Post-fire Assessment Report—Natural Values:

2019 bushfire, Oakview National Park, South East Queensland Region

June 2021

Queensland Government

Prepared by: Technical Services and South East Queensland Region of Queensland Parks and Wildlife Service and Partnerships and the Queensland Herbarium, Department of Environment and Science.

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Front cover

Fire impacted vegetation, Oakview NP (Photo: P Harris)

Contents

List of acronyms and abbreviations used in the text

BVG	Broad Vegetation Groups (BVGs) as described by Neldner *et al.* (2019).
dNBR	Normalised Burn Ratio difference product.
E	Endangered.
EPBC	Federal *Environment Protection and Biodiversity Conservation Act 1999.*
FIRMS	Fire Information for Resource Management System available online at https://firms.modaps.eosdis.nasa.gov/
FLAME	QPWS Fire Management System.
gbh	Girth at breast height – a standard tree measure in vegetation assessment.
LC	Least Concern.
NAFI	Northern Australia Fire Information
NBR	Normalised Burn Ratio
NCA	Queensland *Nature Conservation Act 1992.*
NKV	Natural Key Value.
NP	National Park.
NT	Near Threatened.
OUV	Outstanding Universal Value of a World Heritage Area.
QPWS	Queensland Parks and Wildlife Service.
QPWS estate	National Parks, State Forests and Conservation Parks (in the context of the area encompassed by this report).
RE	Regional Ecosystem, as defined by Queensland Herbarium (2019), is a vegetation community in a bioregion that is consistently associated with a particular combination of geology, landform and soil (Neldner *et al.* 2020).
REDD	Regional Ecosystem Description Database, Version 11.1 (Queensland Herbarium 2019).
V	Vulnerable.

1 Executive summary

The bushfire in Oakview National Park was first detected on 7 November 2019, with a lightning strike during a storm the evening before being the suspected ignition source. The fire threatened core habitat for two critically endangered species, *Phyllurus kabikabi* (Oakview leaf-tailed gecko) and *Nangura spinosa* (Nangur skink) but fire-fighting efforts were successful in protecting their habitat. The fire was contained and safe by 22 November 2019.

The field inspection of fire severity and impacts was undertaken in June 2020, having been delayed as a consequence of COVID-19 restrictions.

The total area burnt within Oakview NP was approximately 1,438ha. A small area (1.2ha) burnt on the adjoining Oakview State Forest but is not included in this report. A summary of the natural values impacted, and the degree of known or likely impact, is provided in Table 1. Approximately 100ha mapped as vine forest (BVG 1 at 1:5M mapping) burnt on Oakview NP representing approximately 5% of this community on the park. Other communities impacted were: eucalypt woodlands to open forest (BVG 3) (1,261ha or 62%); and non-remnant/regrowth (77.4ha or 76%). Relative fire severity was predominately low (797.6ha) to moderate (609.7ha), but 32.3ha burned at high and 0.2ha burned at extreme severity (section 5). A detailed assessment of the impact to natural values is provided in section 6, together with recommended recovery actions. The highest priority recommendations for on-ground operations are to:

1. Prevent the establishment of ecosystem-changing weeds, such as: *Dolichandra unguis-cati* (cat's claw creeper) and weeds that would alter the habitat suitability for the endangered reptiles such as *Rivinia humilis* (coral berry) within and adjacent to Oakview leaf-tailed gecko and Nangur skink habitat.
2. Prevent the establishment of non-native, high biomass grasses and *Lantana camara* (lantana) immediately adjacent to, and within burnt communities, and implement control in the vicinity of unburnt communities at risk from future fires.
3. Conduct surveillance for new weed species and/or new incursions that may impact recovery or increase future fire risk and undertake strategic control.
4. Undertake control programs for feral cats (priority), deer, pigs and foxes.
5. Monitor the populations and habitat of the critically endangered reptiles.
6. Undertake Health Checks (Melzer *et al*. 2019) – these will facilitate early detection of weeds and enable ecosystem condition to be evaluated across the park.

The fire provides research and monitoring opportunities that will help inform a) post-fire management actions for future fires impacting vine forests in south-east Queensland, and b) ongoing fire management planning, planned burning and bushfire suppression. Some recommendations are provided in section 6.3.

Table 1. Summary of the ecosystems and impacts of the fire.

The total area burnt, the area burnt within four relative fire severity classes (percentage of the total burnt area in parentheses) and area of the potential ecological impact for each natural value.

Natural value descriptor	Total area burnt (ha)	Relative fire severity (ha) with percentage of total burnt area in parentheses	Potential Ecological Impact for burnt area (ha) with percentage of total burnt area in parentheses
Vine Forests: • Rainforest (BVG 2). • Includes core, occupied habitat and potential habitat for two Critically Endangered reptiles. • Fire-sensitive ecosystems. • Known or likely habitat for a suite of threatened flora and fauna species. • Vine forest and the Critically Endangered reptiles are listed as Key Values in the *Interim Values Assessment* for Oakview NP.	99.8	Low: 68.7 (68.7%) Moderate: 29.5 (29.6%) High: 1.5 (1.5%) Extreme: 0 (0.0)	Limited or none: 0 (0%) Moderate: 68.7 (68.9%) High: 29.5 (29.6%) Catastrophic: 1.5 (1.5%)
Eucalypt Open Forest to Woodland • Dry and moist eucalypt open forest to woodland (BVG 3 at 1:5million). • Fire-adapted ecosystem.	1 261	Low: 701.9 (55.7%) Moderate: 533.1 (42.3%) High: 26 (2.1%) Extreme: 0.2 (0.01%)	Limited or none:1,235 (97.9%) Moderate: 26 (2.1%) High: 0.2 (0.01%) Catastrophic: 0 (0%)

2 Introduction and purpose of this report

This report is a rapid assessment of the known and likely impacts to the natural values of a protected area arising from a significant bushfire event. It is not intended to be a comprehensive report. It provides an overview of the fire and provides information to inform recovery planning for natural values, particularly Natural Key Values determined through the QPWS Values-Based Management Framework (DES 2020).

The report succinctly documents the extent and ecological severity of the fire, prevailing weather conditions, and suppression methods. It describes the spatial data used in the evaluation and summarises areas and values within the burnt area (section 5). It provides QPWS with a snapshot of the priority impacts and associated risks to natural values following the bushfire, and provides practical recommendations for mitigation, recovery and monitoring (section 6).

Scoping the scale and nature of short- to long-term recovery actions as soon as possible after a fire event better supports land managers to manage immediate risks and plan for the future. It also assists in determining likely cost and resourcing implications.

This assessment is limited to a bushfire within Oakview NP (Figs 1 and 4) in the Southeast Queensland Bioregion that burned over the period from late November 2019 to early February 2020. Landscape features and place names used in this report are as per 1:25 000 scale topographic mapping available online at QTopo: https://qtopo.information.qld.gov.au/.

3 Background

Oakview NP (4,213ha) is approximately 32km west of Gympie and 10km south-east of Kilkivan and lies towards the northern extent of the South East Queensland Bioregion. The terrain is steep and hilly with an altitudinal range from 170m in the eastern gully lines to 630m. It became a national park in 2009 as part of the South East Queensland Forests Agreement with an addition being made in 2010. Prior to this, the area was subjected to logging for hardwood and softwood species, mining for gold (and other metals e.g. copper) and clearing for grazing. Evidence of the forestry and grazing industries is common and widespread in the park and includes old snigging tracks, ramps and clearings with associated weeds present – in particular *Lantana camara* (lantana) and 'improved' pasture grasses (NPRSR 2013a).

3.1 Landscape overview of the fire and timeframe

3.1.1 Overview

The Oakview bushfire 2019 was first detected on 7 November 2019 via satellite hotspot detection and is believed to have started from a lightning strike on park.

The objective of fire-fighting efforts was to contain the fire within the first few days, with the priority being to protect life and property and to prevent it destroying habitat for two critically endangered species: Oakview leaf-tailed gecko and Nangur skink. The steep and inaccessible nature of much of the terrain hampered containment efforts as did deteriorating weather conditions. Fire-control lines were established / re-established and backburning was undertaken from the edges of the vine forest in order to protect the core habitat of the two critically endangered species. Aerial water bombing by numerous aircraft was carried out to assist fire operations. While some vine forest burned in the fire, the core habitat of these species was protected.

The fire was considered contained on 18 November 2019. Active patrols continued until 6 December 2019 with no further flare-ups observed. The extent of bushfire impacts on Oakview NP is shown in **Figure 1**.

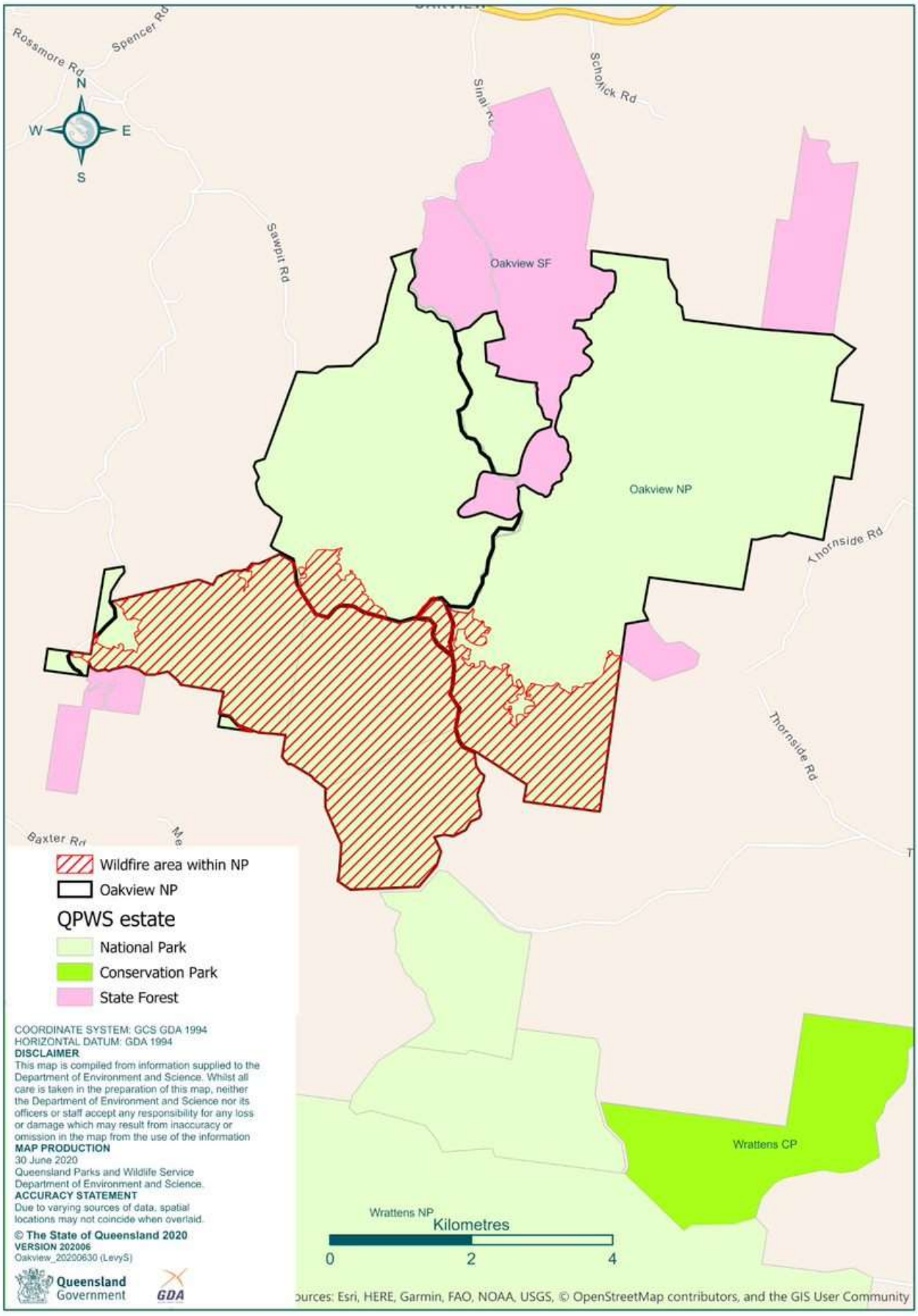

Figure 1. Extent of the bushfire within Oakview NP. The Oakview NP boundary shown as black; National Parks shaded light green, Conservation Parks shaded orange, and State Forests shaded pink.

3.1.2 Fire activity and behaviour

- The fire was first detected via the Northern Australian Fire Information (NAFI) tracking website on the afternoon of 7 November 2019, with a lightning strike from a storm the evening before being the suspected ignition source.
- The fire burnt through inaccessible terrain to the south of Range Rd in a south-easterly direction before spotting over the eastern side of Range Rd and continuing (south-easterly) towards Upper Thornside Rd.
- Ground crews from QPWS and QFES managed to contain the southern front of the fire with assistance from aerial water-bombing and bulldozers to strengthen containment lines.
- The vegetation community most impacted during the initial stages of this fire was BVG 9: *Moist to dry eucalypt open forests to woodlands usually on coastal lowlands and ranges;* much of which had previously been impacted by logging and/or grazing.
- The fire continued to be uncontainable in the eastern and northern sectors, while back-burning helped contain the fire at the southern and western containment lines.
- Priority was given to protecting the draft Key Natural Values (KNV) on the estate: 1 - Vine Forest (BVG 2a, including some BVG 7a as a subdominant vegetation type); and 2 – habitat for the two critically endangered reptiles (Nangur skink and Oakview leaf-tailed gecko).
- A new containment line was opened on the northern flank to protect the vine forest and back-burning was undertaken along the edge of the vine forest. These efforts were largely successful with limited amounts of vine forest being burnt.
- The fire was consider largely contained by 15 November 2019 and considered contained and safe by 22 November 2019 with ongoing monitoring operations continuing until 6 December 2019 to safeguard against a possible flare-up.

3.2 Weather

The Bureau of Meteorology undertook detailed analyses of the fire weather affecting north-east New South Wales (NSW) and south-east Queensland (Qld) during early September 2019 (BOM 2019a) and issued further statements regarding dangerous bushfire weather during spring (BOM 2019b) and extreme heat and fire weather in December 2019 and January 2020 (BOM 2020). Key climate and weather factors, for the Oakview area, from these reports include:

- Rainfall for January to August 2019 was well below average and below average for spring.
- The year-to-date mean maximum temperature to the end of spring 2019 was highest on record.
- Daytime temperatures were well above average for spring.
- Well above average accumulated Forest Fire Danger Index (FFDI) values during 2019.
- Modelled root-zone soil moisture was below average to driest on record for the first week of September over much of south-east Queensland.
- From 6 September, high temperatures, low humidity and strong winds, coupled with the dry conditions led to elevated fire danger across south-east Queensland.

The McArthur Forest Fire Danger Index (FFDI) is commonly used in Australia to indicate the combined influence of various weather factors associated with dangerous bushfire conditions. It reflects longer-term rainfall and temperature patterns and shorter-term weather. A time series of the FFDI data (as described by Dowdy 2018) for the Oakview area of south-east Queensland is provided in Figures 2 and 3: annual averaged FFDI, and the number of severe FFDI days per year (i.e. FFDI greater than 50), respectively. These figures show much higher than average FFDI for the region in 2019 compared to the historical data (data provided by A. Dowdy, Bureau of Meteorology, August 2020).

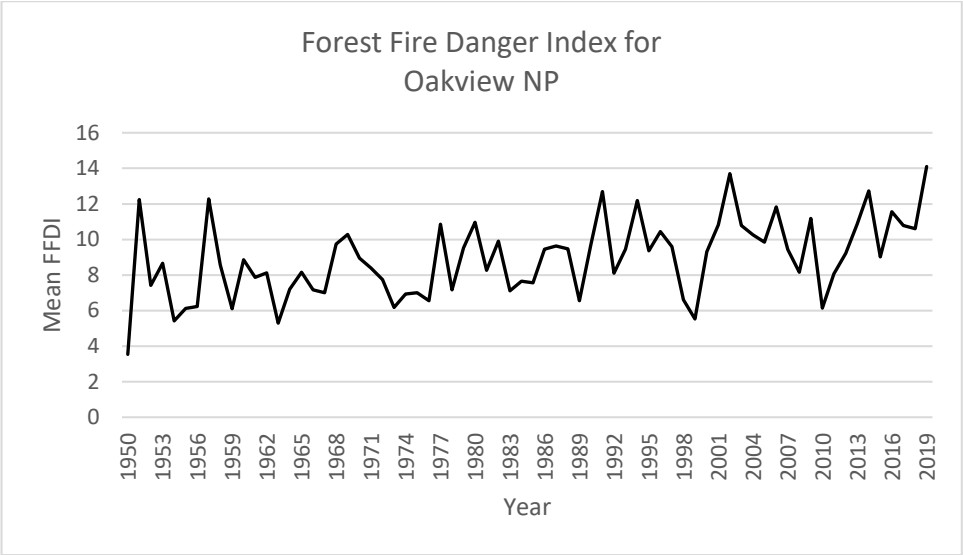

Figure 2. Time series of annual averaged Forest Fire Danger Index for Oakview National Park region, south-east Queensland.

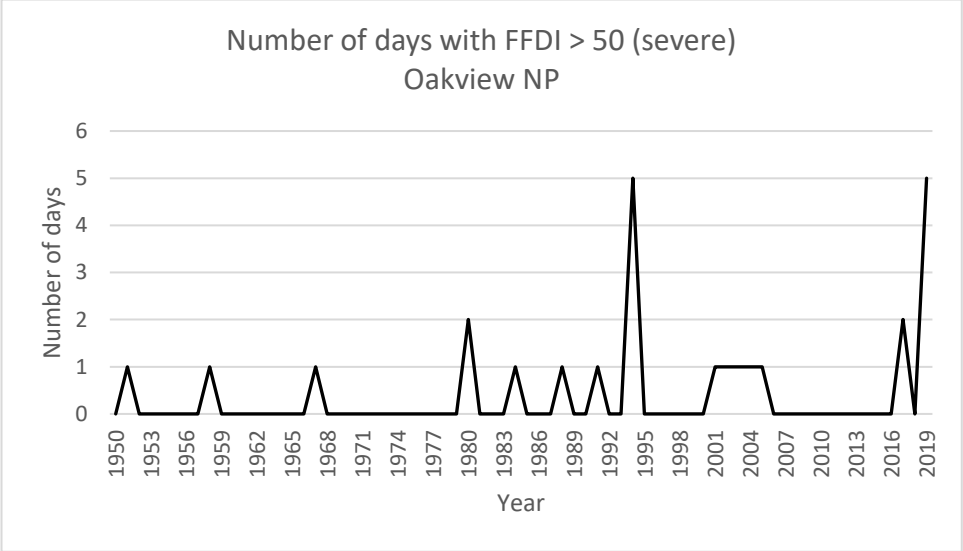

Figure 3. Time series of the number of severe Forest Fire Danger Index days per year, for Oakview National park, south-east Queensland.

3.3 Suppression methods used on estate

A range of suppression methods was used on QPWS estate during the event. Brief details are provided here.

- Aerial water bombing support using planes and helicopters (direct attack to slow progress of the fire and protect assets). Water was sourced from local dams and **no retardant** was used.
- Water, for on-ground fire-fighting, was obtained from local water sources with an in-line, Class A foam block agent used.
- Back-burning on-park was conducted along various fire-lines in a range of forest types. Back-burning was undertaken: along the western side of Range Rd – eastern side of Threlkeld Rd, within eucalypt forest; along Upper Thornside Rd in the east; and from the edge of the vine forest in the north.
- Rake-hoes and bulldozers were used to re-open/widen existing fire-lines tied into the vine forest to the north of Range Rd.

4 Assessment methods

4.1 Fire extent and severity mapping

Spatial data was supplied by Department of Environment and Science, Queensland Fire and Emergency Services, and Department of Natural Resources Mines and Energy.

Fire severity mapping (Fig. 4), using 12 band Sentinel-2 L2A satellite imagery, formed the basis of the assessment for the bushfire. The fire severity classification was derived from pre- and post-fire imagery (6/11/2019 and 6/12/2020, respectively) covering the extent of the fire. Images had a resolution of approximately 10m. A Normalised Burn Ratio (NBR) classification was developed for both the pre-fire and post-fire images (Brewer *et al.* 2005, Miller and Thode 2007), using Sentinel-2 bands 8 (b8) and 12 (b12) according to the following formula (completed using ArcGIS Pro 2.4.2):

$$NBR = (b8 - b12) / (b8 + b12)$$

A NBR difference product (dNBR = Pre fire NBR - Post fire NBR) was derived and divided into five relative fire severity classes (Extreme, High, Moderate, Low and Unburnt) (Table 2). These classes were informed by ground-based field assessment using the severity class descriptions to determine the severity at each site. The maximum dNBR value for each severity class was then adjusted so that it matched the majority of field assessment sites (Table 2). Appendix 1 contains photographs of burnt sites from within the assessment area. Field assessments confirmed the dNBR analysis created a consistent and generally reliable classified product reflecting relative damage to the forest canopy and subcanopy.

The relative fire severity classification must be treated as an approximation as the analysis was rapid in nature and verification limited, so users need to be aware of potential limitations. However, these limitations are unlikely to significantly affect overall assessments of likely ecological impacts nor unduly influence management and recovery recommendations.

Note that fire severity refers to an observable effect on vegetation (in our assessments through the use of satellite imagery, with some ground observation). It shouldn't be confused with fire intensity, which in its simplest definition is the energy output of a fire (which is influenced by a range of variables including amount of fuel, fuel configuration, fuel dryness, prevailing weather, slope, residence time). Thus, a low intensity fire in some vegetation communities (e.g. grasslands) can result in high fire severity (complete removal of standing vegetation) but a fire of the same intensity in an open forest can result in low fire severity (complete removal of the grassy understorey, with no scorching or consumption of shrub or canopy layers).

Table 2. Relative fire severity classes, derived from the dNBR analysis.

Note: Canopy here refers to the ecologically dominant layer – the layer that contributes most to the overall biomass of the vegetation community (Neldner *et al*. 2020).

Severity class	Relative fire severity class description	Maximum dNBR value
Unburnt	Unburnt, canopy and subcanopy unchanged (within the mapped extent).	0.1
Low	Canopy and subcanopy unscorched, shrubs may be scorched, fire-sensitive low shrubs may be killed.	0.26
Moderate	Partial canopy scorch, subcanopy partially or completely scorched, and/or fire-sensitive tall shrub or small tree layer mostly killed.	0.46
High	Full canopy scorch to partial canopy consumption, subcanopy fully scorched or consumed.	0.66
Extreme	Full canopy, subcanopy and understorey consumption.	1.0

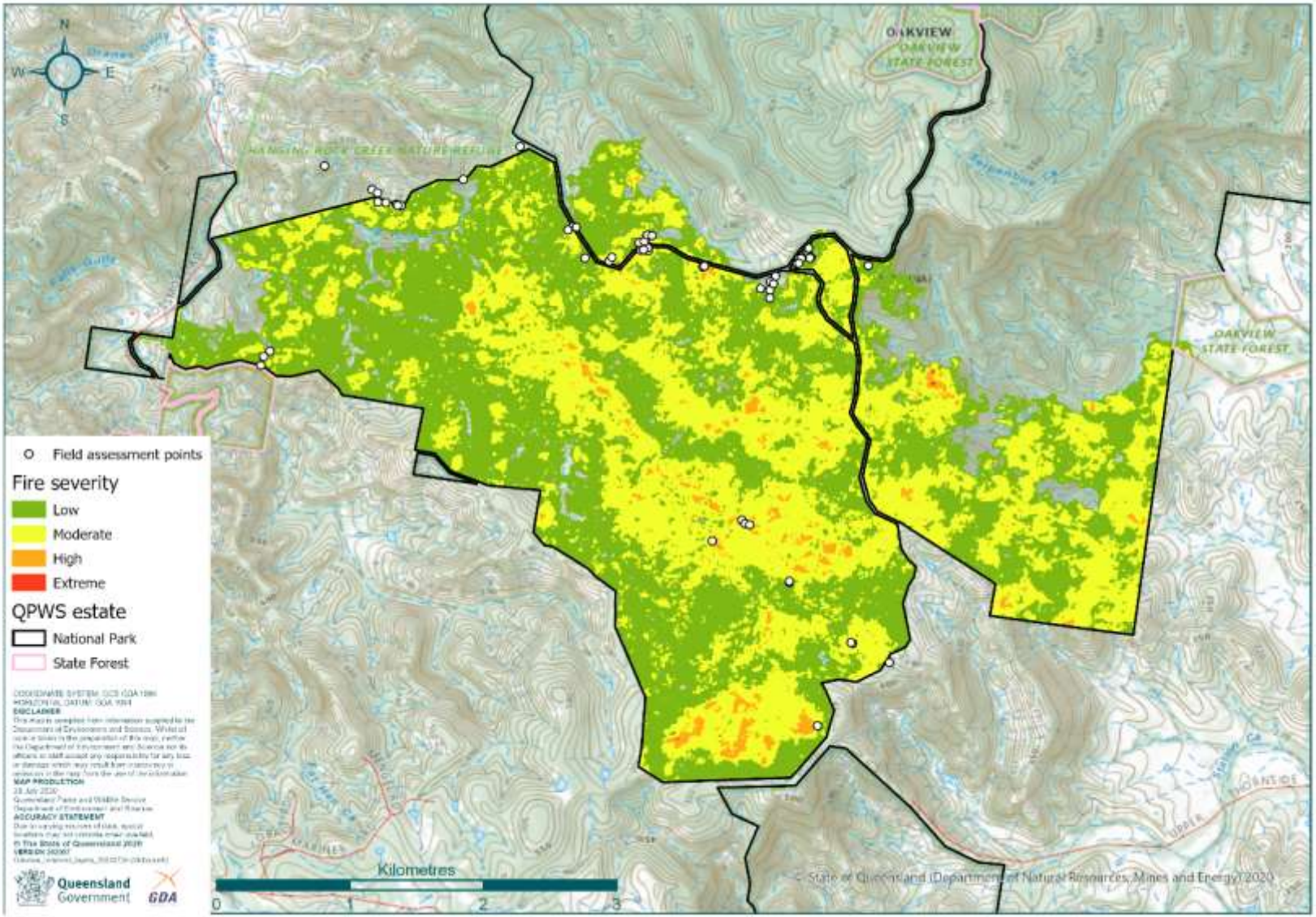

Figure 4. Relative fire severity of the bushfire within Oakview NP. White circles show the location of verification sites. Base map: QTopo.

4.2 Vegetation

Regional Ecosystems (REs) are vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil. The Queensland Herbarium has mapped REs throughout Queensland; version 11 was used for this assessment (Queensland Herbarium 2019). Many areas have a high spatial diversity of vegetation communities, so at 1:100 000 scale it is not always possible to spatially delineate each vegetation community into homogeneous (pure) polygons. Consequently, mapped RE polygons are often heterogeneous, such that a polygon is attributed more than one regional ecosystem code (e.g. 12.12.5/12.12.12), with the percentage of the area of the polygon occupied by each regional ecosystem or vegetation recorded (Neldner *et al.* 2020). For the purposes of this report the RE assessment utilises RE1, or the dominant RE for each mapped polygon, and doesn't attempt to take into account the percentage of it within the polygon. The resolution or scale of RE mapping delineates a minimum area for remnant vegetation of 1ha and/or 35m in width.

REs are grouped into higher-level vegetation communities referred to as Broad Vegetation Groups (BVGs) (Neldner *et al.* 2019) and summaries, at the 1:2 000 000 and 1:5 000 000 scales, are provided.

4.3 Conservation significant species data sources

Information on conservation significant species (Threatened, Near Threatened, Special Least Concern, and/ or endemic) forest fauna and flora species) known, or likely, to occur in the burn area, was derived from the state's wildlife information system WildNet (accessed 25/08/2020), which includes plant species locality information held by the Queensland Herbarium. WildNet was searched for records with a locational precision of 2000m or better that fell within latitudes of -26.1313 and -26.2097 and longitudes 152.2743 and 152.3777, capturing the entire fire extent and the entirety of Oakview NP but not all of Oakview SF (Appendix 4). Limited spatial validation of these records was undertaken; some records were rejected due to likely taxonomic errors or because they were unconfirmed and likely to be vagrant or their known habitat is not present in Oakview.

Spatial datasets on significant species are inherently limited and biased to accessible locations, so we also summarised the area of modelled potential habitat for selected conservation significant species within the burn area. Refer to Appendix 5 for a description of methods used. The lists generated by the models were scrutinised by departmental experts and species deemed highly unlikely to occur on the park were removed.

Knowledge of local staff, published and unpublished information, as well as expert opinion, were used to augment the spatial analyses and inform the impact assessment process. To help identify those significant species most at risk from bushfire each was classified according to their dependence upon fire-sensitive ecosystems.

Species nomenclature, taxonomy and statuses used in this report follow WildNet.

4.4 Field assessment

Field assessment of ecological impacts and limited verification of fire extent and severity mapping was conducted on foot and by vehicle over the period 26-30 May 2020. Field assessments were delayed because of COVID-19 restrictions. Verification sites are shown as white circles on Figure 5. No aerial inspections were undertaken.

4.5 Data and report availability

The fire severity mapping is available via the Queensland Government's Open Data Portal, through the Queensland Spatial Catalogue at http://qldspatial.information.qld.gov.au/catalogue/custom/index.page. Internally the mapping is through the Spatial Information Resource (SIR) (administered by Department of Natural Resources and Mines).

This report is available in WildNet Multimedia, Media ID = 27901, and is searchable using the keywords: fire, severity, ecological, natural values, assessment, Oakview or via the link:
http://wildnet/wildnet/bin/WNE0130$VMEDIAQRY.QueryView?P_MEDIA_ID=27901

5 Summary of areas burnt

Basic fire details and a summary of areas burnt are provided in Table 3. Statistics were derived using ArcGIS pro and the sources identified in the table. A summary of the area burnt (ha) by relative fire severity class is provided in Table 4. The map of relative fire severity is provided in Figure 5.

Table 3. Summary of burnt areas.

Description	Value and units	Source and notes
FLAME Fire ID(s)	13274566	Flame Label: Oakview National Park/NP/W/2019/001
FLAME Fire name(s) (FLAME)	Oakview fire	
Fire start date	07/11//2019	FLAME
Fire started on or off-estate	On estate	FLAME/ FIRMS hotspots (Fig. 1).
Date fire first recorded on estate	07/11//2019	FLAME
Date fire declared contained	06/12/2020	FLAME
Total area burnt (on and off estate)	4714.76ha	FLAME extent mapping
Bioregion(s)	South East Queensland	
Estate name(s) burnt	Oakview NP Oakview SF	FLAME
QPWS Region(s)	South East Queensland	
Area burnt within QPWS estate	1,439.6ha	This report (Table 4, Appendix 3), based on relative fire severity mapping. See also Table 4.
Area burnt within World Heritage Area (**WHA**)	0ha	This report, based on relative fire severity mapping. SIR dataset: ENVBAT.QLD_WORLDHERTAREA
Area burnt within **Ramsar** areas	0ha	Name of Ramsar area: N/A
Directory of Important Wetlands of Australia (**DIWA**) within burn extent	0ha	SIR dataset: ENVWET.QLD_WETLAND_DOIW
Area burnt of habitat of state Biodiversity Significance (**BAMM**)	238.44ha	This report, based on relative fire severity mapping. SIR dataset: ENVBAT.BPA_SEQ See also Table 4.
Area of (SEQ Koala Conservation Strategy 2019-2024) burnt	0ha	This report, based on relative fire severity mapping. SIR datasets: ENVBAT.HSM_SEQRP_KOALA

Table 4. Area burnt (ha) by relative fire severity class within Oakview National Park.

Note: totals include non-remnant vegetation (632ha in total on the site of which 77.4ha burnt)

Severity class	Oakview NP	BAMM State Biodiversity Significance
Low - Canopy and sub-canopy un-scorched, shrubs may be scorched, fire-sensitive low shrubs may be killed.	796.3	796.3
Moderate - Partial canopy scorch, sub-canopy partially or completely scorched, and/or fire-sensitive tall shrub or small tree layer mostly killed.	609.6	609.6
High - Full canopy scorch to partial canopy consumption, sub-canopy fully scorched or consumed.	32.3	32.3
Extreme - Full canopy, sub-canopy and understorey consumption.	0.2	0.2
Total	1,438.4	1,438.4

5.1 Vegetation burnt

Summaries of the area of Regional Ecosystems and Broad Vegetation Groups within Oakview National Park and the area of each burnt, within each relative fire severity class are provided in Appendices 2 and 3, respectively.

5.1.1 Potential ecological impact

Regional Ecosystems were classified into two broad groups based on their fire tolerance {guidance drawn from NPRSR (2013b), Regional Ecosystem Description Database (Qld Herbarium 2019) and expert knowledge}:

- Vine Forest – fire-sensitive canopy and understorey,
- Dry to moist eucalypt open forests to woodlands – fire-adapted canopy and understorey.

The area of each broad group subjected to low, moderate, high or extreme relative fire severity, is shown in Table 5. Burnt areas were assigned to four Potential Ecological Impact classes based on the matrix of fire severity and fire tolerance of the vegetation communities and the susceptibility of the ecosystem to threats, such as invasion by ecosystem-changing weeds (refer Appendix 7), that could significantly impede recovery.

The concept of Potential Ecological Impact was developed to help highlight ecosystems and areas that have been most impacted, and/or may require increased resources (e.g. pest management), or changed management approaches (e.g. modification to planned burn program) to facilitate recovery, and conversely to indicate those that require little or no additional management intervention. It is not an exact science! A brief overview of 'characteristics' of the Potential Ecological Impact classes is provided in Box 1.

A summary of the Potential Ecological Impact is provided in Table 6, is mapped in Figure 5, and discussed in section 6.0.

Table 5. Area (ha) of burnt remnant vegetation (based on RE1) classified by broad fire tolerance and relative fire severity class.

Note: the shading denotes Potential Ecological Impact class as per Table 6.
The percentage of the total burnt area of each ecosystem type, within a relative fire severity class, is given in parentheses.

		Vine forests	Dry-moist eucalypt W-OF (inc. non remnant)
Relative Fire Severity Class		Fire-sensitive canopy & understorey	Fire-adapted canopy & understorey
Low	Canopy and sub-canopy un-scorched, shrubs may be scorched, fire-sensitive low shrubs may be killed.	68.7	727.6
Moderate	Partial canopy scorch, sub-canopy partially or completely scorched, and/or fire-sensitive tall shrub or small tree layer mostly killed.	29.5	580.0
High	Full canopy scorch to partial canopy consumption, subcanopy fully scorched or consumed.	1.5	30.8
Extreme	Full canopy, sub-canopy and understorey consumption.	0	0.2
	Total burnt	99.8	1,338.6

Table 6. Potential Ecological Impact (ha) to burnt remnant vegetation (RE1 only) based on fire tolerance and relative fire severity class.

Note that the concept of Potential Ecological Impact class also takes into account the susceptibility of the ecosystem (given the fire severity to which it has been subjected) to threats post-fire that could significantly impede recovery.

	Vine forests	Dry-moist eucalypt W-OF
Potential Ecological Impact Class	Fire-sensitive canopy & understorey	Fire-adapted canopy & understorey
Limited or none		1,307.6
Moderate	68.7	30.8
High	29.5	0.2
Catastrophic	1.5	

Box 1. Overview of the Potential Ecological Impact classes

Limited or no Potential Ecological Impact (green):

The consequence of the fire is likely to be short-term with persistent canopy and subcanopy cover, and expected relative rapid regeneration by native, fire-adapted, understorey species, helping to minimise the risk of weed invasion by ecosystem-changing species (if they were not already established prior to the fire). There will be limited or no impact on fauna species reliant on the canopy species for food and/or shelter (e.g. hollows) and likely relatively short-term impacts on species reliant on the understorey.

Moderate Potential Ecological Impact (yellow):

There may be localised decline in, or loss of, some understorey species, over the short-term as a direct consequence of the fire and associated poor regenerative capacity or specialised requirements of some species for successful regeneration, and/or as a consequence of a reduction in resources or specialised niches.

High Potential Ecological Impact (orange):

Vine forest recovery requires recovery of both structure and composition and is expected to be slow (decades to hundreds of years) given: the loss of some to many trees (either as a direct consequence of the fire or because of associated stressors such as fungal attack – there may be ongoing death of some tree species/individuals for several years after the fire); vegetative regeneration, where it occurs, is likely to be predominantly basal or from the rootstock; loss of the seedling bank and likely limited seed-bank means that the recovery of some species will be dependent on seed being transported into the site. For shade tolerant species the loss of canopy cover can exclude them from a site until significant canopy closure is achieved. The risk of invasion by ecosystem-changing weed species (e.g. *Lantana camara*) is likely to be high, and may be exacerbated by past disturbance regimes.

For the eucalypt-dominated communities this class reflects: the immediate to short- or mid-term impacts on food resources for fauna; loss of critical structural elements and faunal habitat features such as large hollow bearing trees which take decades to hundreds of years to replace; likely changes in understorey species composition, in the short to mid-term at least, in the wet eucalypt open forests that have a rainforest understorey and the potential flow-on effects to faunal assemblages; and loss of epiphytes and niches suitable for their re-establishment at least in the mid-term. It is recognised that occasional high intensity fire in wet eucalypt open forests is likely critical to the ecology of the ecosystem in terms of providing opportunity for eucalypt regeneration in sites where rainforest dominates the understorey and may assist, in conjunction with a planned burn program, in maintaining a grassy to mixed shrubby understorey in others. The risk of invasion by ecosystem-changing weeds is likely to be high, and may be exacerbated by past disturbance regimes.

Catastrophic Potential Ecological Impact (red):

There is significant risk of an ecosystem not recovering as a consequence of the substantial changes in structure, composition and microclimate and associated likelihood of invasion by ecosystem-changing weeds or native species better adapted to the post-fire environment than the impacted ecosystem, and/or risk of future fire. Some, possibly many, flora and fauna species can be expected to be permanently lost from the location. The risk of permanent change is greater where surrounding ecosystems are also significantly impacted by the bushfire or other disturbances and/or there are no sources of propagules nearby.

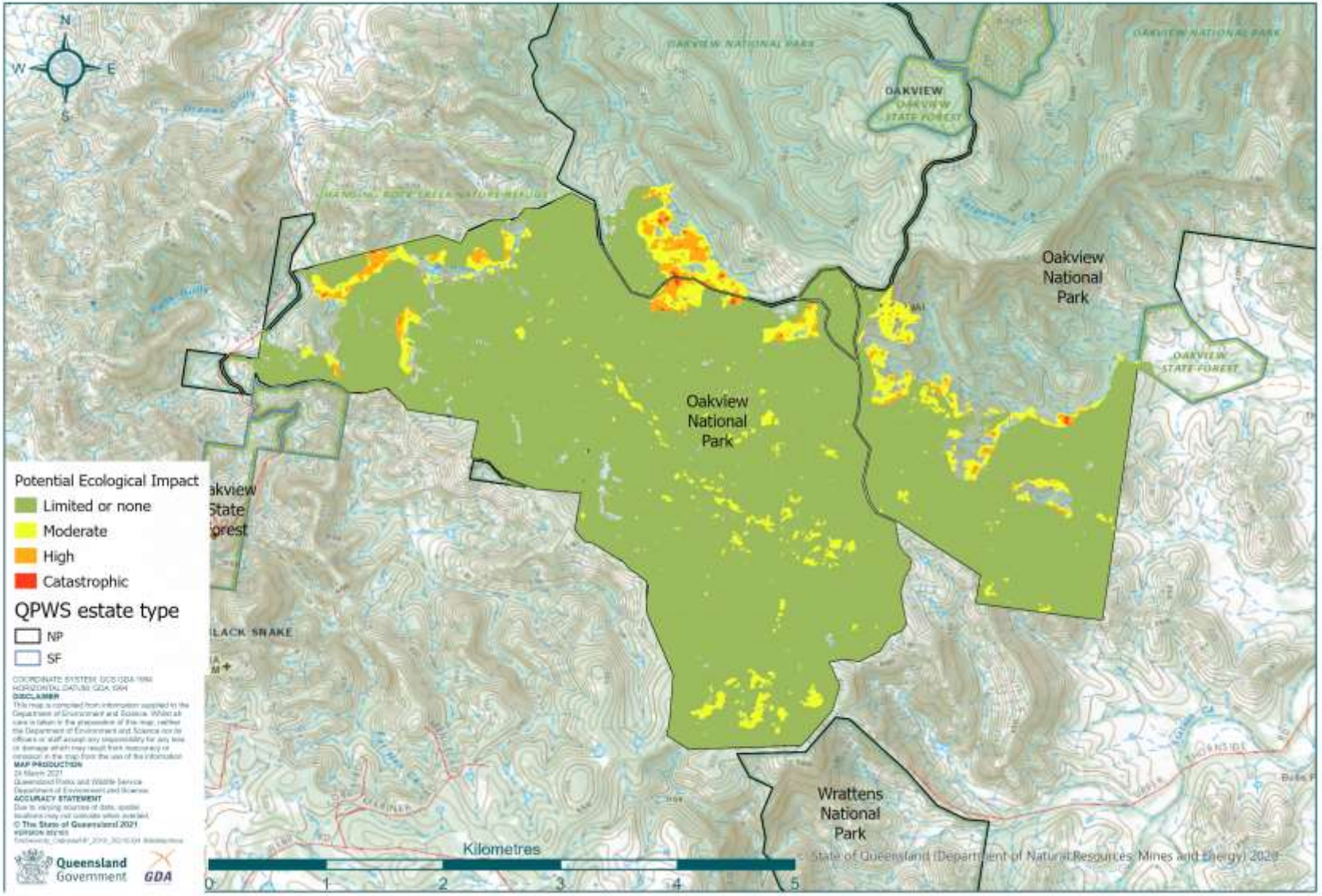

Figure 5. Map of Potential Ecological Impact within Oakview National Park.

5.2 Conservation significant species potentially impacted

The list of significant forest fauna and flora species recorded from within a buffered bounding rectangle of the fire extent is provided in Appendix 4. Appendix 5 summarises the area of modelled Queensland potential habitat for selected conservation significant species within each relative fire severity class.

Most of the species have less than 1% of their modelled potential habitat occurring on Oakview NP. There are two exceptions – Oakview leaf-tailed gecko and Nangur skink (Table 6). It should be noted that the total area of modelled Potential Habitat for these two species is likely to be an over-estimate and thus 'downplays' the importance of their habitat on Oakview NP. Numerous and extensive surveys have been undertaken for these two species with no new populations having been found. Oakview leaf-tailed gecko is only known to occur on Oakview NP and SF. Nangur skink is known only from the latter areas and Nangur NP.

Potential impacts on threatened species are discussed in section 6.3.

Table 6. Threatened species with a substantial proportion of modelled potential habitat burnt.

Scientific name	Common name	Status		Potential Habitat (PH)			
		NCA	EPBC	Total PH in Oakview (ha)	% Qld PH in Oakview	Total PH burnt in Oakview (ha)	% Oakview PH burnt
Phyllurus kabikabi	Oakview leaf-tailed gecko	CE		1252	8.7%	99	7.9%
Nangura spinosa	Nangur skink	CE	CE	1469	3.8%	32	2.2%

5.3 Area of Natural Key Values burnt

Natural Key Values (NKV) identified in the *Interim Values Assessment* for Oakview NP include several vine forest types and the Critically Endangered reptiles. Figure 6 shows the location of the vine forests with respect to the extent of the 2019 bushfire and Table 7 provides the area burnt by relative severity class.

Table 7. Area of interim Natural Key Values (NKV) burnt (ha) in Oakview NP, by relative fire severity class.

Natural Key Value	Area of NKV within estate (ha)	Percentage NKV burnt (%)	Relative fire severity (ha)			
			Low	Moderate	High	Extreme
Vine forest Key Values (combined)	2,311	4	68	29	2	0

Refer to Appendix 3 for a description of the BVG and a summary of the area burnt within each relative severity class for Oakview NP&SF.

5.4 Ecological monitoring sites

Existing ecological monitoring sites that are known to have burnt during the event are listed in Table 8 together with basic details and the priority (high to low or not a priority) for re-sampling the sites/plots to better inform an assessment of the impact of fire on natural values and subsequent recovery.

Table 8. Existing ecological monitoring sites that are known to or are likely to have burnt during the event.

Dataset name	Type of monitoring	General location of monitoring site(s)	Custodian	Priority for resampling
QBERD	Corveg monitoring	Mt Sinai	Dr Dan Ferguson, Queensland Herbarium	High, resampled - 25 August 2020

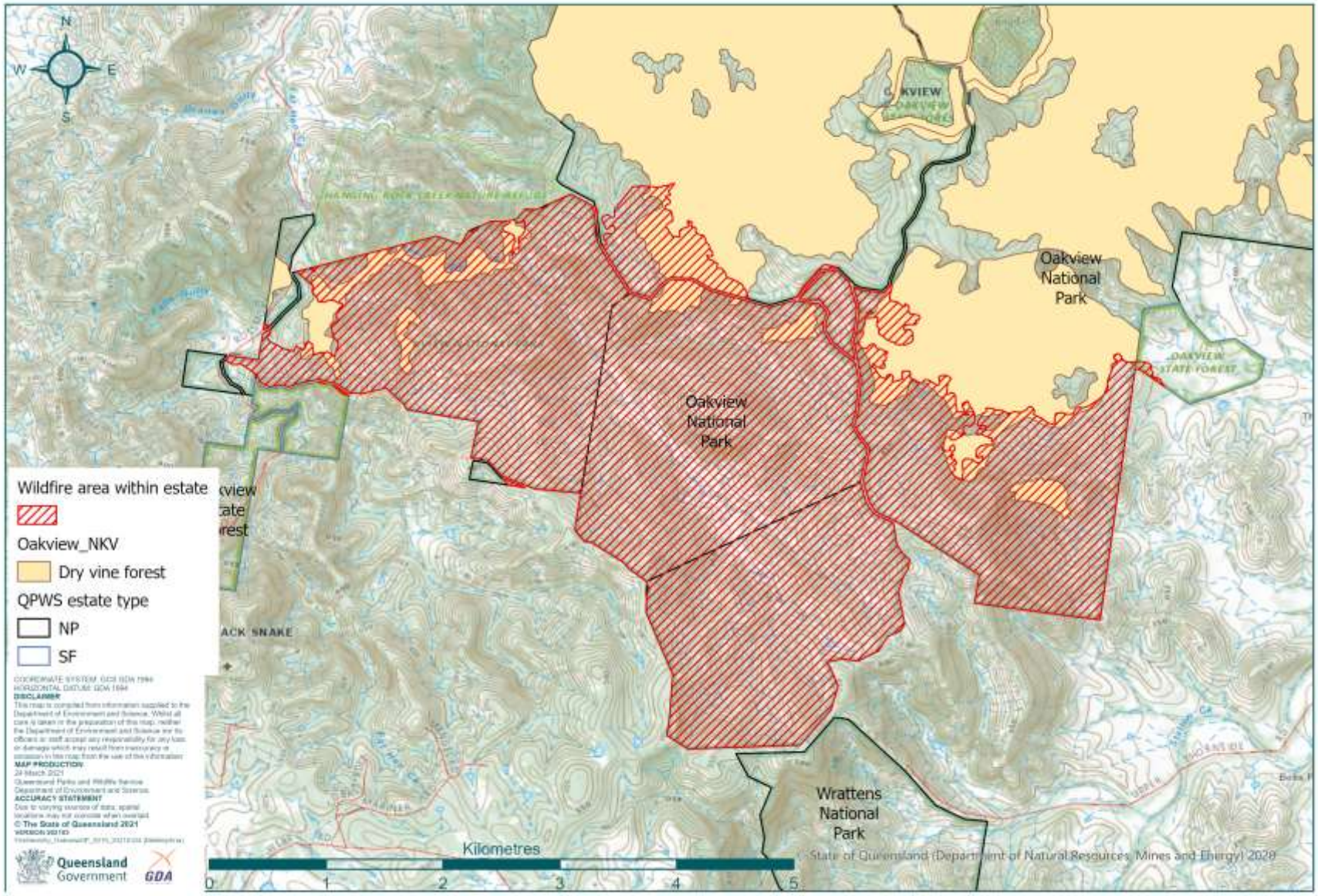

Figure 6. Estimated extent of the bushfires within Natural Key Values of Oakview National Park.

6 Significant impacts and recovery actions

6.1 Summary of priority impacts and recovery actions

There are two natural values identified onsite. They are composed of the following REs and BVGs:

- **Vine forests** (BVG 2a (1:2milion scale), including areas of 5a as sub-dominant in mixed polygons):
- **Dry and moist eucalypt open forests to woodlands including spotted gum open forests and woodlands** (BVG 9a, 9g, 9h, BVG10b and BVG13c at the 1:2million scale; all are within BVG 3 at the 1:5million scale) hereafter, dry-moist eucalypt open forests to woodlands.

The highest priority impacts and actions for recovery are summarised below. A detailed assessment of each significant known or likely impact to natural values and a full list of recommended recovery actions are provided in section 6.3.

- **Vine forests** – Approximately 100ha or 4.7% of the total area mapped as vine forest on Oakview NP was impacted by the fire resulting in moderate to high Potential Ecological Impact. The impact is due to the sensitivity of the ecosystems to fire, the effect on structure and composition, and the significant risk of invasion by ecosystem-changing weeds. The construction of new fire control lines directly adjacent to this value also has the potential to result in increased weed invasion and feral animal impacts. Recovery is likely to take decades and will require exclusion of fire and the prevention of invasion by weeds. The control of ecosystem-changing weeds and review of fire management planning for surrounding fire-adapted ecosystems – with the aim of minimising risk of future fire incursion into recovering rainforest (and unburnt rainforest), are the highest priority actions. Cat and pig control are recommended to minimise impact on threatened species and their habitat. Monitoring is warranted for the two critically endangered reptiles.

    - The currently occupied habitat, and potential habitat, of the two Critically Endangered reptiles (both of which are considered Key Values in the *Interim Values Assessment* for Oakview NP) is contained within the vine forest. While none of the currently occupied habitat burnt, some of the surrounding potential habitat was burnt and a fire control line was opened adjacent to the vine forest to protect the currently used, and potential habitat, from the fire. The creation of new fire control lines, reopening of existing control lines and burning of vegetation adjacent to known or potential habitat presents a potential threat to the reptiles and their habitat by creating a pathway for pest plant and animal invasion. The risk of invasion by ecosystem-changing weeds that can impede recovery (directly through competition and indirectly through changed future fire regimes or microclimates) is a concern. The review of strategies for weed and fire management in adjacent fire-adapted communities, and the control of ecosystem-changing weeds, are the highest priority actions. Feral cats present a particular threat to the endangered reptiles. Cat, deer, fox and pig control is recommended to minimise impact on threatened species and their habitat. Ongoing monitoring of the Critically Endangered reptile populations is also strongly recommended.

- **Dry and moist eucalypt open forest to woodland** – Approximately 1,261 or 61.9% of the total area mapped as BVG 3 (1:5million) on Oakview NP was impacted by the fire. The fire-adapted nature of these vegetation communities prevented significant environment impact, with most of this area (1,235 or 7.9% of burnt area) experiencing Limited or no Potential Environment Impact. Moderate PEI occurred across only 26ha (2.1%) with 0.2ha or 0.01% experiencing a High PEI. Areas of higher severity fire coincided with moist gullies dominated by dense *Lantana camara* infestations. Management of lantana and exclusion of fire from these gullies may result in the development of a rainforest understorey over time and hence, reduced fire risk.

6.2 Limitations

This report focuses on a single fire event; we recognise that the response/recovery of ecosystems and species will vary depending on fire history and future fire and climate. For many species, information on their fire ecology is lacking or poorly known. The direct impact from fire, post-fire response and recovery potential will vary among sites and species.

In our assessment of the Potential Ecological Impact of the fire we assumed that impacts to ecosystems dominated by fire-tolerant species were likely to be relatively lower and of shorter duration than impacts to fire-sensitive communities.

Limited field evaluation was possible. Sites burnt with high and extreme relative fire severity were mostly inaccessible, although were viewed from various vantage points.

The delay in field assessment meant that it was not always possible to attribute canopy death to drought, the immediate impacts of the fire (i.e. scorch), or subsequent death of the tree or shrub. This may have affected our field assessment of fire severity but was unlikely to unduly affect our assessment of the ecological outcome.

Regional Ecosystem mapping and Broad Vegetation Groups underpin our assessment. Many polygons mapped within Oakview NP are heterogeneous, meaning more than one regional ecosystem occurs within the polygon, generally because the REs occur in a mosaic below the scale of mapping. Our quantitative analyses are based on RE1 (the dominant RE in a mixed polygon). The limitations of scale and heterogeneity are unlikely to grossly affect recommended post-fire management actions.

6.3 Impact assessment and recovery actions

Refer to Appendices 2 and 3 for details of the area burnt within each fire severity class by Regional Ecosystem and Broad Vegetation Group, respectively.

6.3.1 Vine Forests

Potential ecological impact: mostly moderate to high but for some areas catastrophic (Table 7).

Fire severity and impact photographs are provided in Appendix 1, Plates A1-A5.

Overview of value and impact

Regional Ecosystems in this value are: RE 12.12.16 (Notophyll vine forest on Mesozoic to Proterozoic igneous rocks); 12.12.13 (Araucarian Complex microphyll to notophyll vine forest on Mesozoic to Proterozoic igneous rocks); and 12.11.10 (Notophyll vine forest +/- *Araucaria cunninghamii* on metamorphics +/- interbedded volcanics). Vine forests are Natural Key Values in the *Interim Values Assessment* for Oakview NP.

Vine forests are highly fire-sensitive and the management intent is fire exclusion. They are self-protecting from fire under most conditions and can usually be relied upon to act as natural fire-breaks.

Approximately 100ha mapped as vine forest burnt, representing about 4.7% of the total area of 2,110ha on Oakview NP. Within burnt vine forests approximately 68.9% (68.7ha) burnt at a low severity, 29.6% (29.5ha) at a moderate severity and a further 1.5% (1.5ha) at high severity.

The fire-sensitive nature of this vegetation community is expected to result in a moderate to high Potential Ecological Impact (refer Table 6, Box 1) in burnt areas.

Vine forests are a significant natural and aesthetic value for Oakview NP and provide habitat and/or potential habitat for a suite of threatened flora and fauna species (refer Appendices 5 and 6). Impacts on these species will vary but those that live in or depend upon the forest floor (e.g. Nangur skink, black-breasted button-quail, long-nosed potoroo, tusked frog, plants with seedling banks) are likely to be most significantly impacted, together with plant species with no or limited capacity for resprouting.

Two species of Critically Endangered reptile – Oakview leaf-tailed gecko and Nangur skink, occur in the vine forests.

***Phyllurus kabikabi* – Oakview leaf-tailed gecko**

Oakview leaf-tailed gecko (*P. kabikabi)* was first collected from Oakview Forest Reserve in 1997. It was described as a new species in 2008 (Couper *et al.* 2008) and is listed as Critically Endangered under the *NCA 1992*. It has a highly restricted range, being known from only a few locations within Oakview NP and Oakview SF, where the preferred habitat is associated with Araucarian vine forest growing on a layer of broken tuff capping a ridge at an elevation of 540m (Couper *et al.* 2008). The species distribution is restricted to patches of these rocky/rubbly outcrops, in excess of 0.8ha in size, underneath vine forests. It is known from a small number of sites ranging from

0.8ha to 6.1ha (Ferguson 2020). Known threats include: catastrophic fire; weed encroachment {specifically *Rivinia humilis* (coral berry), *Dolichandra unguis-cati* (cat's claw creeper) and *Lantana camara* (lantana)}; predation by feral cats and foxes; impact on habitat by deer and feral pigs; climate change; and potential introduction of pathogens (both diseases to the geckos and forest pathogens like *Phytophthora* spp.) whose spread may be aided by feral pigs, deer and humans (Ferguson 2020).

***Nangura spinosa* – Nangur skink**

This moderately-large, spiny, burrow dwelling skink is listed as Critically Endangered under both the *NCA* 1992 and *EPBC Act* 1999*.* It has a highly restricted range, with only two known populations: one on Nangur NP with an approximate extent of 7.4ha; and the other spread across Oakview NP and SF estimated to be 360ha in extent (Borsboom *et al.* 2010). Their preferred habitat is Araucarian vine forest and overlaps the core habitat of the Oakview leaf-tailed gecko on Oakview NP and SF. The known threats to this species survival are: collection; fire; weeds; pest animals; climate change and; diseases (Borsboom 2020).

None of the area identified as currently occupied, core habitat (i.e. primary protection zone) for either of these species was burnt during the bushfire, with fire-fighting efforts successfully protecting it from direct bushfire impact. The likely full extent of their potential range on Oakview NP aligns with the extent of the vine forests. Therefore, as much as 100ha of likely habitat outside of the core protection zone may have been impacted. The construction of a new fire control-line and back-burning operations adjacent to the primary protection zone has created the potential for increased weed, pest animal and pathogen invasion into the core habitat.

The post-fire environment may enhance opportunity for some pest species including cats and foxes – both are known to prefer open areas for foraging and movement, with cats known to target recently burnt areas for foraging (McGregor *et al*. 2014). Cats are a significant threat to the two Critically Endangered reptiles and should be a priority for management efforts. The remote, rugged and inaccessible nature of the terrain makes cat, and other feral animal, control difficult.

Many vine forest species do not have a persistent seedbank but rather seedling and sapling banks which accumulate over decades of recruitment. In burnt areas these banks of potential recruits will have been substantially reduced or lost. Soil or litter seed-stores will have been destroyed or significantly depleted. The loss of these sources of recruits will be a particularly significant issue where the mature individuals in a population have been killed.

There were generally low numbers of ecosystem-changing species (e.g. *Lantana camara)* in the interior of sites. The establishment of new fire control-lines and fire impacts adjacent to this vegetation community have the potential to open-up pathways for weed incursion. The establishment or promotion of ecosystem-changing weeds, such as non-native high biomass grasses, *Dolichandra unguis-cati* (cat's claw creeper), *Rivina humilis* (coral berry) and *Lantana camara* (lantana), pose a serious risk to both burnt and unburnt rainforest communities at Oakview. They are common to abundant along some roadsides and are encroaching into other disturbed areas in the park. Cat's claw creeper is common in the region, has the potential to significantly alter the vegetation structure of vine forests and is extremely difficult and costly to control once established. Ecosystem-changing weeds outcompete native species and greatly increase the risk of future fire incursion and fire intensity. The bare ground and loss of canopy cover resulting from the fire provide an ideal environment for their germination and establishment adjacent to, and within, rainforest communities.

Ongoing, active surveillance and early intervention to control weeds before they become established in and around this value is essential to ensure the ongoing survival of the Oakview leaf-tailed gecko and Nangur skink. The post-fire environment may enhance opportunity for some pest species including cats, foxes, wild dogs, deer and pigs, with cats known to target recently burnt areas for foraging (McGregor *et al*. 2014). Cats are a significant threat to a range of ground-dwelling animals known to occur in the park including the Critically Endangered reptiles.

Signs of pigs have been observed in the vicinity of the vine forest. They pose a direct threat to some threatened flora and fauna species through consumption of individuals and propagules and/or destruction of habitat. They pose an indirect threat through the movement of soil-borne pathogens such as chytrid fungus (*Batrachochytrium dendrobatidis*) and phytophthora (e.g. *Phytophthora cinnamomi*).

Red deer are also known to inhabit the park. Numbers within the vine forest communities are reported to have increased significantly following the fire (Dan Ferguson pers. comm.). The deer can compact the interstitial spaces required by Oakview leaf-tailed geckos and have the potential to trample Nangur skinks and their burrows. Their disturbance is promoting weed growth and invasion (e.g. coral berry and cat's claw). They can also impede habitat recovery through browsing of regrowth and their propensity to 'ring-bark' trees by rubbing their antlers against them. Red deer currently pose a significant threat to both threatened reptiles and other threatened ground dwelling species (e.g. black-breasted button quail and common death adders).

Monitoring is recommended to increase our understanding of the distribution and abundance of the threatened species at this site and to detect any impacts from the fires or pests.

Recommended recovery actions

1. Prevent the establishment of weeds, including: *Dolichandra unguis-cati* (cat's claw creeper), *Rivina humilis* (coral berry), *Lantana camara* (lantana) and high biomass grasses adjacent to, and within vine forest communities. Regular surveillance, rapid response and ongoing monitoring and treatment is required to ensure affective control.
2. Undertake a control program for feral cats, foxes, pigs and deer.
3. Undertake monitoring to ensure early detection of impacts on the Oakview leaf-tailed gecko and Nangur skink populations.
4. Undertake Health Checks (Melzer *et al*. 2019) – these will facilitate early detection of weeds and enable condition to be evaluated across the park.

Contracting of pest animal and weed control may be necessary due to competing priorities (i.e. undertaking planned burning) in the growing season, the extent of the treatment area and access constraints. Where contractors are engaged, strong oversight is required to ensure works are undertaken appropriately (e.g. minimising non-target impacts during weed control).

6.3.2 Dry and Moist Eucalypt Open Forest to Woodland

Potential ecological impact: Mostly limited to none (97.9%) with small areas of Moderate and High.

Fire severity and impact photographs are provided in Appendix 1, Plates B1-B7.

Overview of value and impact:

These tend to be fire-adapted communities and fire management is critical to their conservation. Management of these communities includes burning to maintain their health, with desired extent, frequency and intensity of burning guided by the ecology of these systems and the threats to them (e.g. weed invasion) (NPRSR 2013b, Queensland Herbarium 2019). The eucalypt communities were more impacted by previous management practices than the vine forests, with evidence of past logging, clearing for grazing and sowing of 'improved pasture grasses' (i.e. exotic pastures) throughout most of their area.

In total 1,261ha (61.9%) of eucalypt open forest to woodland were burnt. Of this 55.7% (701.9ha) burnt at Low severity, 42.3% (533ha) at Moderate, 2.1% (26ha) at High and 0.013% (0.2ha) burnt at Extreme severity. The fire tolerant nature of this community and the mostly low to moderate severity of the fire resulted in most of the burnt area (97.9% or 1,235ha) experiencing Limited to no PEI. A Moderate PEI was experienced across 2.1% (26ha) of the burnt area and a further 0.01% (0.2ha) experienced High PEI.

The eucalypt forests and woodlands within the extent of the fire are known or likely habitat for a number of threatened or other significant wildlife species (**Appendices 4 and 5**). Impacts on these species will vary but those that live in or depend upon the forest floor and associated leaf litter and biota for cover or foraging (e.g. long-nosed potoroo), depend upon foliage for food (e.g. koala, greater glider), or large hollow bearing trees (e.g. greater gliders, various micro bats and birds) are likely to be most significantly impacted.

The establishment or promotion of ecosystem-changing weeds (refer **Appendix 6**) poses a risk to eucalypt forest and woodland communities. High biomass exotic grasses (e.g. *Megathyrsus maximus, Chloris gayana*) and *Lantana camara* (lantana) are common in disturbed areas of the park and adjoining lands. They increase the risk of higher fire frequency and/or severity. Observations during the field assessment suggest areas of highest severity fire tended to be associated with lantana infested gully lines (Plates B1-B4). These areas may have had rainforest species in the midstratum prior to historic logging and clearing, areas of. Lantana control and fire exclusion may facilitate the re-establishment of rainforest species in these patches, which in turn may reduce the risk of high severity fires. Other a Eucalypt open forest to woodland communities with lower fuel-loads tended to burn at low to moderate severity. An example of this is RE 12.11.22 which tends to occur on the higher elevations in the south of the park on shallow soils (Plates B5-7).

Burnt communities are at risk due to increased edge effects including weed and pest animal invasion. Indications of deer activity were observed in this community during field visits.

Recommended recovery actions:

1. Consider managing *Lantana camara* (lantana) in gullies to promote the re-establishment of a rainforest mid-stratum.
2. Undertake a control program for deer, pigs, feral cats and foxes.
3. Undertake Health Checks (Melzer *et al*. 2019) – these will facilitate early detection of weeds and enable condition to be evaluated across the park.

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Appendix 1. Fire Assessment Photos

Plates A1&2: Low severity fire at the edge of RE12.12.13: Araucarian Complex microphyll to notophyll vine forest on Mesozoic to Proterozoic igneous rocks.

Plate A3: Low severity fire at edge of vine forest near Mt Sinai

Plates A4&5: Low Severity fire in edge of vine forest west of Mt Sinai

Plate B1&2: Extreme severity fire in previously cleared area, infested with Lantana and high biomass grasses

Plate B3&4: Extreme severity fire in previously cleared area, infested with Lantana and high biomass grasses

Plate B5-7: Low severity fire in RE 12.11.22 – shallow soils with generally lower fuel-loads

Appendix 2. Area burnt within each fire severity class, by Regional Ecosystem, within QPWS estate.

Regional Ecosystem (RE) mapping and Broad Vegetation Groups (BVGs) as described by Neldner *et al.* (2020 & 2019). All areas are in hectares, for RE1 (see Section 4.2). Estate refers to Oakview National Park. Column headings are: RE1 – Regional Ecosystem identifier for RE1; Short Description – brief description of RE1; Status* – Biodiversity Status; BVG 2M – Broad Vegetation Group at the 1:2 000 000 scale; Estate – area of RE1 within QPWS estate; Low, Moderate, High, Extreme – area of RE1 burnt at each fire severity class; % – percentage of the total area of RE1 on the park that has been burnt.

ESTATE	RE1	Short description	Status	BVG2M	Estate	Burnt	Low	Moderate	High	Extreme	%
Oakview NP	non-rem			0	98.48	77.42	25.62	46.94	4.84	0.02	78.6%
Oakview NP	12.11.10	Notophyll vine forest +/- *Araucaria cunninghamii* on metamorphics +/- interbedded volcanics	No concern at present	2	140.52	22.21	17.86	4.27	0.08		15.8%
Oakview NP	12.12.13	Araucarian complex microphyll to notophyll vine forest on Mesozoic to Proterozoic igneous rocks	No concern at present	2	1970.24	77.56	50.85	25.27	1.44		3.9%
Oakview NP	12.11.3	*Eucalyptus siderophloia*, *E. propinqua* +/- *E. microcorys, Lophostemon confertus, Corymbia intermedia, E. acmenoides* open forest on metamorphics +/- interbedded volcanics	No concern at present	9	202.97	162.17	107.02	54.25	0.90		79.9%
Oakview NP	12.11.7	Eucalyptus crebra woodland on metamorphics +/- interbedded volcanics	No concern at present	13	50.23	22.53	14.31	8.21			44.8%
Oakview NP	12.11.14	*Eucalyptus crebra*, *E. tereticornis, Corymbia intermedia* woodland on metamorphics +/- interbedded volcanics	Of concern	13	19.61	16.54	12.46	3.67	0.40		84.3%
Oakview NP	12.11.22	*Angophora leiocarpa, Eucalyptus crebra* woodland on metamorphics +/- interbedded volcanics	No concern at present	9	247.82	202.68	147.42	54.13	1.14		81.8%
Oakview NP	12.12.5	*Corymbia citriodora* subsp. *variegata, Eucalyptus crebra* woodland on Mesozoic to Proterozoic igneous rocks	No concern at present	10	421.49	0.00					0.0%

ESTATE	RE1	Short description	Status	BVG2M	Estate	Burnt	Low	Moderate	High	Extreme	%
Oakview NP	12.12.12	*Eucalyptus tereticornis, Corymbia intermedia, E. crebra* +/- *Lophostemon suaveolens* woodland on Mesozoic to Proterozoic igneous rocks	Of concern	9	189.44	170.11	73.93	94.52	1.66		89.8%
Oakview NP	12.12.15	*Corymbia intermedia* +/- *Eucalyptus propinqua, E. siderophloia, E. microcorys, Lophostemon confertus* open forest on Mesozoic to Proterozoic igneous rocks	No concern at present	9	398.19	239.15	98.06	135.12	5.85	0.12	60.1%
Oakview NP	12.12.24	*Angophora leiocarpa, Eucalyptus crebra* woodland on Mesozoic to Proterozoic igneous rocks	No concern at present	9	500.03	448.02	248.74	183.18	16.04	0.05	89.6%

Appendix 3. Area burnt within each relative fire severity class, by Broad Vegetation Group, within QPWS estate.

Broad Vegetation Groups (BVGs) as described by Neldner *et al.* (2019), derived from Regional Ecosystem mapping (using RE1). All areas are in hectares. Estate refers to Oakview National Park.

Column headings are: BVG 5M & BVG 2M – BVG number and short description at the 1:5 000 000 and 1:2 000 000 scales; Estate – area of BVG 2M within QPWS estate, Burnt – area of BVG 2M burnt on QPWS estate, Percentage – the percentage of BVG 2M within QPWS estate burnt; Low, Moderate, High, Extreme – area of BVG 2M burnt at each relative fire severity class. Note: the total areas do not include the non-remnant vegetation.

ESTATE	BVG 5M	BVG 2M	Estate	Burnt	Percent	Low	Moderate	High	Extreme
Oakview National Park	Non remnant or not vegetated.	Non remnant or not vegetated.	102	77.42	75.9%	25.62	46.94	4.84	0.02
Oakview National Park	1: Rainforests, scrubs.	2: Complex to simple, semi-deciduous microphyll to notophyll vine forest, sometimes with *Araucaria cunninghamii* (hoop pine).	2110.8	99.77	4.7%	68.71	29.53	1.52	0
Oakview National Park	3: Eastern eucalypt woodlands to open forests.	9: Moist to dry eucalypt open forests to woodlands usually on coastal lowlands and ranges.	1538.45	1238.65	80.5%	687.32	524.88	26.97	0.17
Oakview National Park	3: Eastern eucalypt woodlands to open forests.	10: *Corymbia citriodora* (spotted gum) dominated open forests to woodlands on undulating to hilly terrain.	421.49	0.00	0.0%	0	0	0	0
Oakview National Park	3: Eastern eucalypt woodlands to open forests.	13: Dry to moist eucalypt woodlands and open forests, mainly on undulating to hilly terrain of mainly metamorphic and acid igneous rocks (land zones 11 and 12).	78.27	22.53	28.79%	14.32	8.21	0	0

Appendix 4. Conservation significant forest fauna and flora species recorded in the area.

Column headings:
Status – **NCA** (*Nature Conservation Act* 1992) and **EPBC** (*Environment Protection and Biodiversity Conservation Act* 1999); E = endangered, V = vulnerable, NT = near threatened, SL = special least concern, LC = least concern.

Habitat type – Rf = rainforests, **Sclero** = *Lophostemon*, *Angophora, Eucalyptus* and or *Corymbia* woodlands and forests; with x = the habitat is known or expected to be important for the species in the focal region.

(a) Fauna

			Status		Habitat type	
Group	**Scientific name**	**Common name**	**NCA status**	**EPBC**	**Rf**	**Sclero**
Reptiles	*Phyllurus kabikabi*	Oakview leaf-tailed gecko	CE		X	
Reptiles	*Nangura spinosa*	Nangur skink	CE	CE	X	
Mammals	*Phascolarctos cinereus*	koala	V	V		X
Mammals	*Tachyglossus aculeatus*	short-beaked echidna	SL		X	X
Birds	*Turnix melanogaster*	black-breasted button-quail	V	V	X	
Birds	*Calyptorhynchus lathami*	glossy black-cockatoo	V			X
Frogs	*Adelotus brevis*	tusked frog	V		X	X
Reptiles	*Delma torquata*	collared delma	V	V		X
Mammals	*Nyctophilus corbeni*	eastern long-eared bat	V	V		X
Mammals	*Pteropus poliocephalus*	grey-headed flying-fox	C	V	X	X
Reptiles	*Acanthophis antarcticus*	common death adder	V			X
Birds	*Ninox strenua*	powerful owl	V			X
Birds	*Symposiachrus trivirgatus*	spectacled Monarch	SL		X	
Birds	*Hirundapus caudacutus*	white-throated needletail	V	V		X
Birds	*Rhipidura rufifrons*	rufous fantail	SL		X	
Mammals	*Petauroides volans*	greater glider	V	V		X

(b) Flora

			Status		Habitat type	
Family	**Scientific name**	**Common name**	**NCA status**	**EPBC**	**Rf**	**Euc W-OF**
Lamiaceae	*Coleus omissus*		E	E	X	X
Rutaceae	*Bosistoa transversa*	three-leaved bosistoa	LC	V	X	

Appendix 5. Potential habitat for selected conservation significant species within the burnt area on Oakview NP.

The Queensland Herbarium's potential habitat models were created using Maxent (v 3.4.1) (Phillips *et al.* 2006), a proven species distribution modelling tool well suited to the development of models based on records of species presence (Elith & Leathwick 2009). The models utilise vetted records of fauna species occurrence compiled for the purpose of Biodiversity Assessments by the Queensland Department of Environment and Science and additional records held in WildNet. Flora records were compiled from the Queensland Herbarium's Herbrecs specimen database. All records had location precision of better than +/- 2000m, and all fauna records had a collection date post-1975. Records were screened for taxonomic and georeferencing accuracy. As records of species occurrence are heavily biased toward accessible parts of the landscape, a mask of Queensland's road network was used to down-weight species records collected along roads to have half the value of records collected away from roads. Models were constrained within an occurrence mask for each species, defined by a buffer of 200km around a convex hull encompassing all records of that species. These masks are used in Maxent to restrict the selection of background points (pseudo-absences) to the region of species presence and have important implications for model performance (Van Der Waal *et al.* 2007).

Models were based on seven environmental variables:
1. Annual mean temperature;
2. Temperature seasonality (coefficient of variation);
3. Annual precipitation;
4. Mean moisture index of the lowest quarter;
5. Broad vegetation group (BVG 1:1M);
6. Land zone; and
7. Terrain ruggedness index (after Riley *et al.* 1999).

The four climate variables were modelled from Australian monthly mean climate values nominally centred on 1990 (1976-2005) using Anuclim Version 6.1 software (Xu and Hutchinson 2011) applied to a SRTM-derived 3 Second Digital Elevation Model (DEM) (Geoscience Australia 2019). A terrain ruggedness index was also derived from the DEM using the methodology of Riley *et al.* (1999) and indicates the change in elevation between adjacent cells across Queensland. The two categorical variables, land zone and pre-clearing broad vegetation group, were derived from the pre-clearing Regional Ecosystem mapping. Land zone provides a high-level classification of substrate and geomorphology into twelve groups ranging from marine sediments through to ancient igneous substrates (Neldner *et al*. 2020) and broad vegetation group is a high-level classification of vegetation composition at the 1:1M scale (Neldner *et al.* 2019).

Model performance was assessed by comparing the area under the ROC curve (AUC) with the 95th percentile AUC from 1000 null models for each species created by randomly selecting locations from under the species' mask (Raes and ter Steege 2007). Maxent produces a grid of continuous values, analogous to probabilities of habitat suitability, ranging from zero to one. We applied a 50% threshold to each model in order to convert this grid output into a binary prediction of high probability potential habitat. The use of conservative thresholds increases the risk of omission but reduces commission error. Any location records that were excluded as a result of this threshold were added back into the output following the application of a 1km radius buffer. The resulting output was clipped to the species' mask and simplified using a majority filter algorithm to remove outlying 'orphan' cells in the model output.

Potential habitat for species lacking sufficient presence records to allow Maxent modelling have been incorporated into this analysis through the application of a 1km buffer to location records

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Area burnt of potential habitat for selected conservation significant (a) fauna and (b) flora species within the burnt area.

Column headings:
Status – **NCA** (*Nature Conservation Act* 1992) and **EPBC** (*Environment Protection and Biodiversity Conservation Act* 1999); CE = critically endangered, E = endangered, V = vulnerable, NT = near threatened.

Habitat type – Rf = rainforests, **Sclero** = *Lophostemon*, *Eucalyptus* and or *Corymbia* woodlands and forests; W = wetland; with x = the habitat is known or expected to be important for the species in the focal region.

A) Fauna

			Status		Habitat type		Potential habitat (ha or %)					Relative fire severity class (ha)			
Group	**Scientific name**	**Common name**	**NCA status**	**EPBC**	**Rf**	**Sclero**	**Qld area**	**Estate area**	**% in estate**	**Estate habitat burnt**	**% estate habitat burnt**	**Low**	**Mod**	**High**	**Ext**
Birds	*Calyptorhynchus lathami*	glossy black-cockatoo	V			X	527111	1378	0.3%	918	66.6%	522	374	22	0
Birds	*Ninox strenua*	powerful owl	V			X	2239060	1225	0.1%	801	65.4%	450	341	10	0
Birds	*Turnix melanogaster*	black-breasted button-quail	V	V	X		1013079	2739	0.3%	511	18.6%	280	222	9	0
Frogs	*Adelotus brevis*	tusked frog	V		X	X	985730	1220	0.1%	91	7.5%	52	39	1	0
Mammals	*Phascolarctos cinereus*	koala	V	V		X	629597	4238	0.7%	1434	33.8%	794	608	32	0
Mammals	*Nyctophilus corbeni*	eastern long-eared bat	V	V		X	1897768	1845	0.1%	65	3.5%	41	23	1	0
Reptiles	*Acanthophis antarcticus*	common death adder	V			X	3452148	2174	0.1%	569	26.2%	320	239	10	0
Reptiles	*Delma torquata*	collared delma	V	V		X	1954521	2041	0.1%	1085	53.2%	629	431	24	0
Reptiles	*Nangura spinosa*	Nangur skink	E	CE	X		38576	1469	3.8%	32	2.2%	20	11	1	0
Reptiles	*Phyllurus kabikabi*	Oakview leaf-tailed gecko	E		X		14427	1252	8.7%	99	7.9%	59	37	2	0

B) Flora

			Status		Habitat type		Potential habitat (ha or %)					Relative fire severity class (ha)			
Family	**Scientific name**	**Common name**	**NCA status**	**EPBC**	**Rf**	**Sclero**	**Qld area**	**Estate area**	**% in estate**	**Estate habitat burnt**	**% estate habitat burnt**	**Low**	**Mod**	**High**	**Ext**
Sapotaceae	*Planchonella eerwah*		E	E	X		229834	1570	0.7%	39	2.5%	26	13	1	0
Sapindaceae	*Cossinia australiana*		E	E	X		440831	2103	0.5%	83	4.0%	56	26	1	0
Corynocarpaceae	*Corynocarpus rupestris* subsp. *arborescens*	southern corynocarpus	V		X		396187	1801	0.5%	117	6.5%	67	47	3	0
Sapindaceae	*Cupaniopsis shirleyana*	wedge-leaf tuckeroo	V	V	X		600543	1875	0.3%	69	3.7%	45	23	1	0
Myrtaceae	*Backhousia oligantha*		E		X		38461	119	0.3%	4	3.7%	4	0	0	0
Euphorbiaceae	*Fontainea rostrata*		V	V	X		73402	70	0.1%	1	1.4%	1	0	0	0
Fabaceae	*Sophora fraseri*	brush sophora	V	V		X	379715	310	0.1%	207	67.0%	132	73	2	0
Myrtaceae	*Eucalyptus pachycalyx* subsp. *waajensis*		E			X	504758	344	0.1%	334	97.0%	225	99	9	0
Haloragaceae	*Haloragis exalata subsp velutina*		V	V		X	765276	439	0.1%	246	56.2%	110	131	5	0

Appendix 6. Maps of significant species potential habitat and potential ecological impact.

NOTE: Maps in this Appendix are not for public release as they include detailed distributional information for species deemed confidential by the Department.

Appendix 7. Pest plants and animals likely to impact significant species or affect recovery or maintenance of habitat.

More pest species have been recorded in Oakview National Park than those included in the tables below. Only those that are currently known to occur on the Park and have the potential to significantly impact on recovering ecosystems or threatened species, and/or impact on their future protection have been included here. For example, species such as *Phytolacca octandra* (inkweed), which is prolific in some burned areas but will 'disappear' as the ecosystem recovers, have not been included.

a) Animals

Group	Common name	Scientific name
amphibians	deer (red)	*Cervus elaphus*
mammals	cat	*Felis catus*
mammals	fox	*Vulpes vulpes*
mammals	pig	*Sus scrofa*

b) Plants

Family	Scientific name	Common name
Bignoniaceae	*Dolichandra unguis-cati*	cat's claw creeper
Fabaceae	*Neonotonia wightii*	glycine
Phytolaccaceae	*Rivina humilis*	coral berry
Poaceae	*Megathyrsus maximus* var. *maximus*	Guinea grass
Poaceae	*Megathyrsus maximus* var. *pubiglumis*	green panic
Poaceae	*Chloris gayana*	Rhodes grass
Poaceae	*Sporobolus* spp.	rat's tail grass
Verbenaceae	*Lantana camara*	lantana
Solanaceae	*Solanum seaforthianum*	Brazilian nightshade