BUSHFIRE RISK

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Bushfire Assessment - Additional Information Response
Re: Iron Gates Drive Evans Head NSW

Client: Goldcoral Pty Ltd

8 March 2017 – Version 1

This report has been prepared by: **Melanie Jackson**
Grad Dip (Bushfire Protection); B.App.Sc (EnvResMgt)
BPAD-Level 3 Accredited Practitioner & Member of the FPA Australia

BPAD Bushfire Planning & Design Accredited Practitioner Level 3

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‘Prepare—Act—Survive’

In the Event of an Emergency Call:

‘000’

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DISCLAIMER

Despite best efforts, there is no guarantee that desirable outcomes are achievable during extreme bushfire weather episodes, which may occasion unpredictable bushfire behaviour and have detrimental consequences to life, property and the environment.

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TABLES & FIGURES

1 INTRODUCTION

1.1 BACKGROUND

Bushfire Risk has been engaged by Goldcoral Pty Ltd, to respond to the RFS comments in relation to Development Application No. 2015/0096 & Section 138 Roads Act Application, Iron Gates Development, Evans Head. The response is required in order '*to identify the potential risk of bushfire impacts on vehicles using the road during a bushfire emergency'*.

The DA includes an application to widen Iron Gates Drive to incorporate a sealed carriageway of 8m wide inside a 20m wide road reserve. There are two sections along Iron Gates Drive which cannot be widened due to environmental constraints, involving mapped SEPP 14 wetlands; However overhanging limbs/branches will be trimmed.

The actual width of the sealed carriageway through the mapped SEPP 14 wetland section varies between 6.6m and 7.1m (Ref. Appendix A; Access Road Plans (Arcadis, 2017)). The actual overall road width is 9m wide in addition to 1.5m wide shoulders on each side; The southern side includes a formed concrete footpath within the shoulder.

1.2 PREVIOUS REPORT

This information response supersedes the recommendations contained in the document entitled *'Iron Gates Drive' - Suitability Review Public Access Requirements'*, by Melanie Jackson of Bushfire Risk, dated 12 August 2015. This information response and recommendations herein aim to assist Council and NSW RFS in determining compliance for 'Iron Gates Drive' to be used as the main access road to Iron Gates Development.

1.3 INFORMATION TO BE ADDRESSED

The NSW RFS requires the follow information in support of the associated road survey as per the RFS email from Alan Bawden, dated 15 and 17 November 2016.

- Proposed vegetation clearing width within and outside of the SEPP 14 mapping along Iron Gates Drive; and
- Flame length modelling where that vegetation width is below 20 metres; and
- Total number of standing trees that have a potential to fall and block Iron Gates road;

Additional clarification as per Alan Bawden email dated 17 November 2016 states the following:

- Comment on the standing trees applies to those trees that are now within the SEPP 14 area and cannot be removed; and
- Identify if any other trees will now impact on the road reserve as a result of the SEPP 14 issue.

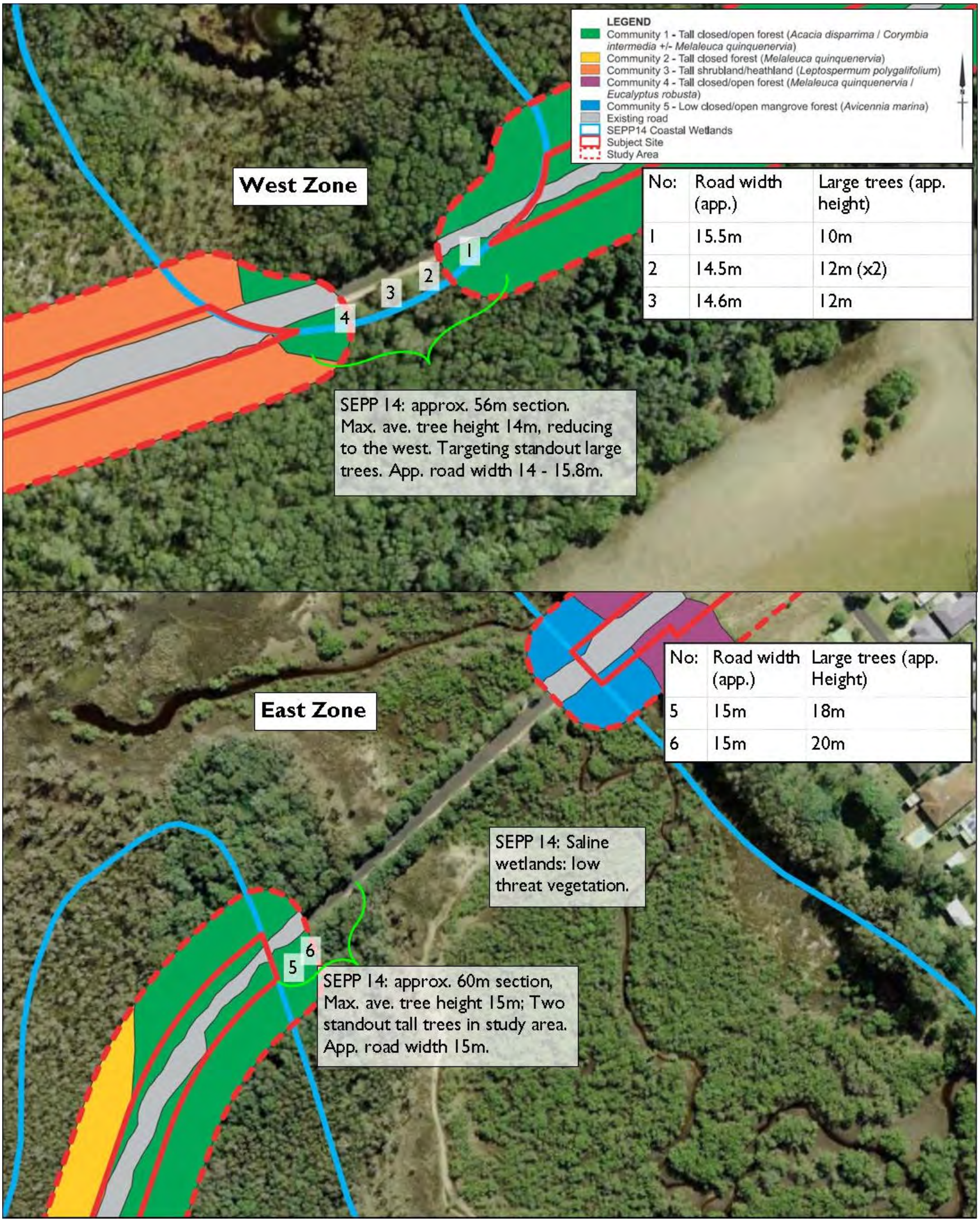


FIGURE 1: MAPPED SEPP 14 STUDY ZONES (MAP SOURCE: JWA PTY LTD, VEGETATION COMMUNITIES MAPPING, 2016).

2 BUSHFIRE ASSESSMENT - SEPP 14 ROAD RESERVE

An assessment of the vegetation impacting the access road in relation to the mapped SEPP 14 wetland areas affecting Iron Gates Road (Figure 1).

2.1 SITE ASSESSMENT

Melanie Jackson (BPAD-Level Practitioner) of Bushfire Risk P/L re-visited Iron Gates Road (the subject site) on 6 December 2016, Graeme Ingles and Jordana McMahon were also in attendance.

2.2 FACTS, CONSIDERATIONS AND ASSUMPTIONS

2.2.1 Evans Head fire weather behaviour:

3pm winds:

Evans Head wind trends are predominantly easterlies (Jan - Feb) and northerlies and southerlies (Sept - Dec) direction (BOM 2016). Fire seasons being predominantly spring shifting to summer. Localised fire weather conditions may vary.

Fires travelling in an easterly direction are more likely to traverse away from the road, however northerly winds may trend towards and/or flank the access road from the north.

Smoke:

Visibility may be reduced, addressed in the previous alternate solution, use of reflectors with no road obstructions and reflective 'fog' lines are to be applied in order to define road verges, centre lines etc. during times of low visibility (Jackson 2015).

2.2.2 Construction requirements - carriageway and trafficable verges

The road outside of the SEPP 14 wetland is to be constructed with an 8m wide carriageway and a 0.5m gravel verge on either side, making a total of 9m. the current sealed width within the SEPP 14 wetland is 6.6 – 7.1m wide contained within a 9m wide gravel base (Ref. Appendix A (Arcadis 2017)).

The southern side of the road contains an additional 1.5m wide shoulder with an existing concrete footpath within the shoulder; In total a 10.5m wide cleared trafficable surface shall be present. An additional shoulder is present on the northern side of the access road however the slope and width variable. No works will be undertaken on the roadway within the SEPP 14 wetland, other than trimming overhanging branches.

2.2.3 Radiant heat exposure:

Assuming occupants in a vehicle evacuating an area may be subject to burning vegetation, radiant heat exposure shall be calculated based on vegetation type, distance to the vegetation and flame length. Radiant heat flux of **29kW/m²** was used as a control to determine separation distance and likely radiant heat flux to the receiver (vehicle).

Radiant heat exposure comparisons:

- 12 kW/m²: Standard float glass could fail. Dry timber elements will readily ignite in a bushfire.
- 19 kW/m²: Screened float glass could fail.
- 29 kW/m²: Ignition of most timbers without piloted ignition (3 min. exposure). Toughened glass could fail.
- >29 kW/m²: At this point flames would be very close to the object. Potential flame contact, increased radiant heat and ember attack.
- (PBP 2006)

2.3 VEGETATION TYPE - MAPPED AS SEPP 14 WETLAND AND ASSOCIATED FUEL MODELLING FACTORS:

Meleauca Swampland EEC (west zone):

- Vegetation classification (PBP 2006): Forested Wetlands;
- Fuel load: 15/20 r/t (ha);
- Variable cleared width:
  - 14 - 15.8m.
- Max. Ave. tree height:
  - 14m for approx. 56m, reducing in a westerly direction;
- Standout large trees (cleared width x height):
  - 15.5m (w) x 11m (h);
  - 14.5m (w) x 12m (h);
  - 14.6m (w) x 12m (h);
- Flanked by estuarine corridor and inundated wetlands potential increase in relative humidity, reduced ignition potential and intensity;

Tall Heath (west zone):

- Vegetation classification (PBP 2006):
  - Scrub - 25 t/ha:
- Cleared width;
  - ≥15m
- Tree height: ≤12m for a distance of approx. 10m
- Individual trees ≥12m;
  - None;
- Area subject to water inundation, relative humidity higher being close to estuary and wetlands resulting in reduced ignition potential and intensity.

Sclerophyll Swamp Forest EEC (east zone):

- Vegetation classification (PBP 2006):
  - Forested Wetlands - 15/20 r/t (ha):

- App. cleared width;
  - 15m;
- Tree height: 15m tall for a distance of approx. 60m;
- Heights reducing in both directions;
- 2 x standout large trees (cleared width x height):
  - 15m (w) x 18m (h);
  - 15m (w) x 20m (h);
- Area subject to water inundation, relative humidity higher being close to estuary and wetlands resulting in reduced ignition potential and intensity.

2.4 METHODOLOGY (NBC (2013) BFAA CALCULATIONS)

A site visit to qualitatively assess the vegetation type, existing and proposed vegetation clearing requirements and, tree number, height, tree health and type of vegetation effected by the SEPP 14 Wetland area. Measurements were taken including the cleared widths to quantitative analysis.

A quantitative assessment using 'Method 2 Calculations' - *Complex Procedure* as per the methodology described in '*Appendix B - Detailed Method for Determining the Bushfire Attack Level (BAL) Method 2'* (AS3959-2009) was used to calculate radiant heat flux and flame length for each vegetation type within the mapped SEPP 14 Wetland area found within the road reserve that cannot be cleared. The calculations shall be carried out using the Newcastle Bushfire Consultants (NBC) Bushfire Attack Assessor Calculator (BFAA) (Couch, P. 2013).

The results of which were used to determine radiant heat flux, flame length and potential impacts to Iron Gates Road and ability of vehicles to traverse the road during an emergency event.

2.5 RESULTS

The results of the method 2 calculations are presented in Table 1 below (Ref. Appendix B). In relation to the RFS additional information requirements, the results have been determined based on the analysis of the findings, summarised as follows.

- The proposed vegetation clearing width outside of the SEPP 14 mapped areas along Iron Gates Drive shall be 20m wide;
- The road width outside of the mapped SEPP 14 wetland shall be constructed with an 8m wide carriageway with a 0.5m gravel verge on either side (total 9m);
- Current sealed width within the SEPP 14 wetland is 6.6 – 7.1m wide contained within a 9m wide gravel base (Ref. Appendix A (Arcadis 2017));
- The southern side of the road also contains a 1.5m wide shoulder with an existing concrete footpath within the shoulder;
- In total a 10.5m wide cleared trafficable surface shall be present;
- The cleared widths inside the SEPP 14 mapped wetland areas along Iron Gates Drive is App. 14m-15.8m wide (West Zone) and 15m wide (East Zone);
- The flame length of the vegetation types within the investigation area is 11.76m (Forested Wetlands) and 11.63 (Tall Heath);

- Where the vegetation width is less than 20 metres in the SEPP 14 area (unable to be removed) the total number of standing trees with potential to fall and block Iron Gates road and any other trees that are likely to impact on the road reserve as a result of the SEPP 14 constraints are limited and unlikely to impact on the road reserve.

TABLE 1: POTENTIAL IMPACT BY TREE FALL OR FLAME LENGTH.

VEGETATION COMMUNITIES	MELALEUCA SWAMPLAND EEC - 15/20 R/T (HA) - (FORESTED WETLAND) - WEST ZONE	SCRUB – 25 R/T (HA) - (TALL HEATH) - WEST ZONE	SCLEROPHYLL SWAMP FOREST - 15/20 R/T (HA)) (FORESTED WETLAND) - EAST ZONE
Affected length (Ref. App. A)	56m approx.	56m approx.	60m approx.
Cleared width	14 - 15.8m	$\geq$15	15m
Ave. tree height	14m	12m	15m
Max. tree height	14m (majority south side)	12m	20m (x 2 south side)
Large trees	YES: $\leq$14m (x5)	NO	YES: $\geq$15m (x2)
Potential to impact Iron Gates Road • Explanation	Unlikely • Inundated wetland areas adjacent; • The majority of vegetation in this location consists of shrubby wattles; • Direction of bushfire and damaging winds, unlikely to have a negative effect on trees in this location; • The majority of trees if they do fall directly across the road, will afford some separation from vegetation opposite; • Trees are predominantly shrubby, tops could be brushed past and/or driven over should a tree or two fall across the access road; • Heads are unlikely to become impassable; • Pruning will remove fuel and weight from the road side and create a break in the canopy.	NO • The direction of bushfire and damaging wind is unlikely to have a negative impact in this location; • Dominant tree height is less than cleared width; • Pruning will increase the break in the canopy, reduce weight and fuel from the road side;	Unlikely • The two large trees lean away from the road; • Majority of trees in this location are shrubby; • The likely direction of bushfire and damaging winds are unlikely to have a negative impact in this location; • Dominant tree height is similar to the cleared width; • Pruning will create a break in the canopy, reduce weight and fuel from the road side and increase separation between the canopy; • The majority of trees if they fall directly across the road will afford some separation from vegetation opposite; • The shrubby heads are unlikely to be impassable, can be easily driven over or brushed past.
29kW/m^2 = flame length	11.76m	11.63	11.76m

$29kW/m^2$ = min. separation distance	13.25m	13.1m	13.25m
Radiant heat flux exceeding $29kW/m^2$? • Explanation	Unlikely: • Worst case scenario affords a min. 0.75m separation distance to a potential bushfire front opposite; • The inputs used were standard for the Richmond Valley Council area including a Moisture factor of 5 and Relative Humidity (RH) of 25%; § • The likelihood of fuel moisture and relative humidity reaching these low levels is unlikely due to proximity to inundated wetlands in the locality. *	Unlikely: • Worst case scenario affords a min. 0.9m separation distance to a potential bushfire front opposite; • Standard inputs were including Moisture factor of 5 and RH of 25%; § • Likelihood of fuel moisture and RH reaching these low levels is unlikely due to proximity to inundated wetlands. *	Unlikely: • Worst case scenario along this section a separation distance of 13.3m affords the $29kW/m^2$ from the effects of a potential bushfire front opposite; • The inputs used were standard for the Richmond Valley Council area including a Moisture factor of 5 and RH of 25%; § • The likelihood of fuel moisture and RH reaching these low levels is unlikely due to proximity to inundated wetlands and riverine corridor in the locality. *
Potential flame contact • Explanation	Unlikely: • A flame length of approx. 11.76m affords a min. deficit of 2.24m to the opposite side.	Unlikely: • A flame length of approx. 11.63m affords a deficit of approx. 3.37m to the opposite side.	Unlikely: • A flame length of approx. 11.76m affords a deficit of approx. 3.24m to the opposite side.

§ The lowest recorded mean average relative humidity (RH) recorded in Evans Head over the past 12 years was 57% (August); December 2016, recorded its lowest RF of 58%; (BOM 2016), December being the height of the bushfire season in the Northern Rivers when fires are most likely to occur. Historically, extreme bushfire events are relatively rare.

* Areas subject to water inundation, being close to riverine corridors, estuaries, wetlands and mangroves may reduce ignition potential, intensity, which may slow a fires rate of spread or prevent a fire spreading from adjacent areas with differing vegetated types e.g. forests etc.

2.6 Discussion

The results indicate there are two significant trees (east zone) with branches large enough to impact on Iron Gates Drive should they fall. However the chance of these trees falling directly towards the road is unlikely as both trees lean away from the road. The remaining vegetation although may match the height of the width of vegetation observed the vegetation type was predominantly shrubby, the majority being wattles with some paperbarks were observed across the investigation areas.

Five (5) trees of any significance were observed in the western zone, namely wattles and a paper bark, with shrubby heads, unlikely to cause a road block due to their shrubby nature and lack of large limbs and their height was less than that of the cleared width. Should a tree fall across the road, the shrubby heads are likely to be easily brushed past or driven over.

The trees observed were unlikely to be effected by a full force bushfire in the area in the west zone due to the direction of bushfire threat and climatic conditions for those bushfire danger conditions of the Northern Rivers Region (BOM 2016). It is unlikely wind driven fires will direct a fire towards Iron Gates Drive from the north as predominant winds during the bushfire danger period are from the east. A fire starting on the southern side of Iron Gates Drive is also unlikely as the vegetation here consists predominantly of inundated wetlands abutting an estuary.

Analysis shows RH reaching such low levels in the area is also very unlikely and a fire equal to that of the design fires presented herein (Appendix B) are limited due to the wetlands and estuary locality and climatic conditions analysed.

The quantitative results therefore are based on the worst case scenario using a conservative approach is likely that the calculated separation distances will be greater and from a lower level of radiant heat than the results show. Ultimately the threat is likely to be lower than that calculated from a potential fire flanking the edge of Iron Gates Drive therefore occupants in vehicles are unlikely to be hindered from traversing Iron Gates Drive during an emergency event.

2.7 Conclusion

In my professional opinion that the results based on the quantitative and qualitative analysis presented herein demonstrated the flame length of the vegetation types affected by the SEPP 14 wetlands, likely impacts from radiant heat flux and trees falling across Iron Gates Road are limited.

Once the remainder of Iron Gates Road is cleared to 20m in width there shall be two remaining pinch points, each approx. 60m in length. Trees in these areas are unlikely to fall into the road and if they do, it is unlikely the road shall become impassable due to the shrubby nature of the trees, climatic conditions and other factors as discussed herein.

3 REFERENCES

Arcadis, 2017, Project No: AA007094, *Access Road Details Layout Plan,* 23 February 2017, Southport Queensland.

Australian Government, 2016, Bureau of Statistics, *climate statistics for Australian locations*, <www.bom.gov.au>, accessed 16 December 2016.

Jackson M.L. 2015, Bushfire Risk, *Iron Gates Drive - Suitability Review Public Access Requirements*. Lismore NSW.

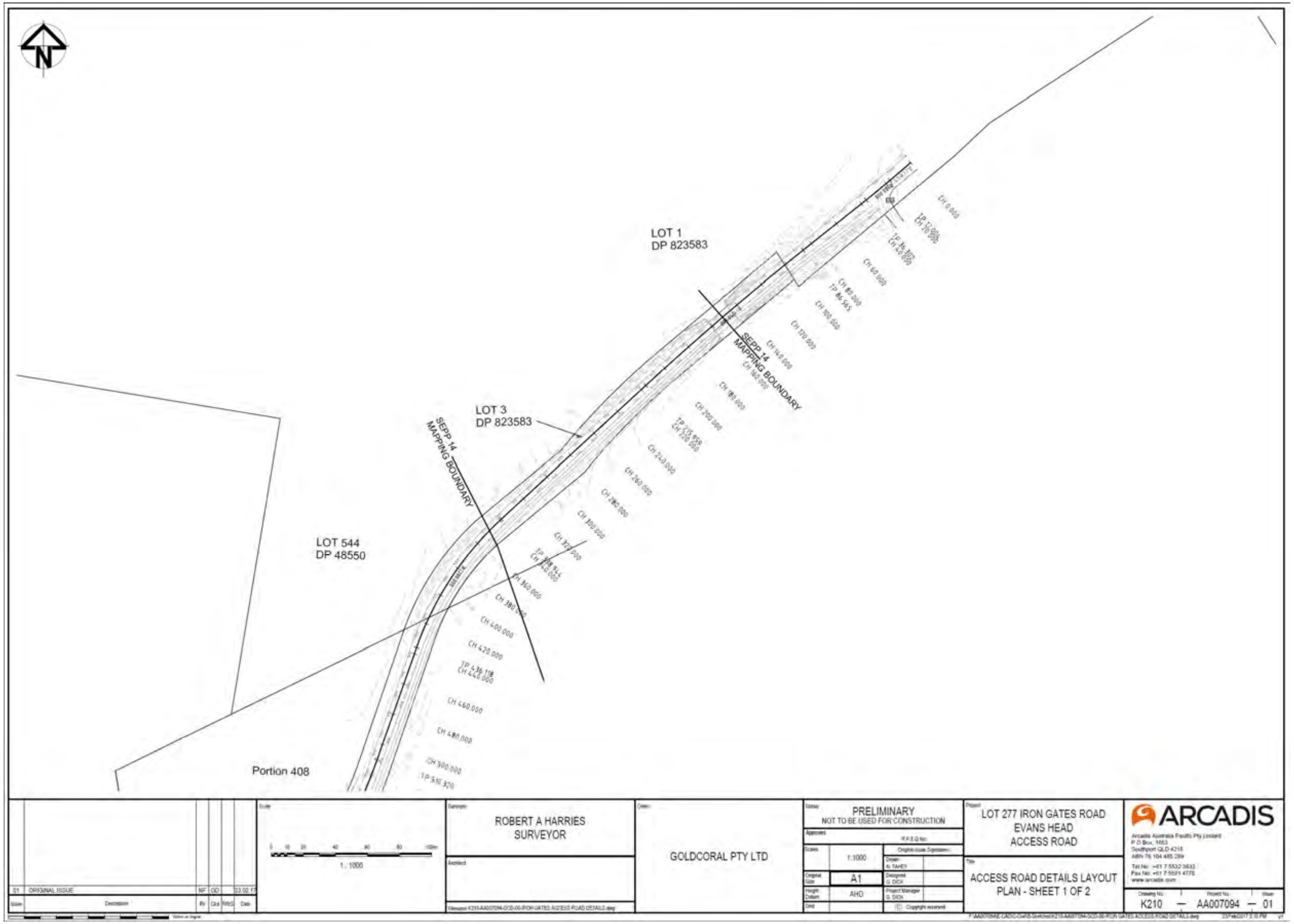
JWA Pty Ltd Ecological Consultants, 2016, *Draft Ecological Assessment,* Ballina NSW.

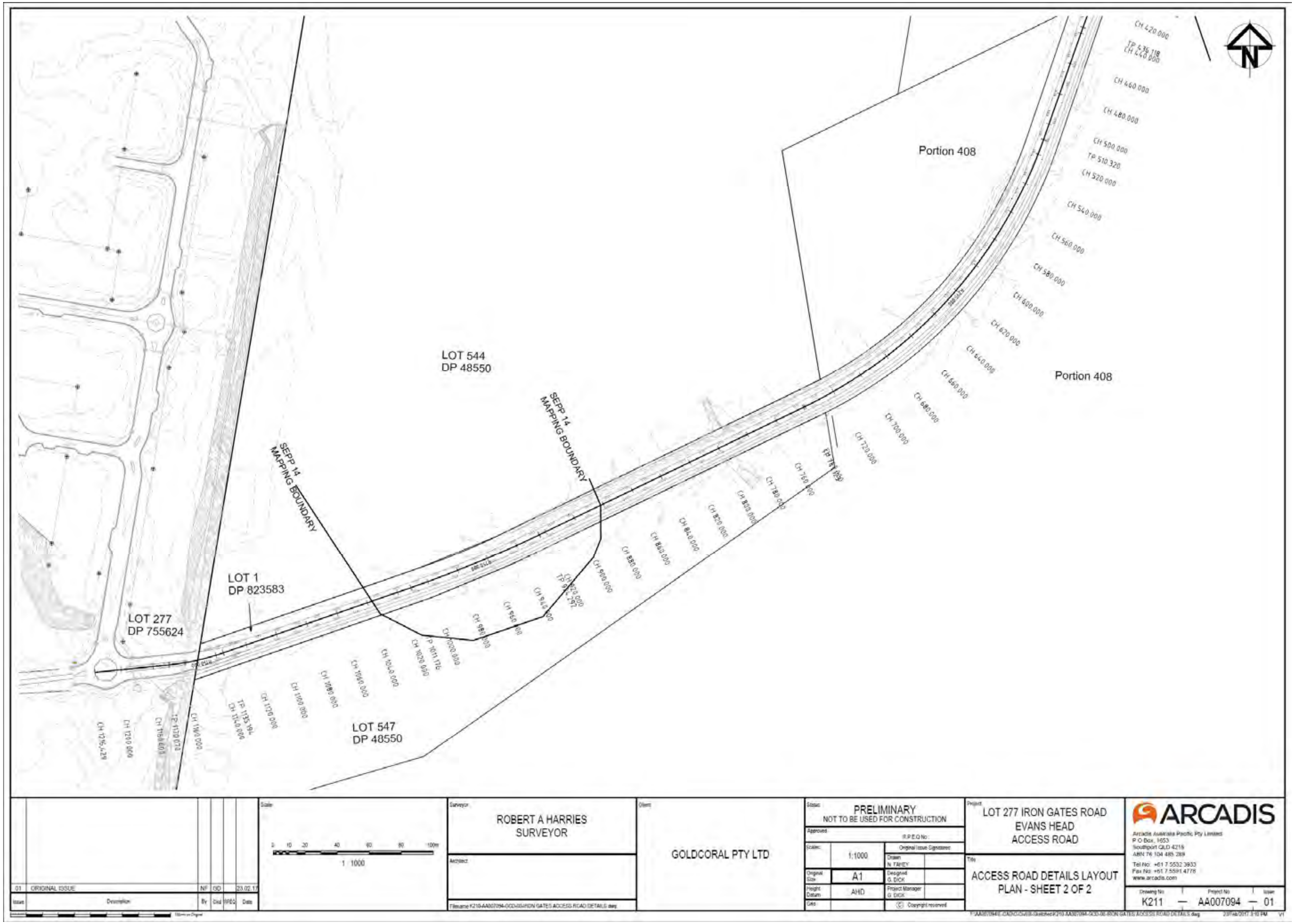
NSW Rural Fire Service, 2006, *Planning for Bush Fire Protection*, A Guide for Councils, Planners, Fire Authorities and Developers, NSW Rural Fire Service, Sydney NSW.

Standards Australia, 2009, *AS 3959–2009 Construction of Buildings in Bushfire Prone Areas*, Sydney, Standards Australia International Ltd.

4 APPENDIX A – ACCESS ROAD DETAILS

Access road details cross sections by: Arcadis; Date: 23 February 2017. A full set of final plans shall be provided by the applicant to accompany the DA. All design and site plans must ensure compliance with the minimum building setbacks in relation to this development as proposed and the recommendations contained herein.

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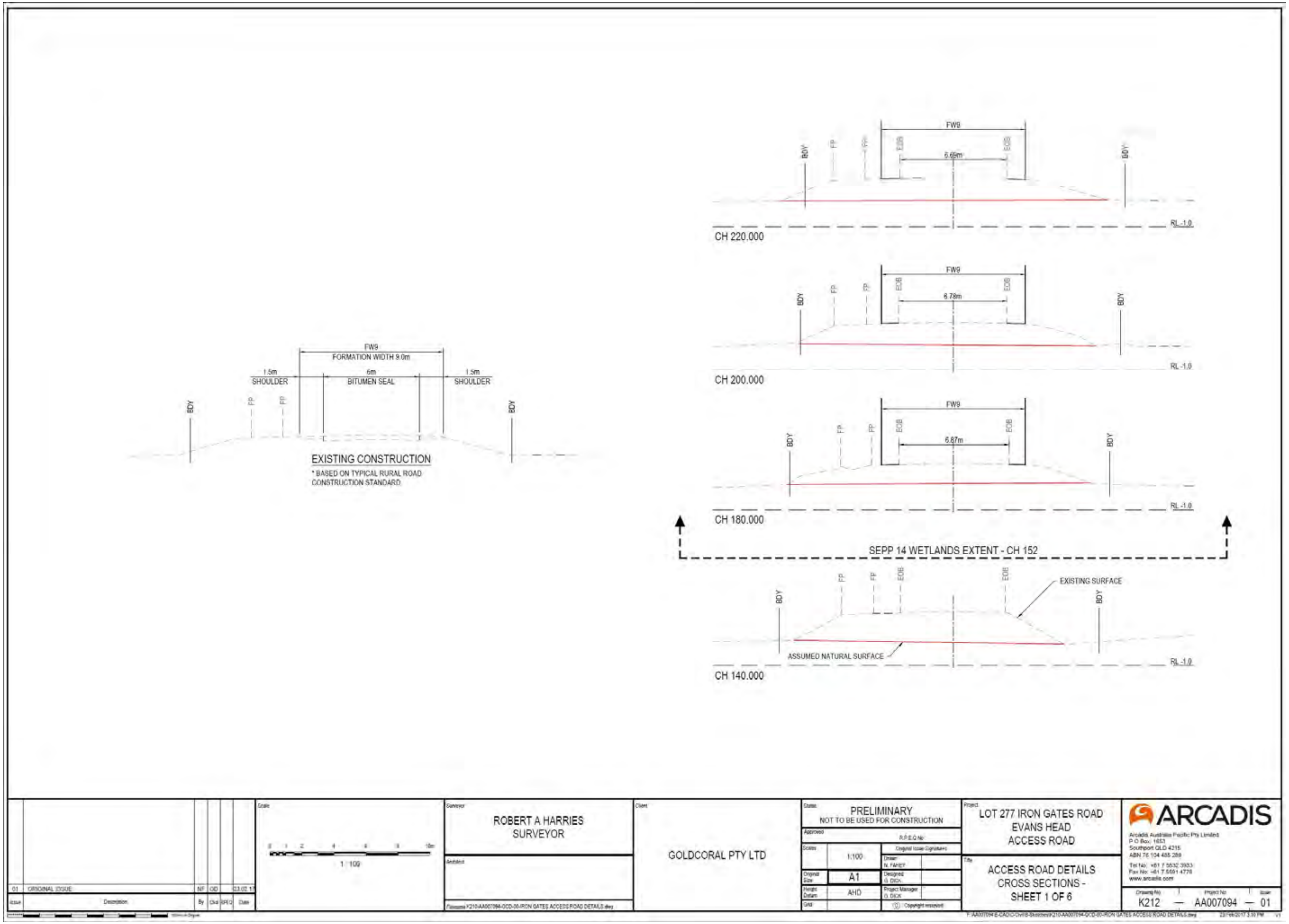
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* BASED ON TYPICAL RURAL ROAD CONSTRUCTION STANDARD
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RL -1.0
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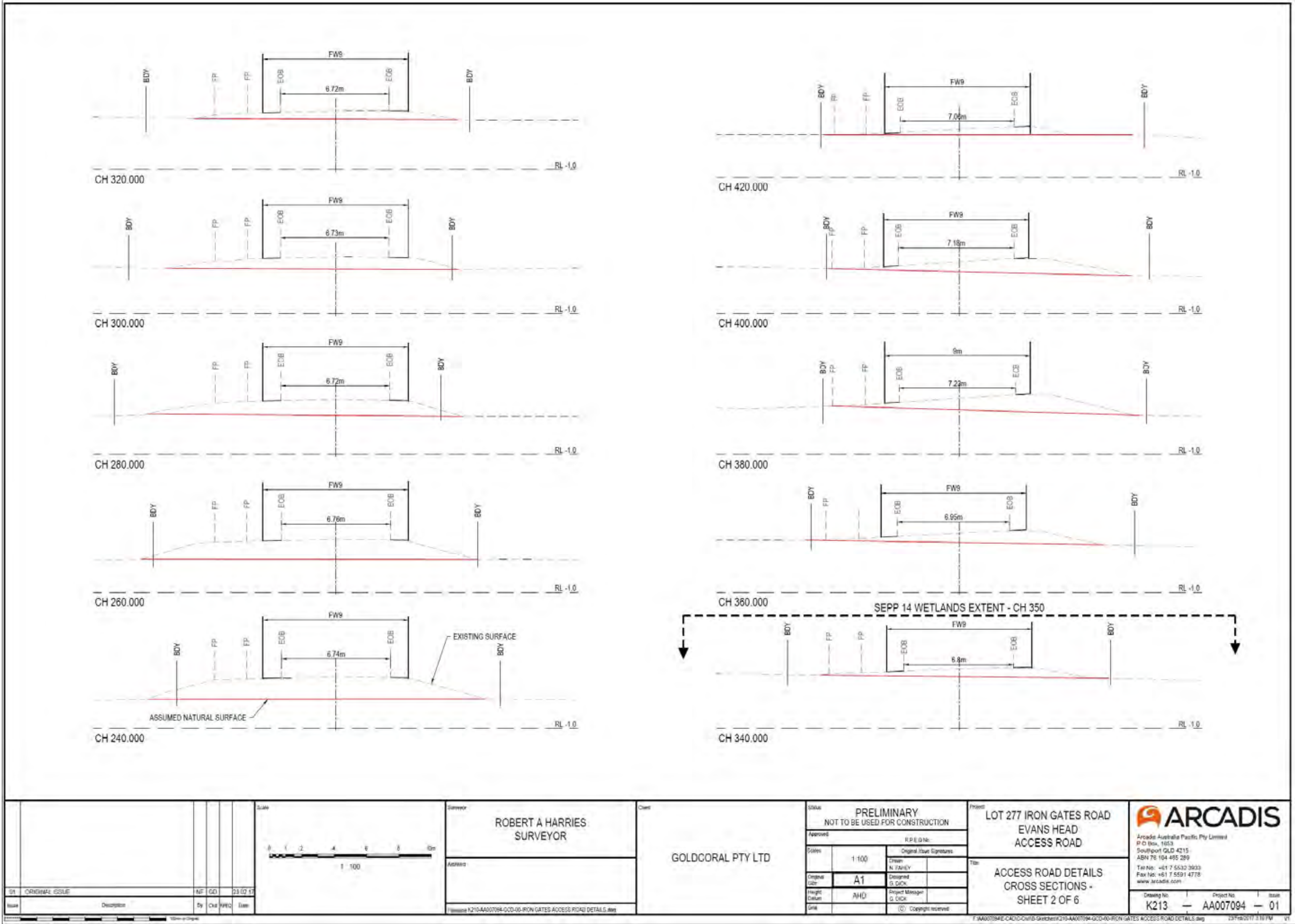
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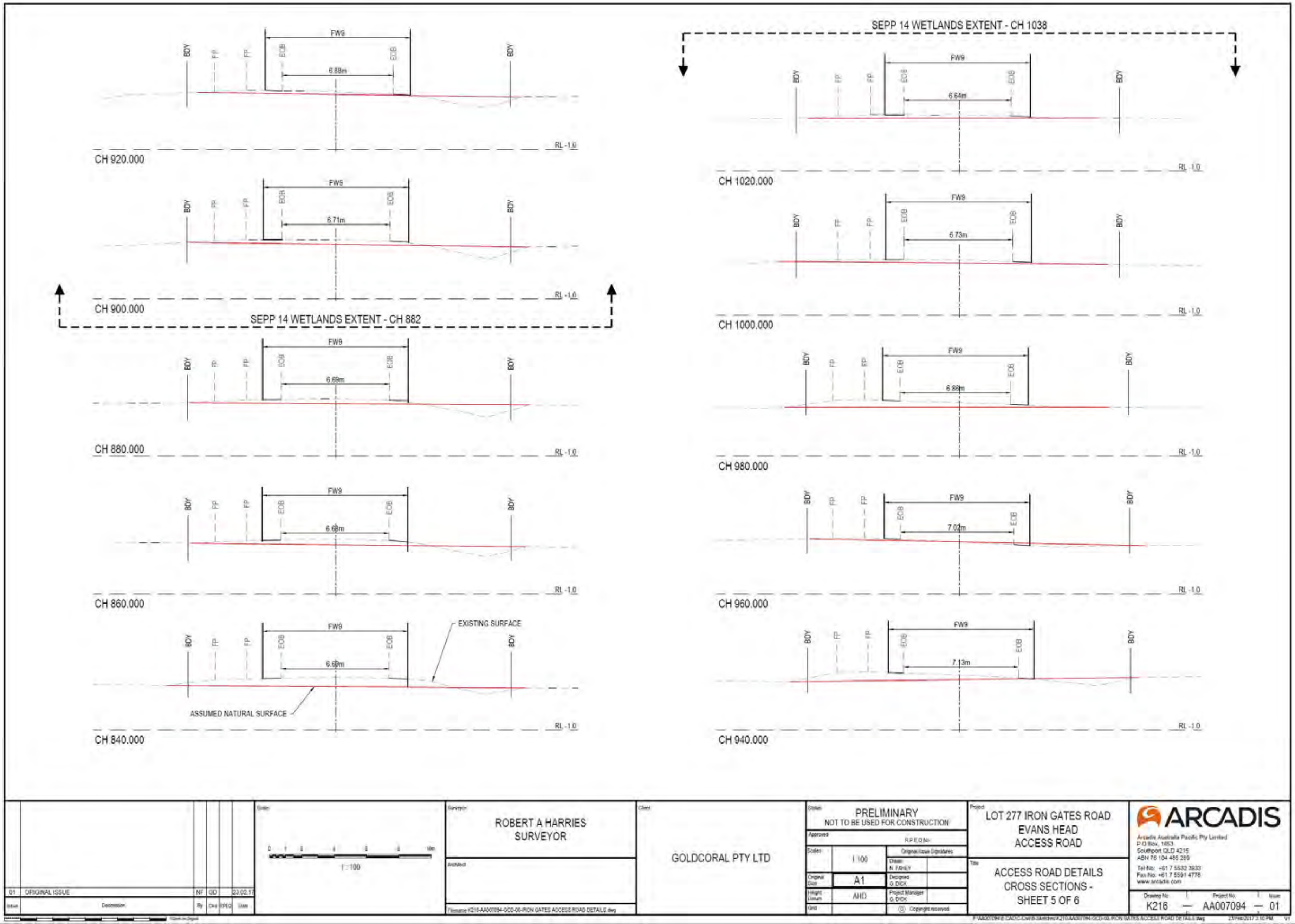
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Project Manager G. DICK
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5 APPENDIX B - DESIGN FIRE 1 - RESULTS

NBC Bushfire Attack Assessment Report V2.1

AS3959 (2009) Appendix B - Detailed Method 2

Printed: 16-Dec-16 **Assessment Date:** 16-Dec-16

BPAD Bushfire Planning & Design Accredited Practitioner Level 3

BUSHFIRE RISK

Site Street Address: Iron Gates Access Design Fire 1, Evans Head

Assessor: Melanie Jackson; Bushfire Risk

Local Government Area: Richmond Valley **Alpine Area:** No

Equations Used

Transmissivity: Fuss and Hammins, 2002
Flame Length: RFS PBP, 2001
Rate of Fire Spread: Noble et al., 1980
Radiant Heat: Drysdale, 1985; Sullivan et al., 2003; Tan et al., 2005
Peak Elevation of Receiver: Tan et al., 2005
Peak Flame Angle: Tan et al., 2005

Run Description: Seperation vs RHF 29kW/m2

Vegetation Information

Vegetation Type:	Scrub/Tall Heath	**Vegetation Group:**	Shrub & Heath
Vegetation Slope:	0 Degrees	**Vegetation Slope Type:**	Downslope
Surface Fuel Load(t/ha):	25	**Overall Fuel Load(t/ha):**	25

Site Information

Site Slope:	0 Degrees	**Site Slope Type:**	Downslope
Elevation of Receiver(m):	Default	**APZ/Separation(m):**	13.1

Fire Inputs

Veg./Flame Width(m):	100	**Flame Temp(K)**	1090

Calculation Parameters

Flame Emissivity:	95	**Relative Humidity(%):**	25
Heat of Combustion(kJ/kg)	18600	**Ambient Temp(K):**	308
Moisture Factor:	5	**FDI:**	80

Program Outputs

Category of Attack:	HIGH	**Peak Elevation of Receiver(m):**	5.18
Level of Construction:	BAL 29	**Fire Intensity(kW/m):**	53816
Radiant Heat(kW/m2):	28.98	**Flame Angle (degrees):**	63
Flame Length(m):	11.63	**Maximum View Factor:**	0.442
Rate Of Spread (km/h):	4.17	**Inner Protection Area(m):**	13
Transmissivity:	0.862	**Outer Protection Area(m):**	0

Run Description: Seperation vs RHF 29kW/m2

Vegetation Information

Vegetation Type:	Forest	**Vegetation Group:**	Forest and Woodland
Vegetation Slope:	0 Degrees	**Vegetation Slope Type:**	Downslope
Surface Fuel Load(t/ha):	15	**Overall Fuel Load(t/ha):**	20

Site Information

Site Slope:	0 Degrees	**Site Slope Type:**	Downslope
Elevation of Receiver(m):	Default	**APZ/Separation(m):**	13.25

Fire Inputs

Veg./Flame Width(m):	100	**Flame Temp(K)**	1090

Calculation Parameters

Flame Emissivity:	95	**Relative Humidity(%):**	25
Heat of Combustion(kJ/kg)	18600	**Ambient Temp(K):**	308
Moisture Factor:	5	**FDI:**	80

Program Outputs

Category of Attack:	HIGH	**Peak Elevation of Receiver(m):**	5.24
Level of Construction:	BAL 29	**Fire Intensity(kW/m):**	14880
Radiant Heat(kW/m2):	28.96	**Flame Angle (degrees):**	63
Flame Length(m):	11.76	**Maximum View Factor:**	0.442
Rate Of Spread (km/h):	1.44	**Inner Protection Area(m):**	13
Transmissivity:	0.862	**Outer Protection Area(m):**	0