst soil test results within the catchment were not available, soils within the adjacent cropping land were assessed by Gilbert & Sutherland in 2021 as Yellow and Grey Dermosols⁹. These soils were described predominantly as loamy to clayey sands overlying sandy clay loams, with gradual change to sandy medium to heavy clays with moderate structure at depth. Hence, soils within

the dam catchment area were assumed to be similar and therefore classified as hydrologic soil group C following the description of hydrologic soil groups presented in Appendix 3.

The majority of the dam catchment area is dominated by dense trees and vegetation with the upstream portion containing grasses and weed species as ground cover with fair hydrologic condition. Hence, a dimensionless curve number of 79 was derived from the SCS curve number table presented in Appendix 4.

The maximum water storage becomes:

$$S = \frac{25400}{79} - 254 = 67.52 \text{ mm/day}$$

and the initial abstraction is as follows:

$$I_a = 0.2 * 67.52 = 13.50 \text{ mm/day}$$

Applying the equations in Section 4.3.1, the estimated runoff and infiltration as well as the recorded rainfall and evapotranspiration at Peachester Station are presented in Appendix 10.

⁹ G&S (September 2021). Agricultural impact assessment proposed eco-holiday park, Lot 10 SP132272 and Lot 6 SP184133, 1807 Roys Road, Coochin Creek, Queensland.

4.4.3 Demand and supply

The objective of demand and supply analysis was to assess the ability of the water resources available on site to supply the projected demand presented in Section 3. The demand and supply analysis were afforded using the water balance model presented in Section 4. In this model, water balance simulation over 108 years of hydrologic data was performed.

In the water balance model, the overall water supply system onsite consists of two main storages (i.e. two dams and additional storage units of ~250 kL capacity that store roof water and bore water). In the analysis, initially water demand was supplied by two existing dams assuming full dam storage of 47 ML as an initial dam storage. Dams water withdrawal to supply daily constant maximum demand is assumed. As such, the daily change in dam storage is dependent upon input (i.e. rainfall) and output (i.e. evapotranspiration, infiltration, runoff, and water demand). The remaining dam storage at the end of each day was set to be the initial dam storage for the following day. If the dam storage is greater than 47 ML the storage is set to 47 ML for the end of the respective day simulation. If the dam storage is equal or less than zero, meaning no storage whilst demand is greater than dam supply, the dam storage is set to 0 ML. In this condition, dams are considered failed to supply demand and therefore water would be derived from the second storage (i.e. additional storage units to supply demand).

In the supply and demand analysis, a 10% cut off of maximum dam storage was applied to consider water supply criteria (i.e. turbidity). As such, if the water in dams is less than 4700 kL then the dam is considered failed and henceforth the additional water tanks should be used to supply water. Number of days when dam storage is considered sufficient to supply peak demand was summed and divided by the total simulation day of 39,447 days to determine the reliability of the dams. The water balance model and reliability analysis of dams at 10% cut off is presented in a table in Appendix 11. In this table, the number of days when dam storage is considered sufficient is denoted as integer 1.

The water balance simulation for the dams applying the 10% cut off scenario shows that 91% of the simulation time the dam storage is considered adequate to supply the maximum daily demand of water onsite. Henceforward, water is then supplied by additional water tanks afforded in the site.

A total of ~250 kL storage of water tanks (i.e. approx. 7 day supply) will be provided onsite as an additional storage. Water collected from roof areas during rain events in addition to groundwater pumped from the onsite bore will be stored in the tanks over time until they reach their maximum capacity.

In the case of dam failure whereby the 10% cut off condition is reached, the water tanks would provide the immediate function of delivering water to supply demand. The tanks would then continuously supply water until water in the dam storage is considered sufficient to deliver water provision again (>10% capacity) or the tank water reaches zero capacity.

If the volume of water stored in the tanks is zero, then the overall water resources onsite are considered to have failed to supply water.

The reliability of the overall water resources onsite to supply water was calculated by dividing the number of days when tank storage can supply water by the total simulation day of 39,447 days. The water balance model and reliability analysis of water tanks at 10% dams cut off is presented in a table in Appendix 12. In this table, the number of days when the tank storage can supply water is denoted as integer 1.

The water balance simulation in the supply and demand analysis demonstrates that under the 10% dams cut off scenario, the reliability of overall water resources onsite, consisting of two dams and two water tanks with the total capacity of ~250 kL that store water from the roof areas and the onsite bore, to supply maximum daily demand is 95%. As such, during peak hours when the camping site is in full occupancy the water resources onsite could afford to supply water in 95% of the simulation time. This figure is much greater than the 75% reliability standard

suggested by a quantitative guideline of drinking water systems substantiated in Dutch Water Act 2001¹⁰ and thus the result of the demand and supply analysis is considered satisfactory.

It should be noted that whilst the above simulations assume the tank supply will be utilised once the 10% dam volume has been reached, in practice, due to the requirement to supply potable water, both tanks will be kept full with bore water and roofwater and topped up with dam water as necessary. Prior to use, the stored tank water will be treated by a dedicated water treatment system.

4.4.4 Measures during low water supply period

Measures taken during periods of low dam water storage will be as follows:

- If useable¹¹ water storage volume (dams + tanks) drops below 30 days storage (about 980kL), management shall consider applying water restrictions (e.g. close laundry, limit showers, use bottled water etc).
- When water storage in the dams drops below 10% capacity (i.e. 4.7 ML) supply from the dams will be automatically shut off.
- A 50% tank water storage trigger/alarm will be applied whereby water delivery from external sources is enacted. This means that if water in the storage tanks is less than or equal to a total volume of 125 kL (~3.5 days storage), water will then be trucked in to fill the water tanks. This would ensure a minimum of ~3.5 days supply from the tanks is available after initiating the external delivery in the event of delays in receipt of the external supply.
- This process will be repeated, as necessary until the dam storage returns to above 10%.

4.4.5 Water quality analysis

The results of the water quality analyses undertaken on the bore water and dam water were compared with the National Health and Medical Research Council (NHMRC) Australian Drinking Water Guidelines 2011 (the Guidelines) to ascertain the suitability of the water for use as drinking water.

Drinking water is defined as water intended primarily for human consumption, either directly, as supplied from the tap, or indirectly, in beverages, ice or foods prepared with water. Drinking water is also used for other domestic purposes as bathing and showering.

The Guidelines include two different types of guideline values:

- A **health-based guideline value**, which is the concentration or measure of a water quality characteristic that, based on present knowledge, does not result in any significant risk to the health of the consumer over a lifetime of consumptions.
- An **aesthetic guideline value**, which is the concentration or measure of a water quality characteristic that is associated with the acceptability of water to the consumer, for example, appearance, taste and odour.

The physical characteristics of water are not of direct public health concern, but do affect the aesthetic quality of the water, which largely determines whether or not people are prepared to drink it.

A summary of the water quality sample retrieved from the onsite groundwater well, in comparison to the NHMRC Health-Based Guideline Values is provided in Table 4.4.5.1 below.

¹⁰ TU Delt (n.d.). Chapter 6 Reliability of drinking water systems. CT5550 - Water Transport. Retrieved from <https://ocw.tudelft.nl/wp-content/uploads/Reliability.pdf>.

¹¹ 'Useable' in this instance means water storage above the 10% dam storage capacity.

Table 4.4.5.1 Comparison of groundwater sample results to drinking water guidelines

Parameter	Unit	GW Well	Guideline Value		Meets NHMRC Guidelines value?
		Sample retrieved: 11/1/23	Health	Aesthetic	
pH	pH Units	7.69	c	6.5-8.5	Yes
TDS	mg/L	188	not necessary	600	Yes
Turbidity	NTU	2.7	c	5	Yes
Hardness	mg/L	104	not necessary	200	Yes
Sodium	mg/L	15	not necessary	180	Yes
Aluminium	mg/L	0.08	c	0.2	Yes
Silver	mg/L	<0.001	0.1		Yes
Arsenic	mg/L	<0.001	0.01		Yes
Boron	mg/L	0.07	4		Yes
Barium	mg/L	0.034	2		Yes
Cadmium	mg/L	<0.0001	0.002		Yes
Chromium	mg/L	<0.001	0.05		Yes
Copper	mg/L	0.002	2		Yes
Manganese	mg/L	0.007	0.5	0.1	Yes
Molybdenum	mg/L	<0.001	0.05		Yes
Nickel	mg/L	<0.001	0.02		Yes
Lead	mg/L	<0.001	0.01		Yes
Antimony	mg/L	<0.001	0.003		Yes
Selenium	mg/L	<0.01	0.01		Yes
Zinc	mg/L	0.199	c	3	Yes
Iron	mg/L	0.08	c	0.3	Yes
Mercury	mg/L	<0.0001	0.001		Yes
Total Cyanide	mg/L	<0.004	0.08		Yes
Fluoride	mg/L	<0.1	1.5		Yes
Ammonia as N	mg/L	0.09	c	0.5	Yes
Nitrite	mg/L	0.02	3		Yes
Nitrate	mg/L	5.25	50		Yes

Notes*

c Insufficient data to set a guideline value based on health considerations
 < less than the laboratory limit of reporting (value)

In general, the results indicate the groundwater meets all the required thresholds for the parameters tested.

NHMRC Health-Based Guideline Values is provided in Table 4.4.5.2 below.

A summary of the water quality samples retrieved from the on-site dam water, in comparison to the

Table 4.4.5.2 Comparison of dam water sample results to drinking water guidelines

Parameter	Unit	GW Well Sample D1#1 retrieved: 22/3/23	GW Well Sample D1#2 retrieved: 22/3/23	GW Well Sample D2#1 retrieved: 22/3/23	Guideline Value		Meets NHMRC Guidelines value?
					Health	Aesthetic	
pH	pH Units	7.04	7.18	7.19	c	6.5-8.5	C
TDS	mg/L	70	65	50	not necessary	600	YES
Turbidity	NTU	6.0	7.7	1.9	c	5	NO
Hardness	mg/L	13	16	11	not necessary	200	YES
Sodium	mg/L	12	11	10	not necessary	180	YES
Aluminium	mg/L	0.13	0.18	0.03	c	0.2	YES
Silver	mg/L	<0.001	<0.001	<0.001	0.1		YES
Arsenic	mg/L	<0.001	<0.001	<0.001	0.01		YES
Boron	mg/L	<0.05	<0.05	<0.05	4		YES
Barium	mg/L	0.005	0.015	0.003	2		YES
Cadmium	mg/L	<0.0001	<0.0001	<0.0001	0.002		YES
Chromium	mg/L	<0.001	<0.001	<0.001	0.05		YES
Copper	mg/L	<0.001	<0.001	<0.001	2		YES
Manganese	mg/L	0.021	0.021	0.009	0.5	0.1	YES
Molybdenum	mg/L	<0.001	<0.001	<0.001	0.05		YES
Nickel	mg/L	<0.001	<0.001	<0.001	0.02		YES
Lead	mg/L	<0.001	<0.001	<0.001	0.01		YES
Antimony	mg/L	<0.001	<0.001	<0.001	0.003		YES
Selenium	mg/L	<0.01	<0.01	<0.01	0.01		YES
Zinc	mg/L	<0.005	<0.005	<0.005	c	3	YES
Iron	mg/L	0.93	1.40	1.02	c	0.3	NO
Mercury	mg/L	<0.0001	<0.0001	<0.0001	0.001		YES
Total Cyanide	mg/L	<0.004	<0.004	<0.004	0.08		YES
Fluoride	mg/L	<0.1	<0.1	<0.1	1.5		YES
Ammonia as N	mg/L	<0.01	<0.01	<0.01	c	0.5	YES
Nitrite	mg/L	<0.01	<0.01	<0.01	3		YES
Nitrate	mg/L	<0.01	<0.01	<0.01	50		YES
Heterotrophic Plate Count (36°C)	CFU/m L	290	2300	780	c ¹		c
Faecal Coliforms	CFU/m L	4000	2900	1500	c		c
Escherichia coli	CFU/1 00mL	490	1000	10	0.00 (No trace)		NO
Coliforms	CFU/1 00mL	220	130	3	c ²		c
Heterotrophic Plate Count (36°C)	CFU/1 00mL	10000	29000	3900	c		c

Notes*

c Insufficient data to set a guideline value based on health considerations
< less than the laboratory limit of reporting (value)

1. GUIDELINE No guideline value has been set for **heterotrophic plate counts** in drinking water. Immediately after disinfection, numbers would be expected to be low. If used as an indicator of distribution system cleanliness, numbers should be established on a system-specific basis. Marked increases in numbers after disinfection or within distribution systems should be investigated.
2. GUIDELINE **Escherichia coli** should not be detected in any 100 mL sample of drinking water. If detected in drinking water, immediate action should be taken including investigation of potential sources of faecal contamination.

In general, the results indicate the groundwater meets the majority of required thresholds for the parameters tested. Whilst the value for E. Coli in all samples exceeded the Guideline threshold, as the supplied water will be treated, this is not considered an issue.

5 Setbacks from on-site effluent disposal area to groundwater well and on-site dams

5.1 Setback distances analysis

An updated assessment was conducted to address Council's Information Request and confirm the potential water supply sources for the proposed Eco-Park.

As being provided in a previously submitted report on September 2021¹², a high quality of effluent equivalent to Advanced Secondary which complies with the Queensland Plumbing and Wastewater Code (advanced secondary effluent) has been proposed to treat effluent from the camping site. In the report, treated water will be dispersed over a 1.6 hectares effluent disposal irrigation area located at northwest of the site (Drawing 12139 WSA_002A).

To assess the extent of interaction between the disposed water and the receiving environment and to verify any possible risks of cross contamination, an analysis of vertical and horizontal separation distance which considers pathogen level and travel time accounting sub surface characteristics of site, i.e., groundwater temperature, water table gradient, hydraulic conductivity, and porosity was undertaken. The separation distance is a radius of influence of effluent which migrates across soil profile and provides a buffer zone between the disposal area and the sensitive down gradient feature, i.e., groundwater extracted at the existing bore. The following improved viral die-off method (Cromer et al., 2004) to estimate setback distances was adopted¹³:

$$d_g = \left(t - \frac{d_v * P}{K} \right) * \left(\frac{P}{K * i} \right)^{-1}$$

where:

- d_g = setback distance (m)
- t = required travel time to reduce viral numbers to non-detectable levels (days) which corresponds to groundwater temperature and order of magnitude reduction in viral numbers in Figure 5.1
- d_v = vertical distance between the effluent area and the receiving environment (m)
- P = porosity
- K = hydraulic conductivity (m/day)
- i = groundwater gradient

¹² G&S (September 2021). On-Site Effluent Disposal and Nutrient Impact Assessment Proposed Eco-Holiday Park, Lot 10 SP132272 and Lot 6 SP184133 1807 Roys Road Coochin Creek, Queensland. Gilbert and Sutherland, Robina.

¹³ WC Cromer, EA Gardner & PD Beavers (January 2004). An improved Viral Die-Off Method for Estimating Setback Distances". Appendix A - On-site Sewerage Facilities Guidelines for Vertical and Horizontal Separation Distance. Department Local Government & Planning, QLD Government.

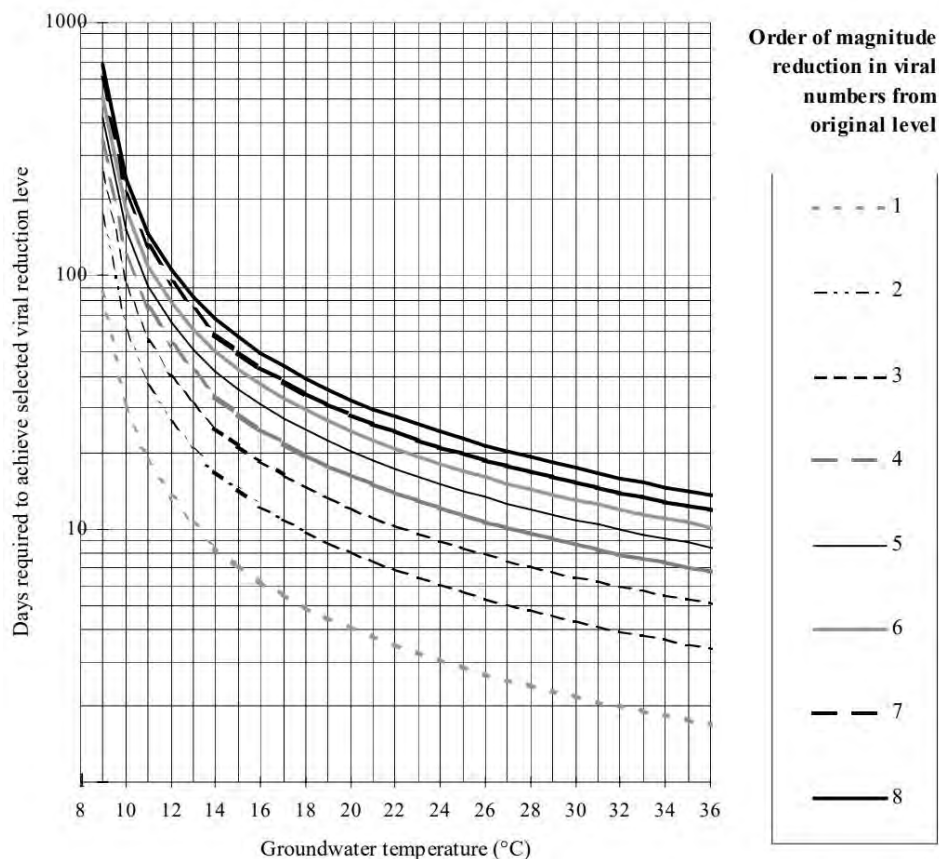


Figure 5.1 Relationship between groundwater temperature and viral die-off time for various order-of-magnitude reductions in viral numbers (Cromer et al., 2004)

5.2 Results

Assuming a groundwater temperature of 20°C and an 8 order of magnitude reduction in viral numbers from original level, the required travel time (t) of assumed bacteria or viruses from the effluent disposal area is 33 days, derived from Figure 5.1. Based on soil information from bore logs collected during two separated site investigation (G&S, September 2021; G&S, December 2021)¹⁴ the dominating soil type in the site is clay with an adopted porosity of 0.47 from a suggested range of 33-60% (Fetter, 2001).¹⁵ An average values of hydraulic conductivity of 0.423 m/day was adopted from onsite permeability test

at BH1, BH2 and BH3 within the site as being reported in the G&S report (September 2021) and presented in this report in Drawing No. 12139 EEC-003.

Two scenarios based on two assumptions, i.e., existing groundwater gradient and steep groundwater gradient during wet period as a worst case, were adopted. In the first scenario, a groundwater gradient of 6.64×10^{-4} was adopted using water tables information during the site investigation at ASS1 and ASS6 and a distance of 337.68 m between the two locations. In the second scenario, a groundwater gradient of 5.45×10^{-3} to characterise a groundwater level of 1

¹⁴ G&S (December 2021). Acid Sulfate Soils Assessment Proposed Eco-Holiday Park, Lot 10 SP132272 and Lot 6 SP184133 1807 Roys Road Coochin Creek, Queensland. Gilbert and Sutherland, Robina.

¹⁵ Fetter CW (2001). Applied Hydrogeology. Prencice-Hall, Upper Saddle.

meter below the disposal area and 537.9 m between the disposal area and the existing well. Applying the forementioned parameters, the calculated setback distances based on the equation presented in Section 5.1 for the two scenarios are 0.02 m and 0.14 m, respectively. Beyond these distances, the original viral concentration in the wastewater would be expected to have been reduced by 8 orders of magnitude, to acceptable levels.

In conclusion, given the maximum radius of influence of 0.14 m from the effluent disposal a cross-contamination and an appreciable distance between the disposal area and groundwater well (~540 m) and considering the level of the proposed effluent treatment proposed (advanced secondary), the risk of cross contamination

between the irrigated effluent area and the groundwater bore could be considered negligible.

The current amended proposal for effluent treatment and disposal includes the addition of 60KL of balance tanks (pre-treatment storage) and 250 kL of wet weather storage tanks. In this manner, irrigation will only occur during dry periods with no irrigation undertaken during periods of wet weather. The possibility of any runoff from the irrigation area is therefore considered minimal. Additionally, given the large setbacks distance to the dams and the groundwater well and as the on-site effluent will be treated to advanced secondary standard (essentially tertiary standard), with additional treatment of the dam and groundwater supply, no impacts from disposal of treated effluent on the potable water supply are anticipated.

6 Conclusions

Comiskey Group Pty Ltd (Comiskey Group) commissioned Gilbert & Sutherland Pty Ltd (G&S) to undertake an Addendum Volumetric Water Supply Assessment (AWSA) in order to address the following:

- Issues raised by an information request by Sunshine Coast Council regarding the Preliminary Volumetric Water Supply Assessment dated September 2021 prepared in support of a Material Change of Use (MCU) application for a proposed Eco-Holiday Park located at 1807 Roys Road, Coochin Creek, Queensland.
- Further issues raised by Council's expert during the Court Mediation process.

The updated assessment identified the potential maximum daily water demand for the proposed development to be approximately 36,904.29 L per day. This calculation is based partly on the Queensland Government's Planning Guidelines for Water Supply and Sewerage (2010), and partly on real water usage data for an existing holiday park located at Sandstone Point, QLD, supplied by the Comiskey Group.

In responding to Council's Information Request G&S completed a desktop assessment and additional site investigations and modelling to confirm potential water supply sources for use in the proposed development.

The confirmed water sources identified onsite are as follows:

- Groundwater well located in SW corner of the site
- Rainwater harvesting from proposed roof areas
- 2 x onsite dams in North-East corner of the site
- ~250 kL water tank storage as an additional water storage

A 72 hour pump test of the existing groundwater well indicated a sustainable flow rate of 0.12 L/s or 10,369 L/day (3.78 ML/yr).

Based on calculations of the rooftop area of the proposed Eco-Park and rainfall data derived from SILO, captured rainfall from roofed areas was estimated to be 4.02 ML/year at an 80% capture rate, 4.52 ML/year at a 90% capture rate and 5.02 ML/year at a 100% capture rate.

Water consumption rates have been based partly on the Queensland Government's Planning Guidelines for Water Supply and Sewerage (2010), and partly on real water usage data for an existing holiday park located at Sandstone Point, QLD, supplied by the Comiskey Group.

A demand vs supply analysis based on a water balance model simulation over a 108-year hydrologic data set obtained from Peachester Station indicated that, applying a 10% dam storage cut off scenario, the reliability of the overall onsite water resources, consisting of two dams and water tanks (with a total capacity of ~250 kL to store water from roof areas and the onsite bore) to supply maximum daily demand is 95%. This exceeds the 75% water reliability standard within the Dutch guidelines.

In the period of low flow when water demand exceeds supply, a set of appropriate measures including use of the stored tank water supply, trucking in water from external sources and applying temporary water restrictions is provided.

In terms of potential impacts from on-site effluent disposal on the proposed water sources (dams and existing groundwater well), given the proposed quality of treatment (advanced secondary), proposed wet weather storage measures, setback distance analysis, and proposed secondary treatment of the onsite water supply, no impacts on the water supply are envisaged.

Appendix 1 – Reference drawings

Appendix 1 is accessible from the following link:

<https://www.dropbox.com/scl/fo/kf7g9yxz2c06ujzkwfubv/h?dl=0&rlkey=l6dsirieiuibll3o5fgku0l61>

Appendix 2 – Dam base survey & volumes 1807 Roys Road, Coochin Creek (supplied by Comiskey Group)

Appendix 2 is accessible from the following link:

<https://www.dropbox.com/scl/fo/kf7g9yxz2c06ujzkwfubv/h?dl=0&rlkey=l6dsirieiuibll3o5fgku0l61>

Appendix 3 – Hydrologic soil group for (SCS method)^{16, 17}

Soil group	Characteristics
A	Low overland-flow potential; high minimum infiltration capacity even when thoroughly wetted (> 0.76 cm/h). Deep, well- to excessively drained sands and gravels. soils typically have less than 10 percent clay and more than 90 percent sand or gravel and have gravel or sand textures. Some soils having loamy sand, sandy loam, loam or silt loam textures may be placed in this group if they are well aggregated, of low bulk density, or contain greater than 35 percent rock fragments.
B	Moderate minimum infiltration capacity when thoroughly wetted (0.38 to 0.76 cm/h). Moderately deep to deep, moderately to well-drained, moderately fine- to moderately coarse-grained (e.g., sandy loam). Soils typically have between 10 percent and 20 percent clay and 50 percent to 90 percent sand and have loamy sand or sandy loam textures. Some soils having loam, silt loam, silt, or sandy clay loam textures may be placed in this group if they are well aggregated, of low bulk density, or contain greater than 35 percent rock fragments.
C	Low minimum infiltration capacity when thoroughly wetted (0.13 to 0.38 cm/h). Moderately fine- to fine grained soils or soils with an impeding layer (fragipan). Soils typically have between 20 percent and 40 percent clay and less than 50 percent sand and have loam, silt loam, sandy clay loam, clay loam, and silty clay loam textures. Some soils having clay, silty clay, or sandy clay textures may be placed in this group if they are well aggregated, of low bulk density, or contain greater than 35 percent rock fragments.
D	High overland-flow potential; very low minimum infiltration capacity when thoroughly wetted (0.13 cm/h). Clay soils with high swelling potential, soils with permanent highwater table, soils with a clay layer near the surface, shallow soils over impervious bedrock. Soils typically have greater than 40 percent clay, less than 50 percent sand, and have clayey textures. In some areas, they also have high shrink-swell potential.

¹⁶ USSCS (1972). National Engineering Handbook: U.S. Soil Conservation Service.

¹⁷ USDA (January 2009). Chapter 7 Hydrologic Soil Groups. In: National Soil Survey Handbook, Part 630 - Hydrology, Natural Resources Conservation Service. United States Department of Agriculture.

Appendix 4 – SCS curve number (CN) for various soils/land-cover complexes, antecedent wetness condition II (“average”) ¹⁸

Land use cover	Treatment or Practice	Hydrologic Condition	Hydrologic Soil Group			
			A	B	C	D
Fallow	Straight row	–	77	86	91	94
Row crops	Straight row	Poor	72	81	88	81
	Straight row	Good	67	78	85	89
	Contoured	Poor	70	79	84	88
	Contoured	Good	65	75	82	86
	Contoured and terraced	Poor	66	74	80	82
	Contoured and terraced	Good	62	71	78	81
Small grain	Straight row	Poor	65	76	84	88
	Straight row	Good	63	75	83	87
	Contoured	Poor	63	74	82	85
	Contoured	Good	61	73	81	84
	Contoured and terraced	Poor	61	72	79	82
	Contoured and terraced	Good	59	70	78	81
Close-seeded legumes or rotation meadow	Straight row	Poor	66	77	85	89
	Straight row	Good	58	72	81	85
	Contoured	Poor	64	75	83	85
	Contoured	Good	55	69	78	83
	Contoured and terraced	Poor	63	73	80	83
	Contoured and terraced	Good	51	67	76	80
Pasture or range		Poor	68	79	86	89
		Fair	49	69	79	84
		Good	39	61	74	80
	Contoured	Poor	47	67	81	88
	Contoured	Fair	25	59	75	83
	Contoured	Good	6	35	70	79
Meadow (permanent)		Good	30	58	71	78
Woodlands (farm woodlots)		Poor	45	66	77	83
		Fair	36	60	73	79
		Good	25	55	70	77
Farmsteads		–	59	74	82	86
Roads, dirt		–	72	82	87	89
Roads, hard surface		–	74	84	90	92

¹⁸ USSCS (1972). National Engineering Handbook: U.S. Soil Conservation Service.

Appendix 5 – Usage figures Sandstone Point Holiday Park

Appendix 5 is accessible from the following link:

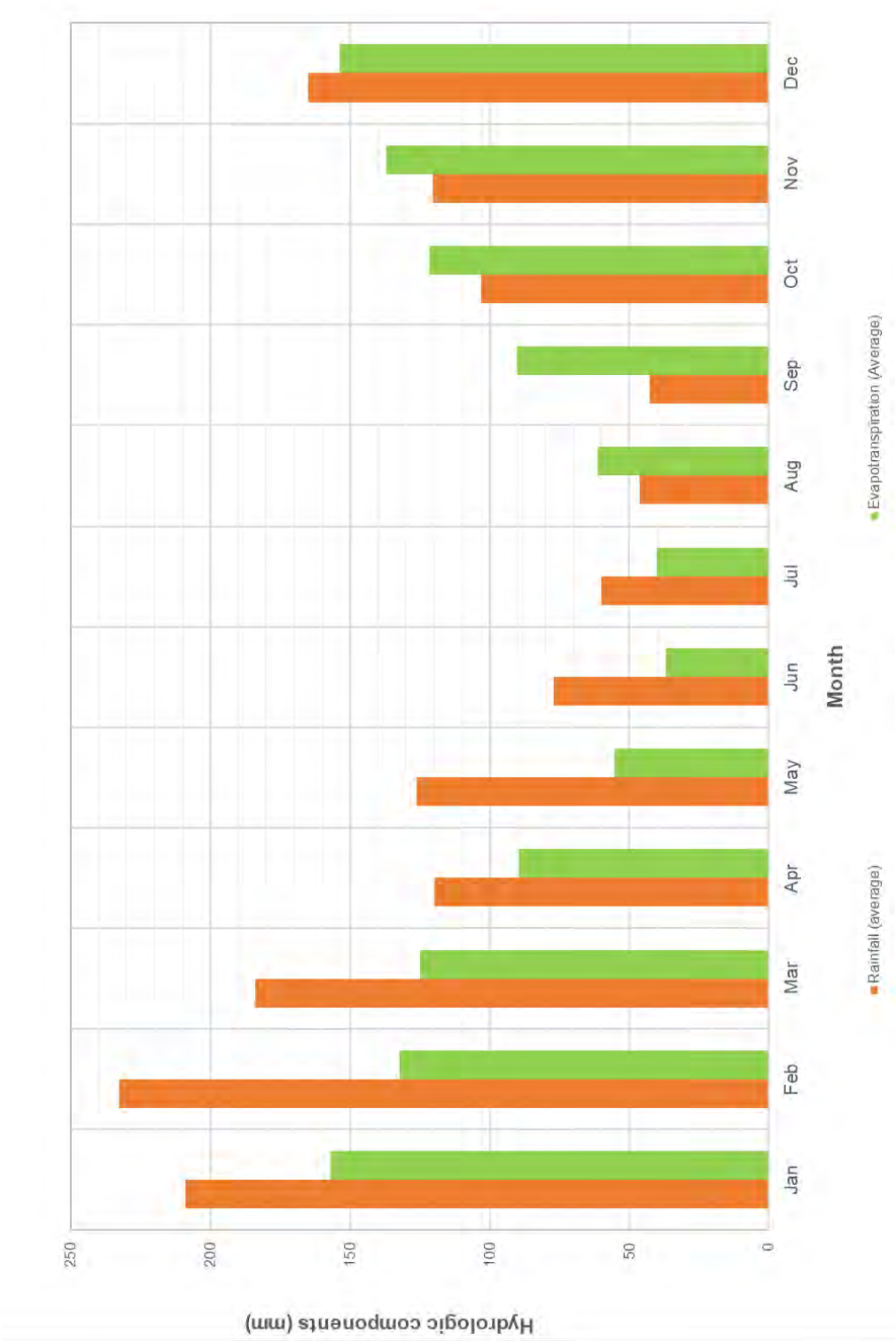
<https://www.dropbox.com/scl/fo/kf7g9yxz2c06ujzkwfubv/h?dl=0&rlkey=l6dsirieiuibll3o5fgku0l61>

Appendix 6 – Groundwater pump testing report and results

Appendix 6 is accessible from the following link:

<https://www.dropbox.com/scl/fo/kf7g9yxz2c06ujzkwfubv/h?dl=0&rlkey=l6dsirieiuiB3o5fgku0l61>

Appendix 7 – Temporal variation of hydrologic parameters



Appendix 8 – Summary of average monthly rainfall recorded at Peachester Station

Table Summary of average monthly rainfall, *P* (mm/month)

Year	Month												Annual rainfall (mm)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1915	152.30	488.30	6.00	59.00	100.90	12.40	50.80	45.30	111.60	6.30	106.90	31.80	1171.60
1916	102.30	40.00	86.30	436.70	44.80	64.40	88.80	108.40	117.70	119.50	133.40	348.20	1690.50
1917	218.70	162.90	168.80	57.90	53.20	8.10	9.90	65.00	130.90	44.40	295.90	182.60	1398.30
1918	465.30	202.00	246.40	117.00	141.20	7.10	14.20	122.90	69.40	18.50	24.70	59.40	1488.10
1919	16.80	72.40	301.90	173.60	305.40	57.20	13.70	22.30	8.10	18.30	14.60	20.80	1025.10
1920	473.30	80.20	142.40	163.20	120.90	100.50	72.50	38.00	92.60	175.50	154.30	79.60	1693.00
1921	285.10	100.70	353.00	322.30	91.00	284.90	186.20	46.80	131.10	49.80	84.90	366.90	2302.70
1922	178.90	472.30	45.50	39.90	78.90	54.80	89.20	38.60	94.80	47.60	127.60	250.10	1518.20
1923	100.80	89.10	169.60	346.80	40.90	70.90	102.60	32.90	38.60	21.00	123.30	250.20	1386.70
1924	182.40	238.50	219.40	95.70	103.10	84.80	222.50	54.70	46.20	172.00	123.70	135.00	1678.00
1925	300.50	235.00	385.70	69.70	179.90	364.20	15.50	124.50	21.30	38.50	220.30	154.90	2110.00
1926	234.80	9.20	134.80	161.80	121.00	170.60	27.90	21.30	162.20	14.40	3.60	558.10	1619.70
1927	853.00	119.70	381.60	69.80	2.80	99.80	7.10	5.90	161.50	130.20	175.90	306.70	2314.00
1928	275.30	973.30	72.00	694.10	80.20	64.60	35.30	24.80	7.30	46.80	31.20	106.80	2411.70
1929	314.40	167.20	227.30	395.00	19.10	108.40	5.80	28.90	7.80	131.50	69.50	237.00	1711.90
1930	564.00	216.90	156.30	85.00	340.80	486.40	46.00	49.30	6.80	37.10	44.90	44.70	2078.20
1931	304.30	783.60	455.80	91.40	102.50	29.60	50.50	76.40	38.60	32.60	230.30	188.30	2383.90
1932	40.90	74.00	84.20	259.30	47.50	26.70	13.20	29.20	109.40	105.70	106.50	39.70	936.30
1933	228.30	117.90	58.10	310.30	8.10	55.40	128.00	32.60	151.20	152.10	332.20	335.20	1909.40
1934	227.30	425.30	109.50	425.00	146.00	46.50	131.00	30.30	32.90	65.80	212.20	168.00	2019.80
1935	184.40	406.20	99.40	172.70	55.90	7.10	113.00	115.20	94.30	142.80	37.00	170.60	1598.60
1936	135.00	57.70	398.50	44.30	122.50	138.50	41.70	1.60	29.20	26.20	60.60	77.50	1133.30
1937	63.60	232.00	364.30	93.80	23.30	42.50	33.00	71.80	8.60	154.40	264.70	138.90	1490.90
1938	405.70	67.30	275.40	26.20	581.40	67.40	79.60	20.60	24.30	162.50	100.00	10.90	1821.30
1939	86.70	90.60	395.90	213.80	89.20	93.10	76.20	79.50	7.10	87.40	81.80	62.90	1364.20
1940	171.40	232.90	358.30	97.10	49.80	74.60	43.20	90.00	17.10	40.40	172.50	212.50	1559.80
1941	324.60	171.60	306.50	123.60	172.70	47.10	6.80	14.50	11.10	13.70	78.10	33.30	1303.60
1942	106.90	455.50	47.80	249.80	43.20	82.50	74.50	23.80	15.50	198.70	58.60	437.70	1794.50
1943	154.60	140.10	107.00	51.00	31.80	53.70	2.50	45.70	142.10	204.40	94.20	214.90	1242.00
1944	363.80	92.70	70.20	10.10	46.30	51.70	185.80	44.10	61.40	69.80	122.10	63.30	1181.30
1945	80.10	252.80	121.80	124.90	103.10	175.40	76.60	12.50	31.90	52.10	71.60	119.40	1222.20
1946	202.80	146.80	485.90	174.30	22.10	5.80	9.70	4.80	75.50	108.50	45.00	65.80	1347.00
1947	165.40	631.90	344.80	119.80	103.20	9.10	4.00	27.00	85.60	82.90	161.20	267.20	2002.10
1948	135.60	199.40	310.40	195.30	223.70	233.60	16.20	32.70	45.80	3.30	77.40	148.30	1621.70
1949	152.70	276.40	390.50	41.20	48.90	78.50	58.10	30.50	123.30	329.90	56.40	116.20	1702.60
1950	308.10	760.70	270.10	181.90	58.50	149.50	420.70	61.70	42.20	106.60	169.40	226.30	2755.70
1951	683.80	193.80	279.20	15.80	74.70	41.70	0.50	14.50	10.20	81.20	8.60	78.50	1482.50
1952	94.20	191.90	192.30	97.40	128.20	130.30	82.90	88.50	75.00	114.00	17.70	101.50	1313.90
1953	315.40	819.40	345.50	113.00	20.40	0.00	3.80	134.90	22.10	140.70	74.50	104.30	2094.00
1954	302.40	592.30	177.10	78.50	84.80	32.70	447.10	108.10	78.60	137.60	119.80	36.90	2195.90
1955	118.90	182.10	805.50	370.10	197.70	62.20	44.70	4.80	48.90	105.30	26.40	178.60	2145.20
1956	282.90	440.30	814.70	171.80	164.80	148.30	69.30	16.80	26.40	51.10	62.60	254.20	2503.20
1957	155.50	154.10	69.40	22.10	3.00	27.90	98.20	77.00	1.30	81.90	73.60	29.70	793.70
1958	119.60	311.80	114.60	477.30	25.20	499.30	0.00	78.00	49.10	44.70	55.00	264.70	2039.30
1959	370.00	297.10	267.20	71.70	90.00	46.20	115.70	16.30	129.70	199.50	330.60	131.60	2065.60
1960	197.10	175.90	101.00	44.40	158.30	26.50	32.00	12.40	9.40	133.10	110.40	78.00	1078.50
1961	227.50	288.60	148.00	109.80	48.10	38.80	36.30	30.60	55.40	245.20	234.20	293.60	1756.10
1962	274.30	232.30	379.90	170.30	26.10	32.20	86.70	27.20	44.70	21.60	57.90	261.80	1615.00
1963	487.50	83.60	683.70	88.00	173.10	8.60	2.50	72.80	38.70	133.70	96.60	167.20	2036.00
1964	110.10	187.90	530.80	110.00	106.80	49.20	52.10	31.20	189.90	63.60	110.70	88.50	1630.80
1965	176.80	78.20	25.20	128.30	143.20	151.10	165.00	105.50	56.10	78.30	182.40	276.20	1566.30
1966	69.40	133.00	152.10	155.80	40.70	137.90	45.30	147.60	57.20	94.30	127.30	183.10	1343.70
1967	346.10	130.90	383.40	100.40	210.80	631.10	58.80	21.80	113.20	101.90	101.90	92.20	2207.80
1968	735.50	239.00	147.50	55.60	82.40	2.80	46.80	62.80	6.20	22.90	94.90	56.30	1552.70
1969	124.80	86.10	127.00	57.90	334.70	27.60	53.90	137.50	27.20	238.50	112.00	117.70	1444.90
1970	427.90	193.30	120.90	140.30	16.30	25.20	30.50	37.40	48.00	109.10	149.70	842.60	2141.20
1971	370.90	506.10	193.40	79.30	26.20	16.60	40.30	72.00	27.20	64.50	138.40	237.90	1772.80
1972	269.70	720.90	149.30	313.00	211.10	62.80	3.80	10.40	3.70	254.50	226.70	59.40	2285.30
1973	206.10	655.90	108.60	67.60	46.50	24.40	672.10	20.90	47.30	213.40	80.20	175.60	2318.60
1974	1177.30	190.20	398.80	160.40	173.50	59.00	18.30	59.80	63.40	125.60	299.00	48.00	2773.30
1975	288.00	169.00	57.60	189.80	29.20	94.00	33.20	87.00	133.40	67.20	131.40	252.00	1531.80
1976	340.80	414.80	521.00	188.20	231.20	35.40	81.40	6.00	74.80	61.80	195.60	64.40	2215.40

1977	157.20	236.20	226.00	39.40	60.40	20.20	55.00	12.00	7.00	31.00	200.40	25.00	1069.80
1978	185.00	225.80	365.60	90.80	107.40	31.00	61.00	68.00	132.00	48.80	109.40	130.40	1555.20
1979	287.40	153.40	97.00	95.20	51.20	95.60	35.00	4.00	24.80	107.40	144.00	74.40	1169.40
1980	179.00	239.00	15.00	81.60	410.40	14.60	65.00	40.60	0.00	136.00	38.60	214.80	1434.60
1981	112.30	455.00	50.00	219.80	159.00	53.00	31.00	80.00	0.00	17.90	230.80	169.00	1577.80
1982	582.90	160.40	237.40	120.40	123.60	1.50	22.60	81.00	68.60	53.00	15.20	90.40	1557.00
1983	93.50	35.20	132.40	256.00	399.40	522.60	108.90	70.00	55.00	108.50	345.00	192.00	2318.50
1984	192.20	105.20	70.00	157.40	38.20	153.00	229.80	20.00	32.60	214.00	125.40	167.80	1505.60
1985	194.40	119.00	384.60	117.80	110.40	48.40	204.00	38.80	57.00	99.00	57.40	90.60	1521.40
1986	31.00	92.00	70.00	44.00	154.00	0.00	103.60	79.00	83.00	152.20	143.20	174.80	1126.80
1987	101.60	292.60	116.20	100.60	84.40	144.60	75.70	75.20	2.20	171.00	37.20	232.40	1433.70
1988	95.20	46.30	216.00	741.20	46.00	264.00	169.10	59.80	35.20	8.00	15.50	450.00	2146.30
1989	205.40	241.20	391.60	1025.90	334.90	75.50	55.00	85.60	49.00	59.80	175.20	103.80	2802.90
1990	72.60	526.50	419.40	269.90	198.00	116.20	47.00	2.00	4.60	57.70	136.00	177.10	2027.00
1991	118.30	206.50	110.20	21.00	94.20	69.00	26.00	0.00	2.00	92.70	32.80	577.30	1350.00
1992	61.70	674.60	449.10	211.10	156.30	21.10	50.80	15.30	43.40	6.30	87.80	88.50	1866.00
1993	119.90	215.60	198.20	42.90	26.20	5.00	83.60	140.00	87.70	93.00	176.00	122.00	1310.10
1994	248.50	202.00	212.10	148.00	91.50	29.30	42.40	13.50	9.50	34.30	49.10	175.10	1255.30
1995	57.40	557.00	82.50	71.70	63.10	47.60	0.00	69.30	1.70	63.60	254.50	78.30	1346.70
1996	312.60	122.50	99.00	93.50	526.80	62.50	30.00	21.00	18.50	78.00	64.00	112.70	1541.10
1997	154.60	97.90	180.00	103.50	210.40	13.50	53.50	3.50	23.70	100.00	145.50	79.70	1165.80
1998	130.30	95.50	78.00	170.90	188.00	19.20	44.20	108.40	267.60	0.20	165.00	103.60	1370.90
1999	186.10	964.00	381.90	87.20	243.40	204.70	132.90	106.00	65.30	158.00	124.00	304.50	2958.00
2000	96.50	184.00	103.80	137.80	192.10	43.10	30.00	30.50	0.00	183.00	180.80	127.50	1309.10
2001	24.60	288.00	225.70	45.50	12.00	42.60	46.40	5.50	17.90	37.40	177.60	158.50	1081.70
2002	117.70	96.80	108.80	74.50	59.80	88.20	0.60	129.40	2.40	81.40	85.80	132.00	977.40
2003	14.00	639.80	131.00	122.50	114.20	38.00	57.20	62.00	1.00	91.10	97.60	206.30	1574.70
2004	205.10	151.20	296.60	139.60	12.30	13.70	11.00	5.00	14.40	62.60	153.40	201.00	1265.90
2005	189.00	20.50	54.90	169.20	113.90	195.60	34.00	19.20	31.00	106.20	201.00	133.60	1268.10
2006	173.30	145.80	171.20	12.30	34.50	69.20	41.10	40.70	137.90	12.60	104.70	102.30	1045.60
2007	47.30	234.90	123.10	37.30	90.80	142.90	7.50	298.10	99.50	55.20	132.70	219.40	1488.70
2008	370.70	305.70	99.90	5.90	61.90	148.70	135.00	1.20	148.70	43.00	202.20	105.00	1627.90
2009	117.30	270.90	190.90	404.90	301.20	148.20	2.40	7.40	21.00	103.70	37.40	170.90	1776.20
2010	156.70	521.20	435.90	98.00	39.70	12.40	55.60	82.50	100.40	450.70	77.50	566.80	2597.40
2011	926.40	155.50	261.40	263.60	91.00	39.40	28.00	96.90	23.80	125.30	47.60	342.60	2401.50
2012	583.60	396.30	485.20	139.50	72.00	230.30	55.50	0.00	12.40	24.50	58.30	23.00	2080.60
2013	645.10	649.60	179.40	158.20	104.10	156.10	49.60	0.00	30.90	33.20	95.20	58.50	2159.90
2014	60.50	76.50	268.10	102.80	48.60	17.40	17.20	135.10	46.20	17.50	110.60	122.00	1022.50
2015	240.60	541.60	55.10	161.80	322.10	81.70	16.00	90.20	70.10	125.20	88.40	48.00	1840.80
2016	162.60	93.20	102.70	41.00	53.00	329.70	19.80	19.60	104.50	20.50	16.30	59.00	1021.90
2017	176.80	41.30	472.30	20.50	77.20	54.40	15.10	12.00	12.70	279.40	168.80	103.30	1433.80
2018	51.80	348.40	185.00	136.20	79.00	63.50	41.00	20.70	22.60	305.20	25.80	251.20	1530.40
2019	10.30	61.00	230.80	191.80	70.10	113.20	26.30	6.20	0.00	75.10	10.60	37.40	832.80
2020	261.10	412.70	124.20	20.00	13.50	51.00	93.30	7.20	20.70	60.90	44.70	269.00	1378.30
2021	219.10	121.80	191.10	235.10	80.70	30.30	59.80	5.20	39.10	170.80	331.80	151.10	1635.90
2022	306.30	####	172.60	98.60	635.30	3.40	180.30	19.40	99.60	225.40	22.80	130.60	2920.60
Average	239.52	275.91	228.68	157.38	123.21	93.00	70.58	50.40	53.87	99.89	118.78	170.02	1681.23

Appendix 9 – Summary of average monthly evapotranspiration recorded at Peachester Station

Table Summary of average monthly evapotranspiration, ETo (mm/month)

Year	Month												Annual ETo (mm)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1915	179.40	140.20	135.40	92.30	57.70	32.60	43.60	65.30	102.90	122.50	137.90	160.20	1270.00
1916	172.10	146.60	137.10	91.40	59.90	47.00	49.80	75.30	105.00	128.10	137.10	163.50	1312.90
1917	173.90	135.50	131.30	100.50	53.40	37.90	35.60	64.40	98.70	142.90	151.40	170.60	1296.10
1918	153.30	144.60	135.20	103.70	68.40	41.20	48.10	68.70	114.40	134.80	149.20	165.30	1326.90
1919	168.00	140.40	133.00	102.60	65.00	44.40	42.90	68.70	90.50	129.30	156.40	162.30	1303.50
1920	158.50	145.60	133.90	85.80	64.00	45.10	50.80	68.70	110.40	136.80	158.20	175.90	1333.70
1921	156.50	136.30	121.80	101.50	68.20	47.90	54.20	69.70	107.70	134.80	159.50	147.40	1305.50
1922	180.90	143.20	139.60	102.60	50.20	41.20	48.60	75.00	107.50	133.70	144.90	166.00	1333.40
1923	180.20	152.50	136.10	94.10	53.00	39.40	36.10	67.30	89.10	123.70	147.90	173.70	1293.10
1924	174.40	137.00	137.20	90.10	60.40	39.90	49.30	75.10	107.50	138.70	153.90	166.50	1330.00
1925	169.30	142.70	128.80	97.10	56.70	39.60	43.60	67.80	98.00	140.10	156.00	166.20	1305.90
1926	176.50	153.10	131.80	93.70	51.10	43.70	48.90	59.00	97.90	131.40	151.90	158.30	1297.30
1927	164.30	145.90	127.80	106.90	59.60	38.80	37.30	64.20	95.60	141.90	163.00	149.20	1294.50
1928	183.60	139.80	148.00	103.70	62.50	44.00	44.30	74.70	104.10	123.10	154.90	174.40	1357.10
1929	171.20	137.70	136.50	99.80	58.50	32.60	39.40	71.10	99.10	132.20	141.60	158.10	1277.80
1930	147.00	142.50	143.00	99.40	67.50	40.30	51.00	72.30	106.30	126.80	143.90	160.70	1300.70
1931	166.30	135.80	132.90	100.60	67.00	43.70	40.60	76.40	97.30	123.60	142.10	160.50	1286.80
1932	178.60	143.90	122.80	90.30	64.00	38.10	39.50	65.50	99.30	134.90	154.40	163.60	1294.90
1933	167.50	141.10	138.30	99.00	52.50	39.50	41.40	66.80	95.30	145.30	151.70	166.80	1305.20
1934	175.20	142.00	141.70	97.20	68.40	41.00	40.60	74.60	111.40	128.60	151.10	179.90	1351.70
1935	181.50	157.60	139.70	93.50	61.60	34.40	43.70	72.80	101.20	136.00	159.50	171.30	1352.80
1936	167.00	146.40	121.80	95.30	66.70	42.70	52.50	72.00	106.20	123.20	143.90	148.40	1286.10
1937	170.70	112.40	129.40	91.60	59.10	39.10	50.50	75.80	102.80	141.60	160.60	174.80	1308.40
1938	167.60	146.80	137.20	103.10	69.60	40.40	48.10	70.30	115.80	149.20	154.50	165.30	1367.90
1939	166.70	142.90	132.60	100.10	77.20	49.60	53.40	74.80	120.80	138.10	159.30	184.10	1399.60
1940	182.80	146.30	139.40	106.30	68.00	50.50	57.80	86.50	122.50	152.50	162.90	184.20	1459.70
1941	146.20	143.60	129.30	106.10	64.00	45.20	54.70	81.10	122.50	143.90	163.90	179.40	1379.90
1942	168.10	126.60	151.60	104.30	75.00	52.70	56.80	82.90	105.10	139.70	159.60	145.20	1367.60
1943	183.30	135.40	158.50	105.20	67.50	41.90	54.20	78.10	105.80	146.30	157.40	182.60	1416.20
1944	194.00	145.50	131.00	107.30	59.70	42.90	53.30	82.70	122.60	160.60	168.50	164.60	1432.70
1945	175.30	145.80	149.40	106.50	73.30	57.00	55.80	83.00	120.40	129.40	176.40	189.20	1461.50
1946	174.40	163.60	129.50	94.70	72.00	31.70	41.40	68.30	105.70	144.30	158.30	179.10	1363.00
1947	168.50	106.80	141.80	98.80	72.00	44.80	45.80	67.60	104.90	135.00	151.50	184.30	1321.80
1948	183.50	154.80	149.00	88.20	68.20	45.50	58.70	80.40	104.70	147.40	161.20	179.30	1420.90
1949	183.80	132.90	128.90	108.60	70.70	41.90	52.00	72.90	110.10	133.00	151.50	181.20	1367.50
1950	162.90	109.90	118.20	84.70	59.30	35.70	45.10	67.00	109.90	121.50	125.80	163.90	1203.90
1951	138.30	141.80	133.10	92.70	54.80	34.40	37.70	51.90	112.40	127.20	147.00	162.60	1233.90
1952	166.90	120.20	120.40	88.60	51.00	30.50	47.60	72.70	100.60	132.90	137.60	156.70	1225.70
1953	131.10	116.30	121.50	98.20	54.70	29.00	32.50	49.80	101.80	118.80	133.50	177.10	1164.30
1954	128.50	99.20	141.50	87.60	48.00	30.70	45.90	69.50	98.40	113.40	150.60	154.90	1168.20
1955	159.10	117.00	122.70	91.20	50.90	40.50	38.50	61.80	100.90	123.90	141.60	158.10	1206.20
1956	153.80	123.30	107.60	90.70	49.80	29.50	42.40	58.00	83.40	119.60	131.10	149.60	1138.80
1957	172.70	130.20	123.80	104.70	46.90	33.70	35.30	55.00	112.40	117.00	162.30	179.40	1273.40
1958	145.60	126.70	135.50	88.20	69.50	37.30	38.10	60.50	97.00	121.90	140.40	169.70	1230.40
1959	159.90	148.10	133.30	98.00	59.00	45.10	42.80	67.80	103.00	130.90	156.60	175.00	1319.50
1960	174.00	141.20	134.70	95.00	40.30	31.60	40.50	73.60	89.80	134.20	151.80	148.40	1255.10
1961	152.50	123.20	128.60	87.30	54.80	39.40	37.00	66.10	99.70	147.30	142.50	169.60	1248.00
1962	148.70	159.90	105.00	83.70	51.80	36.20	44.20	67.00	88.60	110.70	154.20	134.40	1184.40
1963	139.80	150.20	113.20	87.90	53.70	30.80	30.50	68.90	94.60	128.50	132.70	159.70	1190.50
1964	170.00	144.40	135.10	84.60	54.30	34.40	38.70	58.10	93.30	111.60	135.60	151.20	1211.30
1965	172.10	151.20	125.80	101.50	66.50	43.80	49.70	76.90	111.40	141.50	148.80	146.90	1336.10
1966	134.20	142.90	134.00	102.10	64.80	46.40	41.40	63.70	94.60	132.30	141.50	161.30	1259.20
1967	164.20	131.30	111.40	96.20	57.00	43.70	50.50	55.20	99.60	144.90	150.40	130.20	1234.60
1968	142.60	137.60	132.40	98.60	48.70	29.10	37.80	52.90	99.70	116.00	133.80	155.90	1185.10
1969	173.20	125.10	120.10	87.80	49.90	39.40	51.70	79.40	89.10	127.40	161.60	171.80	1276.50
1970	172.20	146.10	138.00	98.80	47.70	31.80	49.90	53.70	82.00	135.70	137.80	155.90	1249.60
1971	165.20	105.70	118.00	96.00	52.60	34.60	37.90	54.20	86.80	116.20	127.00	158.50	1152.70
1972	156.60	104.60	131.50	88.90	53.80	44.30	38.30	66.50	106.90	137.60	141.30	179.20	1249.50
1973	145.20	136.00	141.10	91.30	60.60	35.00	46.80	73.30	101.20	142.20	149.20	164.20	1286.10
1974	130.20	129.20	108.80	94.20	63.40	44.90	35.20	50.80	78.10	119.50	139.50	172.30	1166.10
1975	169.30	132.30	135.10	91.20	59.10	35.50	51.90	63.90	98.70	105.20	149.80	152.80	1244.80
1976	145.40	119.90	113.20	90.00	66.60	48.20	45.80	65.90	86.50	116.10	149.10	174.70	1221.40

1977	174.30	134.40	129.20	105.40	58.40	35.40	42.00	79.70	83.60	141.10	154.00	155.30	1292.80
1978	147.60	156.80	137.20	101.40	61.00	38.50	37.70	53.20	95.00	126.50	151.60	153.00	1259.50
1979	166.00	131.20	135.30	104.70	60.60	47.30	44.30	65.30	90.40	119.50	161.40	191.00	1317.00
1980	174.00	129.50	137.00	93.60	62.70	45.40	40.00	80.10	108.50	128.30	154.70	143.80	1297.60
1981	164.60	131.80	151.60	102.90	59.00	35.80	43.30	57.60	105.50	127.20	119.20	190.70	1289.20
1982	149.20	132.90	135.20	99.60	62.30	40.30	38.20	80.50	92.90	137.00	144.20	150.80	1263.10
1983	166.90	152.60	123.40	78.60	59.00	41.10	43.70	70.70	114.90	135.50	128.40	162.80	1277.60
1984	149.10	136.60	127.60	86.70	60.30	45.40	40.00	69.50	92.10	121.80	151.70	160.80	1241.60
1985	186.30	132.70	119.70	87.60	65.80	34.90	44.70	68.90	92.10	116.20	119.30	163.00	1231.20
1986	156.10	126.40	136.00	104.80	61.30	32.00	40.50	61.70	94.00	114.20	143.50	165.20	1235.70
1987	172.20	135.50	134.60	86.20	58.60	41.10	37.70	73.40	103.10	103.10	124.50	164.90	1234.90
1988	171.20	130.10	120.30	85.60	59.10	44.20	46.20	72.50	100.30	137.00	134.20	155.30	1256.00
1989	172.50	120.90	119.20	90.00	66.20	40.60	38.20	68.30	104.80	120.10	143.30	167.30	1251.40
1990	169.30	135.90	111.60	73.60	66.10	36.80	43.90	45.60	95.40	132.20	158.40	160.10	1228.90
1991	146.90	144.60	137.70	90.90	62.90	38.70	34.00	53.10	89.20	136.80	143.10	173.80	1251.70
1992	177.70	124.70	129.40	91.60	54.70	38.10	47.70	58.50	95.70	132.60	150.90	158.20	1259.80
1993	187.40	151.70	137.00	103.90	70.40	42.40	56.40	68.90	93.20	127.50	139.90	161.40	1340.10
1994	180.80	140.60	126.30	100.20	62.40	43.40	48.60	77.70	107.10	132.80	143.20	178.80	1341.90
1995	172.60	117.20	151.70	94.80	62.30	50.10	48.80	82.00	108.80	126.70	142.50	180.70	1338.20
1996	173.50	153.70	131.60	73.10	57.70	44.30	39.00	65.40	86.30	129.90	140.70	173.50	1268.70
1997	155.40	140.50	137.20	106.30	59.50	43.90	52.60	73.70	95.70	135.90	160.40	173.60	1334.70
1998	169.20	153.00	147.40	87.80	58.30	50.00	43.20	76.50	101.70	121.20	136.70	156.50	1301.50
1999	166.50	121.80	132.90	77.00	65.20	41.00	45.40	80.60	110.40	133.80	120.70	153.50	1248.80
2000	155.90	121.50	131.80	80.70	56.70	38.80	46.00	62.50	96.00	110.10	122.70	151.10	1173.80
2001	175.70	144.20	133.30	99.10	59.70	52.30	49.40	64.60	97.70	114.80	118.50	155.00	1264.30
2002	159.80	126.50	133.20	97.80	56.80	35.10	39.60	64.20	100.80	132.20	152.00	158.70	1256.70
2003	156.50	108.80	131.80	92.30	66.10	47.30	59.10	70.80	86.70	126.30	149.40	155.70	1250.80
2004	162.60	161.40	138.00	109.10	52.20	48.00	46.30	61.70	99.00	113.20	148.20	158.30	1298.00
2005	149.80	144.90	114.10	102.00	50.40	43.60	53.20	67.10	97.40	119.00	145.70	177.00	1264.20
2006	175.40	154.00	111.00	87.50	53.70	37.10	43.50	60.30	100.80	124.70	143.40	136.00	1227.40
2007	159.80	126.60	138.10	92.80	68.80	25.90	31.60	57.50	94.90	130.40	122.60	126.70	1175.70
2008	121.60	109.60	118.10	79.20	56.20	46.40	36.40	44.70	97.10	119.00	116.30	154.50	1099.10
2009	127.10	122.60	116.40	82.00	53.70	42.70	44.10	70.40	88.80	112.10	145.50	144.00	1149.40
2010	150.20	122.00	104.00	83.70	49.90	29.10	37.30	49.20	69.10	108.20	108.20	105.30	1016.20
2011	142.30	139.70	100.90	87.60	51.70	32.10	35.60	68.50	88.60	104.00	144.50	114.90	1110.40
2012	124.00	140.20	105.30	80.10	59.50	37.30	40.50	56.10	92.10	110.10	139.40	140.40	1125.00
2013	137.90	102.10	109.20	88.10	48.20	37.30	49.30	63.10	95.50	119.90	135.50	150.00	1136.10
2014	134.10	113.20	119.70	89.40	55.20	35.00	37.50	59.30	83.90	128.90	139.30	131.80	1127.30
2015	139.00	134.90	134.40	73.90	53.00	36.20	38.50	59.10	84.80	132.00	150.00	141.50	1177.30
2016	142.50	133.40	130.90	89.00	56.10	27.90	37.40	62.80	62.90	99.30	116.60	142.50	1101.30
2017	143.20	127.40	107.30	66.70	56.60	33.10	39.50	49.40	56.10	94.80	125.30	158.10	1057.50
2018	160.10	116.90	114.10	85.50	46.90	33.90	39.50	51.30	82.70	119.50	115.80	141.70	1107.90
2019	151.70	111.40	107.70	91.10	52.30	37.90	48.60	50.70	66.10	120.10	120.10	123.30	1081.00
2020	150.50	126.60	110.70	100.10	38.20	38.80	38.10	54.00	85.60	117.90	143.50	127.60	1131.60
2021	144.70	129.40	106.10	76.80	59.60	38.10	40.20	61.50	70.80	112.80	101.20	147.00	1088.20
2022	144.40	113.30	116.50	95.60	51.80	38.00	41.40	68.80	77.10	102.40	101.20	130.30	1080.80
Average	161.50	134.56	128.95	93.69	59.16	39.78	44.14	66.71	97.82	127.56	143.89	160.20	1257.96

Appendix 10 – Recorded rainfall and evapotranspiration at Peachester Station Station and estimated runoff and infiltration

Appendix 10 is accessible from the following link:

<https://www.dropbox.com/scl/fo/kf7g9yxz2c06ujzkwfubv/h?dl=0&rlkey=l6dsirieiuiBl3o5fgku0l61>

Appendix 11 – Water balance model and reliability analysis at dams at 10% cut off

Appendix 11 is accessible from the following link:

<https://www.dropbox.com/scl/fo/kf7g9yxz2c06ujzkwfubv/h?dl=0&rlkey=l6dsirieiuibll3o5fgku0l61>

Appendix 12 – Water balance model and reliability analysis at water tank storage at 10% cut off

Appendix 12 is accessible from the following link:

<https://www.dropbox.com/scl/fo/kf7g9yxz2c06ujzkwfubv/h?dl=0&rlkey=l6dsirieiuiBl3o5fgku0l61>

Coochin Creek Eco Park

Aquatic Ecology Assessment



Prepared for Comiskey Group

Prepared by Ecological Service Professionals Pty Ltd

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