Figure 2-4
Proposed disturbance footprint, Wollara Road

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3 Landscape character impact with amendments

3.1 Amendments that may affect landscape character

As shown in Table 2-1, the following amendments to the EIS Project may affect landscape character:

- Golden Highway/Ringwood Road intersection upgrade.
- Upgrade to part of Ringwood Road (around 3.4 km).
- Upgrade to part of Wollara Road (around 4.7 km).

3.2 Landscape character zones

The LCVIA identified two distinct landscape character zones[3]:

- Open, agricultural landscape, distinguished by grazing pastures, rural infrastructure, and agricultural land use, including the project site, and
- Dense, forested landscape distinguished by tall, native vegetation, including the Goulburn River National Park.

Photographs illustrating landscape character in the vicinity of the road upgrades are shown in Figure 3-1.

Golden Highway landscape at the location of the proposed Golden Highway / Ringwood Road intersection upgrade

Open, agricultural landscape along Ringwood Road at location of proposed road upgrade

Dense, forested landscape along the route of the proposed Wollara Road upgrade

Figure 3-1: Photographs illustrating landscape character in the vicinity of proposed road upgrades

[3] The character of the landscape was described within approximately 5 km from the proposed development (as per the *Technical Supplement*).

The proposed Ringwood Road upgrade is located within the open, agricultural landscape, and the proposed Wollara Road upgrade is located wholly within the road corridor contained within the dense forested landscape character zone. However, the proposed Golden Highway intersection upgrade is located beyond the two originally described landscape character areas.

The Highway intersection is generally within an open, agricultural landscape, however, the character of the intersection is dominated by, the highway. Therefore, a new landscape character zone has been added to the assessment. This landscape character zone is typified by the two-lane, sealed highway, which carries comparatively higher-speed, greater-volume, heavier traffic than other roads within the study area. The terrain at the intersection is undulating, with cut and fill embankments. Individual tall native trees occur either side of the road within a grassed verge, and there are areas of dense shrubs and trees. For the purposes of this report, this character zone is called the 'Golden Highway' landscape character zone.

3.3 Assessment of landscape character impact

The assessment of impact to landscape character (of the Amended Project), is shown in Table 3-1. In summary:

- Sensitivity: Landscape character sensitivity is presented in Column A:
  - There is no change to the *low* rating of landscape sensitivity within the open, agricultural, or the dense forested landscape (determined in the LCVIA).
  - Landscape character sensitivity within the Golden Highway landscape is determined to be *low*.
- Magnitude. The assessment of magnitude of change is presented in Column B:
  - There is no change to the *low* rating of landscape magnitude within the open, agricultural landscape.
  - Magnitude of change to the dense, forested landscape zone increases to *moderate* from very low in the LCVIA.
  - Magnitude of change to the Golden Highway landscape character zone is assessed as *low*.
- Landscape character impact. The overall impact to landscape character impact is shown in Column C:
  - There is no change to the *low* rating of landscape character impact within the open, agricultural landscape.
  - Landscape character impact to the dense, forested landscape zone increases to *low* from very low in the LCVIA.
  - Landscape character impact to the Golden Highway landscape zone is assessed as *low*.

Table 3-1: Assessment of landscape character impacts

Landscape character zone	Column A Sensitivity of existing landscape character to the Project		Column B Magnitude of change to landscape character		Column C Landscape Character Impact	
	LCVIA	Amended Project	LCVIA	Amended Project	LCVIA	Amended Project
Golden Highway landscape	Not applicable. The EIS Project did not include changes to the Golden Highway.	Low The existing landscape is: ▪ Not recognised as having national or regional landscape values, and the highway is not a designated tourist route or scenic drive. ▪ Zoned SP2 Infrastructure (classified road) under the *Upper Hunter Local Environmental Plan (LEP) 2013*. There are no visual or amenity-related objectives for the zone. The purpose of the zone is to provide for infrastructure and prevent development that is not compatible or may detract from provision of infrastructure. ▪ However, the road is a main route from the Hunter Valley / east coast of NSW to western NSW, and is used by tourists, residents and heavy transport. ▪ And although the road corridor has been modified from its natural state, it has a rural countryside character established by the presence of tall native trees either along many parts of the road.	Not applicable. The EIS Project did not include changes to the Golden Highway.	Low ▪ Although apparent, particularly initially, the proposed removal of trees, road widening, and cut and fill are within the anticipated visual experience of a main road corridor, and overall would have a minor change on the visual environment of the intersection. ▪ The amendments are not uncharacteristic of the landscape character zone.	Not applicable. The EIS Project did not include changes to the Golden Highway.	Low
Open, agricultural landscape	Low (As determined in the LCVIA).	Low (no change)	Low (As determined in the LCVIA).	Low (no change) ▪ Some trees to be removed are mature and contribute to the landscape character of the road. ▪ Most trees to be removed are single, isolated trees; some are grouped together. Tree removal would be apparent, particularly initially. ▪ The proposed road widening and associated realignment of the road are within the anticipated visual experience of a road corridor. ▪ Although tree removal would change the visual environment, the amendments are not uncharacteristic of a road corridor. ▪ Trees to be removed are near the existing road edge. Trees beyond the construction zone would be retained and maintain the overall character of the road corridor.	Low (As determined in the LCVIA).	Low (no change)
Dense forested landscape	Low (As determined in the LCVIA).	Low (no change)	Very Low (As determined in the LCVIA).	Moderate ▪ There would be a noticeable change to the character of Wollara Road through the removal of tall native trees and shrubs within the road corridor for 4.7 km, and sealing of the road. ▪ Native vegetation would still flank both sides of the road, enclosing and restricting the view to the road corridor; however, the view within the road corridor would be wider, featuring more sky and less overhead canopy, and the new sealed road would be a prominent feature. ▪ The changes would be permanent.	Very low (As determined in the LCVIA).	Low (Increases from Very Low)

4 Visual impact with amendments

4.1 Amendments that may affect views

As shown in Table 2-1, the following amendments to the EIS Project may affect views:

- Golden Highway/Ringwood Road intersection upgrade.
- Upgrade to part of Ringwood Road (around 3.4 km).
- Upgrade to part of Wollara Road (around 4.7 km).
- Decentralised BESS
- Project layout modifications (removal and relocation of solar panels)
- Increased width to two internal roads

4.2 Assessment viewpoints

Solar farm

The amendments associated with the decentralised BESS, layout modifications, and internal roads, would occur within the EIS Project Development Footprint (the solar farm). The LCVIA identified five residences (R3, R5, R9, R21, R46) and one public road (Wollara Road) within 4 km of the Development Footprint which required 'detailed assessment'[4]. Two of those viewpoints (R9 and R21) were subsequently eliminated from the detailed assessment, as vegetation obstructed views toward the Project.

As the Amended Project involves removal of trees between R9 and R21 residences and the Project Area, the potential impact to these viewpoints has been re-examined. Table 4-1 describes the changes:

- There was no change in the view of R9 and R21 toward the solar farm due to the Amended Project.
- However, R9 would view the Wollara Road upgrade, and has therefore been included in the assessment of the road upgrade.

Table 4-1: Visibility of R9 and R21

Viewpoint	Original LVIA assessment	With proposed tree clearing on Wollara Road (Amended Project)	
		View of solar farm?	View of Wollara Road upgrade?
R9	Vegetation obstructs the view toward the solar farm. The view from R9 is shown in Figure A-1, Appendix A.	Proposed tree removal along Wollara Road would not affect the view south toward the solar farm.	Proposed tree removal may affect the view east, of Wollara Road at the entry to the property.
R21	Vegetation obstructs the view toward the solar farm. The view from R21 is shown in Figure A-2, Appendix A.	Existing trees in the foreground not affected by proposed tree removal would continue to limit the view toward the solar farm. There is over 2 km of dense trees south of Wollara Road (between Wollara Road and the Development Footprint) that would continue to screen the solar farm.	Proposed tree removal along Wollara Road would not affect the view south toward Wollara Road. Wollara Road is around 10 m or so lower in elevation than the residence, and there is an area of trees (around 150 m wide) between the residence and Wollara Road that would continue to screen Wollara Road.

Road upgrades

In addition to R9, two other viewpoints already identified (R46 and Wollara Road) would potentially have views of the proposed Wollara Road upgrade, and have been included in the assessment.

Other viewpoints in the vicinity of the proposed road upgrades (which did not require 'detailed assessment' in the LVIA) have been investigated to determine if they would have potential views. It was found that:

[4] Viewpoints were identified within 4 km from the proposed development (as per the *Technical Supplement*).

- There were no residences with a view of the proposed Golden Highway / Ringwood Road intersection.
- Road users travelling through the Golden Highway / Ringwood Road intersection would see the upgrade.
- There are five Ringwood Road residences (not previously identified in the LCVIA) with a potential view of the proposed Ringwood Road upgrade (R11, R12, R13, R14 and R15). These residences have similar characteristics and are assessed as a 'representative viewpoint'.
- Road users travelling along Ringwood Road would see the upgrade.
- In addition to R9, there are new Wollara Road residences (not previously identified in the LCVIA) which would have potential views of the Amended Project (being the Wollara Road upgrade): R22, R29, R32, R39, R41and R44.

Consolidated viewpoints

As a result of the above investigations there are now a total of 14 viewpoints to be assessed: 10 private residential viewpoints along Wollara Road (three of which were previously assessed), one viewpoint representing residences along Ringwood Road, and three viewpoints representing users of public roads). A consolidated list of viewpoints is shown in Table 4-2. Wollara Road residential receivers are mapped on Figure 4-1 and Figure 4-2.

Table 4-2: Consolidated viewpoints for assessment

Type of viewer	Receiver number	Aspect of Amended Project potentially in view			
		Solar Farm	Ringwood Road upgrade	Wollara Road upgrade	Golden Highway / Ringwood Road intersection
Private residential	R3	Originally assessed for views of solar farm	No	No	No
	R5	Originally assessed for views of solar farm	No	No	No
	R9	Previously identified, however, eliminated from detailed assessment	No	Included in this addendum for impact of Wollara Road upgrade.	No
	R22	New viewpoint. Not previously assessed.	No	Included in this addendum for impact of Wollara Road upgrade.	No
	R29	New viewpoint. Not previously assessed.	No	Included in this addendum for impact of Wollara Road upgrade.	No
	R32	New viewpoint. Not previously assessed.	No	Included in this addendum for impact of Wollara Road upgrade.	No
	R39	New viewpoint. Not previously assessed.	No	Included in this addendum for impact of Wollara Road upgrade.	No
	R41	New viewpoint. Not previously assessed.	No	Included in this addendum for impact of Wollara Road upgrade.	No
	R44	New viewpoint. Not previously assessed.	No	Included in this addendum for impact of Wollara Road upgrade.	No
	R46	Originally assessed for views of solar farm.	No	Included in this addendum for impact of Wollara Road upgrade.	No
	Ringwood Rd residences (representative)	No. New viewpoint. Not previously assessed.	New viewpoint. Included in this addendum for impact of Ringwood Road upgrade.	No	No
Public	Ringwood Rd users	No. New viewpoint. Not previously assessed.	New viewpoint. Included in this addendum for impact of Ringwood Road upgrade.	No	No
	Wollara Road users	Originally assessed for views of solar farm.	No	Included in this addendum for impact of Wollara Road upgrade.	No
	Golden Hwy / Ringwood Rd intersection users	No. New viewpoint. Not previously assessed.	No	No	Included in this addendum for impact of Golden Hwy / Ringwood Rd upgrade.

Figure 4-1
Receivers - Wollara Road

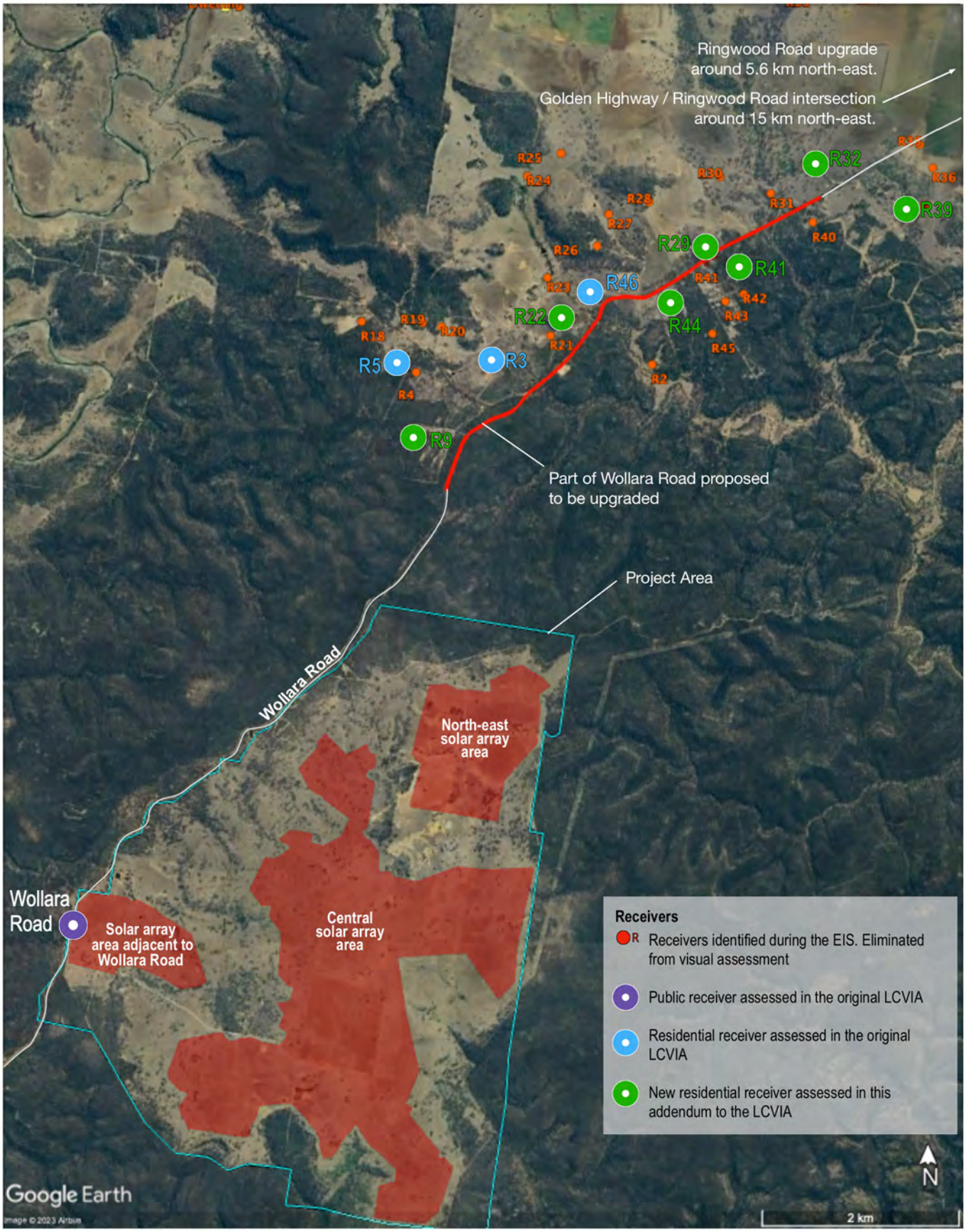

Figure 4-2
Receivers - Ringwood Road

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4.3 Assessment of impact

The assessment of visual impact to the 14 viewpoints is presented in Table 4-3. The key points are:

- Sensitivity: Viewpoint sensitivity is presented in Column A:
  - There is no change to the rating of sensitivity for the four originally assessed viewpoints (R3, R5, R46 and Wollara Road).
  - Viewpoint sensitivity rating for the additional seven Wollara Road viewpoints (R9, R22, R29, R32, R39, R41 and R44) was determined using Tables 5, 6 and 7 of the *Technical Supplement*. Sensitivity was determined as *low or very low.*
  - Viewpoint sensitivity for Ringwood Road residents (representative viewpoint) was determined as *low.*
  - Viewpoint sensitivity for the two new public road user viewpoints (Ringwood Road and the Golden Highway/Ringwood Road intersection) was determined as *very low.*
- Magnitude: The assessment of magnitude is presented in Column B:
  - There is no change to the rating of magnitude for the four originally assessed viewpoints.
  - The magnitude rating for the additional seven Wollara Road residential viewpoints, and the representative Ringwood Road residential viewpoint was determined as *low.*
  - The magnitude rating for the two new public road user viewpoints (Ringwood Road and the Golden Highway/Ringwood Road intersection) was determined as *low*.
- Visual impact: The overall rating of visual impact of the Amended Project is presented in Column C:
  - There is no change to the visual impact rating for the four originally assessed viewpoints.
  - The visual impact rating for the additional seven Wollara Road residential viewpoints is *low.*
  - The visual impact rating for the representative Ringwood Road residential viewpoint is *low.*
  - The visual impact rating for the additional two public viewpoints(that would see the proposed Ringwood Road upgrade or Golden Highway / Ringwood Road upgrade) is *very low.*

Table 4-3: Updated visual impact assessment – Project with amendments

Viewpoint		Column A Visual sensitivity rating		Column B Visual magnitude rating		Column C Visual impact rating		Column D Residual impact rating	
		LCVIA	Amended Project	LCVIA	Amended Project	LCVIA	Amended Project	LCVIA	Amended Project
Private residences	R3	Moderate	Moderate	Very low	Very Low (no change) ▪ The Amended Project would not affect the cell count of the 'modelled view' of the EIS Project. Therefore, there is no change to the original rating of magnitude. ▪ Although there would be tree removal along Wollara Road, an area of trees (over 450 m wide) would remain between the residence and Wollara Road reserve. Therefore, the proposed Wollara Road upgrade would not be seen from the residence.	Low	Low (no change)	Low	Low (no change)
	R5	Moderate	Moderate	Very low	Very Low (no change) ▪ The Amended Project would not affect the cell count of the 'modelled view' of the EIS Project Therefore, there is no change to the original rating of magnitude. ▪ The residence is over 3 km from Wollara Road and there are tall trees between the residence and the road reserve. Therefore, the proposed Wollara Road upgrade would not be seen from the residence.	Low	Low (no change)	Low	Low (no change)
	R9	N/A	Low There is a secondary view from the rural dwelling toward Wollara Road which includes forested landscape.	N/A	Low The residence is around 530 m from Wollara Road. There may be a minor change to the existing view east because of proposed tree removal. There may be a larger section of Wollara Road seen, and therefore, more traffic visible from the residence. However, overall, there would be a minor change to the view.	N/A	Low	N/A	Low
	R22	N/A	Low It has been assumed there would be a secondary view from the rural dwelling toward Wollara Road which would include forested landscape.	N/A	Low The residence is over 340 m from Wollara Road. There would be a minor change to the existing view east because of proposed tree removal. There may be a larger section of Wollara Road seen, and therefore, more traffic visible from the residence, however, overall, there would be a minor change to the view.	N/A	Low	N/A	Low
	R29	N/A	Low It has been assumed there would be a secondary view from the rural dwelling toward Wollara Road which would include forested landscape	N/A	Low The residence is around 90 m from Wollara Road. There is an area of trees (around 50 m wide) between the residence and the road, however, it is likely Wollara Road would be seen beyond the trees. There would be a change to the existing view south-east because of proposed tree removal within the road reserve, however, overall, there would be a minor change to the view.	N/A	Low	N/A	Low
	R32	N/A	Low It has been assumed there would be a secondary view from the rural dwelling toward	N/A	Low The residence is around 250 m from Wollara Road. There are relatively few trees between the residence and the road reserve. There would be a change to the existing view south to south-east because of proposed tree removal. There would be a larger section of the road seen, and therefore, more traffic	N/A	Low	N/A	Low

Viewpoint		Column A Visual sensitivity rating		Column B Visual magnitude rating		Column C Visual impact rating		Column D Residual impact rating	
		LCVIA	Amended Project	LCVIA	Amended Project	LCVIA	Amended Project	LCVIA	Amended Project
			Wollara Road which would include forested landscape		visible from the residence, however, overall, there would be a minor change to the view.				
	R39	N/A	Low It has been assumed there would be a secondary view from the rural dwelling toward Wollara Road which would include forested landscape	N/A	Low Wollara Road is over 500 m from the residence, however, there are relatively few trees between the residence and the road reserve. There would be a change to the existing view west because of proposed tree removal. There would be a larger section of the road seen, and therefore, more traffic visible from the residence, however, However, overall, there would be a minor change to the view.	N/A	Low	N/A	Low
	R44	N/A	Low It has been assumed there would be a secondary view from the rural dwelling toward Wollara Road which would include forested landscape	N/A	Low The residence is over 120 m from Wollara Road. There are relatively few trees between the residence and the road reserve. There would be a change to the existing view north to north-west because of proposed tree removal. There would be a larger section of the road seen, and therefore, more traffic visible from the residence, however, overall, there would be a minor change to the view.	N/A	Low	N/A	Low
	R46	Moderate	Moderate	Very low	Very Low (no change) ▪ The Amended Project does not affect the cell count of the 'modelled view' of the EIS Project. Therefore, there is no change to the original rating of magnitude. ▪ Although there would be tree removal along Wollara Road, an area of trees (around 180 m wide) would remain between the residence and Wollara Road reserve. Therefore, the proposed Wollara Road upgrade would not be seen from the residence.	Low	Low (no change)	Low	Low (no change)
	Ringwood Road residential (repres-entative)	N/A	Low It has been assumed there would be a secondary view from the rural dwelling toward Ringwood Road which would include the open, agricultural landscape.	N/A	Low ▪ The five residences range from around 100 m to 300 m to the road corridor. ▪ The road corridor is generally at a lower elevation compared to the residence, and it is likely the road would not be prominent in views. ▪ All residences have trees surrounding the residence, or between the residence and the road corridor, that would be retained. ▪ Tree removal would not result in a significant change to the view. It would be unlikely to increase the extent of road surface in view. It may open the view slightly to agricultural landscape.	N/A	Low	N/A	Low
Public	Ringwood Road	N/A	Very low Local sealed road with view of open, agricultural landscape.	N/A	Low ▪ Ringwood Road users would initially notice removal of mature trees, however, visual changes associated with road upgrades (such as the widened road surface, and realignment of the road) are an expected experience for road users and, would be unlikely to significantly impact views.	N/A	Very low	N/A	Very low

Viewpoint		Column A Visual sensitivity rating		Column B Visual magnitude rating		Column C Visual impact rating		Column D Residual impact rating	
		LCVIA	Amended Project	LCVIA	Amended Project	LCVIA	Amended Project	LCVIA	Amended Project
	Wollara Road	Low	Low	Very high	Very high (no change) ▪ The visual magnitude cell count of the 'modelled view' of the EIS Project, was 'very high'. This is the highest magnitude rating (as per the *Technical Supplement*). ▪ The Amended Project reduces the extent of solar panels that would be in view (due to relocation of panels from the TSR). However, as the originally modelled view represents a 'worst-case scenario' and was used as the basis to develop the landscape plan. the 'modelled view' has not been updated. ▪ However, the following visual differences associated with the Amended Project are noted compared to the EIS Project: o The proposed decentralised BESS units, although a similar height to the solar panels, would be lighter in colour and contrast to the darker panels, and be seen within the solar array. o One of the wider internal roads may be partly seen; however, it would not be prominent. ▪ Tree removal along the 4.7 km section of Wollara Road to be upgraded would be clearly apparent and adversely affect the scenic experience for many road users. The extent of trees to be removed would change the view - from an enclosed, tree-lined, unsealed road corridor to a wider, more open, sealed road corridor.	Moderate	Moderate (no change)	Moderate	Moderate (no change)
	Golden Hwy / Ringwood Rd intersection	N/A	Very low The Golden Highway is a classified main road.	N/A	Low ▪ Views of the intersection for road users would be brief and temporary. ▪ Proposed tree removal would be apparent, at least initially, to regular travellers using the intersection. ▪ However, visual changes associated with highway upgrades (such as the proposed new acceleration lane and widened road surface) are an expected experience for road users of a main road and, would be unlikely to impact views.	N/A	Very low	N/A	Very low

N/A – Not applicable. This viewpoint did not require 'detailed assessment' in the LCVIA

4.4 Performance objectives and mitigation

There is no change to the EIS Project assessment which found the Wollara Road public viewpoint (with a moderate visual impact rating) was the only viewpoint requiring mandatory consideration against the 'performance objectives' in the *Technical Supplement*.

Draft landscape plan

To address 'performance objectives', the EIS Project assessment included a draft landscape plan (presented in the LCVIA as Figure 6-11).

Due to the relatively minor amendments, there is no change to the intended landscape strategy or draft planting schedule. The draft landscape plan would be finalised as part of management plans, including adjustment of any fencing to accommodate the proposed landscaping.

Additional mitigation measures

Mitigation measures were included in the LCVIA and are shown in Column A, Table 4-4. Additional mitigation measures, including clarification of measures associated with the landscape plan, have been added to address impacts associated with the Amended Project, as shown in Column B, Table 4-4.

Lighting

There is no change to operational lighting from the EIS Project, however, the proposed road upgrades increase the construction zone, and likelihood for lighting during construction. To reduce the potential impact of construction light, mitigation measures included in the EIS Project assessment (to address potential dark sky impacts) are applicable and should be implemented for the Amended Project.

4.5 Residual visual impact

The residual visual impact of the Amended Project is presented in Column D, Table 4-3, and shows:

- There is no change to the residual visual impact rating for the four originally assessed viewpoints. A photomontage of Wollara Road with proposed mitigation screening was included in the LCVIA and showed the likely effectiveness of proposed landscaping, reducing the magnitude rating from very high (67 cells) to very low (3 cells), and the visual impact from *moderate* to *very low.*
- The residual visual impact rating for the additional seven Wollara Road residential viewpoints (that would see the Wollara Road upgrade) and the representative Ringwood Road residential viewpoint is *low,* consistent with the visual impact determined following construction.
- The residual visual impact rating for the two additional public viewpoints (that would see the proposed Ringwood Road upgrade or Golden Highway / Ringwood Road upgrade) is *very low,* consistent with the visual impact determined following construction.

4.6 Cumulative visual impact

There is no change to the LCVIA of cumulative impact. The Amended Project would increase the area affected by construction; however, construction would be temporary and road upgrades would occur within existing road corridors. Following construction there would be no ongoing visual connection or association between the upgraded roads and the solar farm.

Table 4-4: Mitigation measures

Intent	Timing	Column A Original mitigation measures	Column B Additional mitigation measures to address Amended Project
Avoid night sky impacts	Design	- Design and install lighting to follow best practice lighting principles identified within the Dark Sky Planning Guidelines [5]: 1. Eliminate upward spill light 2. Direct light downwards, not upwards 3. Use shielded fittings 4. Avoid 'over' lighting 5. Switch lights off when not required 6. Use energy efficient bulbs 7. Use asymmetric beams, where floodlights are used 8. Ensure lights are not directed towards reflective surfaces 9. Use warm white lighting colours.	No change
	Construction	- Ensure all lights are turned off before vacating the construction site at the end of the day. - Lighting to be installed in accordance with AS4228-1997 - Control of Obtrusive Effects of Outdoor Lighting.	No change
	Operation	- Switch lights off when not required. - Ensure lights are only used in exceptional circumstances – emergency or security situations.	No change
Reduce visibility and contrast of Project in the landscape	Design	- Select an inconspicuous colour for the office/storage containers if possible, so they are darker in colour and less prominent[6]. Dark grey is generally considered a good colour for ancillary infrastructure. - Fences surrounding the solar modules should have a dulled finish to reduce contrast. Do not install highly reflective materials.	- Subsequent to project approval, as part of the management plans, the draft landscape plan would be refined, detailed and finalised, including adjustment of any fencing to accommodate the proposed landscaping. - The aim of the detailed landscape plan is to establish a quick growing, dense screen to reduce public views of the solar panels from Wollara Road, as well as providing additional ecological benefits. - The detailed landscape plan is to be: ▪ Prepared prior to landscape implementation. ▪ Be guided by ongoing consultation with NP&WS, Upper Hunter Shire Council and TfNSW (particularly regarding plant species, spacing, and whether soil improvement is required and road safety measures/tree clearance zones and TFNSW relevant policy).
	Construction	- Locate the construction compound, vehicle parking and equipment storage areas, in the vicinity of the Post War homestead (as shown on Project Area plans) so they are set back from Wollara Road and partially (or fully) screened from view (from Wollara Road) via existing vegetation or landform. - Keep site tidy and neat. - If soils are disturbed (e.g., during the construction of internal roads or due to wear and tear of surfaces from vehicle movement), introduce wind erosion controls to reduce the potential for dust: ▪ bring water cart to site and water exposed surfaces ▪ avoid ground disturbance on high wind days - cover stockpiles of loose materials (if any).	- Implement the detailed landscape plan. - Progressively stabilise surfaces as construction is completed.

[5] Australian Government, Department of the Environment and Energy, *National Light Pollution Guidelines for Wildlife*, January 2020 and New South Wales Department of Planning & Environment, *The Dark Sky Planning Guideline*, 2023

[6] Inverters and other larger facility components that are colour-treated two to three shades darker than the background landscape colour, better match the surroundings and decrease their visibility and contrast. White is generally the most conspicuous colour. Lighter colours should be avoided.

Intent	Timing	Column A Original mitigation measures	Column B Additional mitigation measures to address Amended Project
	Operation	- Do not install commercial messages or large-scale signage. Signage (if required) should be of sufficient size to contain only information sufficient for the basic facility and company identification, for safety, navigation, and delivery purposes.	- Implement ongoing maintenance of landscaping as detailed in the landscape plan. - Monitor road upgrade to ensure the stabilisation of verges. - Implement correctional measures if erosion occurs or dust is an issue.
Minimise impact to existing landscape character	Design	- Retain as much existing vegetation within the solar farm Project Area as possible.	- Retain trees where possible within/near the road upgrade construction zone.
	Construction	- Protect existing trees (that are to be retained) during construction activities.	- Protect trees within/near the road upgrade construction zone in accordance with TfNSW guidelines *(Vegetation Management (Protection and Removal) Guideline. DMS-SD-111)*. - Replace native trees to be removed at the Ringwood Road upgrade, and the Golden Highway / Ringwood Road intersection, in accordance with TfNSW guidelines (*Vegetation Offset Guide DMS-SD-087*).
	Operation		- Monitor disturbed trees that have been heavily impacted within their root zone for stability and longevity. - Stabilise exposed surfaces.

5 Key findings

5.1 Summary of visual changes

The Amended Project would result in the following *visible* changes compared to the originally assessed Project:

- Tree clearing, earthworks and road widening associated with an upgrade of the Golden Highway / Ringwood Road intersection.
- Road widening, realignment, and likely removal of around 20 trees along Ringwood Road at the location of the upgrade. Some trees to be removed are mature native trees.
- Tree clearing, vegetation removal, realignment and bitumen surfacing of a 4.7 km unsealed section of Wollara Road.
- Option for decentralised BESS units throughout all three (originally identified) solar array areas.
- Minor relocation of solar panels within the solar array area adjacent to Wollara Road.
- Increased width of an internal access road within the solar farm.

The following proposed amendments would not be seen:

- Increased capacity of centralised BESS (located near the Project substation)
- Relocation of solar array to avoid threatened species habitat (located in the north-eastern solar array area)
- One of the widened internal roads (located between the central and north-east solar array areas).
- Construction of an additional transmission tower (located near the substation).

5.2 Landscape character impact with amendments

Additional landscape character zone

A new 'Golden Highway' landscape character zone has been added to the assessment, as the proposed Golden Highway / Ringwood Road intersection upgrade is beyond the two originally described landscape character areas. The intersection is within a distinct landscape character zone centred along the highway.

Landscape sensitivity

There was no change to the *low* rating of landscape sensitivity for the two original landscape character zones. The Golden Highway character zone was determined by this assessment to have *low* sensitivity.

Landscape magnitude to change

The magnitude of change to landscape character from the Amended Project:

- Remains at *low* within the open agricultural landscape zone. The Amended Project would not exacerbate the extent of visual change to occur in the landscape.
- Increases to *moderate* (from *very low*) along the road corridor within the dense, forested landscape zone due to proposed tree removal, widening and sealing of Wollara Road. Although native vegetation would still flank both sides of the road, visual character would change from a narrower enclosed landscape with an unsealed road; to a more open landscape, with a wider, sealed, road.
- Is assessed as *low* within the Golden Highway landscape zone. Removal of trees, road widening, cut and fill would have a minor change overall on the visual environment of the intersection.

Impact to landscape character

Landscape character findings are summarised in Table 5-1. The overall rating of impact to each landscape character zone from the Amended Project is determined as:

- *low* within the open agricultural landscape character zone (no change from the LCVIA)
- *low* within the dense, forested landscape character zone (increasing from *very low* in the LCVIA)
- *low* within the Golden Highway landscape character zone.

Table 5-1: Summary of assessment of landscape character impacts

Landscape character zone	Column A Sensitivity	Column B Magnitude of change		Column C Landscape Character Impact	
		LCVIA	Amended Project	LCVIA	Amended Project
Open, agricultural landscape	Low	Low	Low	Low	Low
Dense forested landscape	Low	Very Low	Moderate	Very low	Low
Golden Highway landscape	Low	Not applicable	Low	Not applicable	Low

5.3 Visual impact with amendments

Viewpoints

The LCVIA identified viewpoints within 4 km of the Project Area and determined four viewpoints (three residences: R3, R5 and R46); and one public receiver: Wollara Road users) required 'detailed assessment'[7]. In this Addendum, viewpoints within 4 km of the Project Area that were previously eliminated from 'detailed assessment', as well as viewpoints beyond 4 km of the Project Area, were re-examined to determine if there would be potential views of the Amended Project.

Ten additional viewpoints have subsequently been identified for detailed assessment in this Addendum:

- Seven additional Wollara Road residential receivers (R9, R22, R29, R32, R39, R41 and R44)
- One representative Ringwood Road residential viewpoint (representing five Ringwood Road residences (R11, R12, R13, R14 and R15), and
- Two public road user viewpoints (Ringwood Road users and Golden Highway / Ringwood Road intersection users).

There is now a total of 14 viewpoints assessed in this addendum.

Viewpoint sensitivity

There is no change to the rating of sensitivity for the four originally assessed viewpoints.

Viewpoint sensitivity ratings for the additional viewpoints have been determined to be *low* or *very low* for the seven residences and *very low* for the two public road viewpoints.

Magnitude

There is no change to the rating of magnitude for the four originally assessed viewpoints.

The magnitude rating for the additional residential and public road user viewpoints was determined as *low*.

Visual impact

There is no change to the visual impact rating for the four originally assessed viewpoints. The visual impact rating for the additional eight viewpoints was determined as:

- *low* for the additional seven residences (that would see the proposed Wollara Road upgrade) and the viewpoint representative of Ringwood Road residences.
- *very* low for the two additional public road user viewpoints (that would see the proposed Ringwood Road upgrade or Golden Highway / Ringwood Road upgrade).

[7] Detailed assessment as per the *Technical Supplement*. Originally five receivers within 4 km of the Project required 'detailed assessment', however, two were subsequently eliminated as vegetation obstructed views.

Visual impact findings are summarised in Table 5-2.

Table 5-2: Summary of visual impact assessment impacts

Viewpoint		Column A Visual sensitivity rating		Column B Visual magnitude rating		Column C Visual impact rating		Column D Residual impact rating	
		LCVIA	Amended Project	LCVIA	Amended Project	LCVIA	Amended Project	LCVIA	Amended Project
Private residences	R3	Moderate	Moderate	Very low	Very Low	Low	Low	Low	Low
	R5	Moderate	Moderate	Very low	Very Low	Low	Low	Low	Low
	R9	N/A	Low	N/A	Low	N/A	Low	N/A	Low
	R22	N/A	Low	N/A	Low	N/A	Low	N/A	Low
	R29	N/A	Low	N/A	Low	N/A	Low	N/A	Low
	R32	N/A	Low	N/A	Low	N/A	Low	N/A	Low
	R39	N/A	Low	N/A	Low	N/A	Low	N/A	Low
	R44	N/A	Low	N/A	Low	N/A	Low	N/A	Low
	R46	Moderate	Moderate	Very low	Very Low	Low	Low	Low	Low
	Ringwood Road residential	N/A	Low	N/A	Low	N/A	Low	N/A	Low
Public	Ringwood Road	N/A	Very low	N/A	Low	N/A	Very low	N/A	Very low
	Wollara Road	Low	Low	Very high	Very high	Moderate	Moderate	Moderate	Moderate
	Golden Highway / Ringwood Road intersection	N/A	Very low	N/A	Low	N/A	Very low	N/A	Very low

5.4 Performance objectives

There is no change to the LCVIA which determined that the Wollara Road viewpoint (with a moderate visual impact rating) is the only viewpoint requiring mandatory assessment against the *Technical Supplement* 'performance objectives'.

The draft landscape plan prepared to address those performance objectives has been prepared and would be detailed prior to implementation of the Project to reflect the final solar farm layout, and additional mitigation measures have been recommended to address impacts associated with the Amended Project, including removal of trees associated with road upgrades.

There is no change to the findings of cumulative visual impact associated with the Amended Project.

6 References

Australian Government, Department of the Environment and Energy, *National Light Pollution Guidelines for Wildlife*, January 2020.

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New South Wales Department of Planning and Environment, August 2022, *Technical Supplement – Landscape and Visual Impact Assessment. Large-Scale Solar Energy Guideline.*

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Transport for NSW, 2020, *Guideline for Landscape Character and Visual Impact Assessment - Environmental Impact Assessment Guidance Note EIA–N04'*

Transport for NSW, 2022, *Vegetation Management (Protection and Removal) Guideline. DMS-SD-111.*

Transport for NSW, 2022, *Vegetation Offset Guide. DMS-SD-087.*

Appendix A

Figure A - 1: Existing view from R9 looking toward the Project Area (8 February 2023)

Figure A - 2: Existing view from R21 looking toward the Project Area (8 February 2023)

APPENDIX J

Aboriginal Cultural Heritage Assessment Report

Axe grinding groove site at Killoe Creek (37-1-1033 [Killoe Creek GG1]).

ADDENDUM ABORIGINAL CULTURAL HERITAGE ASSESSMENT REPORT

GOULBURN RIVER SOLAR FARM

UPPER HUNTER LOCAL GOVERNMENT AREA, NSW

DECEMBER 2023

Report prepared by

OzArk Environment & Heritage

for Umwelt (Australia)

on behalf of Lightsource Development Services Australia Pty Ltd

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Heritage NSW

ABORIGINAL CULTURAL HERITAGE ASSESSMENT REPORT COVER SHEET

Report Title	Addendum Aboriginal Cultural Heritage Assessment Report: Goulburn River Solar Farm
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Address of Subject Area	Local Government Area: Upper Hunter
Report prepared for	Company Name: Lightsource Development Services Australia Pty Ltd Contact Person: Diana Mitchell Address: Level 29, 420 George Street, Sydney. NSW 2000 Email: Diana.mitchell@lightsourcebp.com
Date of Report	December 2023
Use of Report/ Confidentiality	This report is not confidential This report may be used by Heritage NSW in a number of ways including: placing it in a database generally making hard and electronic copies available to the public and communicating the report to the public.
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Ben Churcher, OzArk Environment & Heritage Principal Archaeologist

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DOCUMENT CONTROLS

Proponent	Lightsource Development Services Australia Pty Ltd
Client	Umwelt (Australia)
Document Description	Addendum Aboriginal Cultural Heritage Assessment Report: Goulburn River Solar Farm
File Location	OzArk Job No.
Umwelt Australia\Goulburn River solar farm\Addendum ACHAR	3414

Document Status: V3.0 Final	Date:11 December 2023
OzArk internal edits	V1.0: BD author 18/9/23 V1.1: BC edit 29/9/23
OzArk and client edits	V2.0 BC prepares for client release 16/10/23 V2.1: BC amends with new project description V2.2: BC amends with new project description 9/11/23 V2.3 BC amends with client comments 25/11/23 V2.4 BC amends with new project figures 9/12/23 V2.5 BC amends 10/12/23
Final document	V3.0 BC finalises 11/12/23
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Acknowledgement

OzArk acknowledge the traditional custodians of the area on which this assessment took place and pay respect to their beliefs, cultural heritage, and continuing connection with the land. We also acknowledge and pay respect to the post-contact experiences of Aboriginal people with attachment to the area and to the Elders, past and present, as the next generation of role models and vessels for memories, traditions, culture and hopes of local Aboriginal people.

ABBREVIATIONS AND GLOSSARY

ACHAR	Aboriginal Cultural Heritage Assessment Report. As set out in the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales*, all developments where harm to Aboriginal objects is likely must be assessed in an ACHAR.
ACHCRs	*Aboriginal Cultural Heritage Consultation Requirements for Proponents.* Guidelines for conducting Aboriginal community consultation for developments where harm to Aboriginal objects is likely.
Addendum Study Area	Areas of proposed additional impact related to Wollara and Ringwood Roads and the intersection with the Golden Highway.
AHIMS	Aboriginal Heritage Information Management System. Administered by the DPE, AHIMS is the central register of all Aboriginal sites within NSW.
Code of Practice	*Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* under Part 6 NPW Act. Issued by DECCW in 2010, the Code of Practice is a set of guidelines that allows limited test excavation without the need to apply for an AHIP.
Development Footprint	The area within which all project impacts will be located.
EIS	Environmental Impact Statement. A required document for major projects documenting all potential impacts to the environment, including heritage, that may arise due to the development.
Heritage NSW	Government department tasked with ensuring compliance with the NPW Act. Heritage NSW is advised by the Aboriginal Cultural Heritage Advisory Committee (ACHAC).
Lightsource bp	Lightsource Development Services Australia Pty Ltd
NPW Act	*National Parks and Wildlife Act 1974*. Primary legislation governing Aboriginal cultural heritage within NSW.
RAP	Registered Aboriginal Party. An individual or group who have indicated through the ACHCR process that they wish to be consulted regarding the project.

EXECUTIVE SUMMARY

OzArk Environment and Heritage (OzArk) has been engaged by Umwelt (Australia) Pty Ltd on behalf of Lightsource Development Services Australia Pty Ltd (Lightsource bp) (the proponent) to complete an Addendum Aboriginal Cultural Heritage Assessment Report for several amendments to the original project design as outlined in the Environmental Impact Statement (EIS), associated with the Goulburn River Solar Farm (SSD-33951458) (the Project). The amendments are termed 'the Amended Project' in this report.

The Amended Project is in the Upper Hunter Local Government Area.

Proposed amendments to the Project following public exhibition of the EIS and additional design refinements are summarised below.

1. Transport route amendments and upgrade of the intersection of the Golden Highway and Ringwood Road.
2. Upgrades to additional parts of Wollara Road and Ringwood Road.
3. Increased BESS capacity and option of a decentralised BESS and the choice to host both centralised and decentralised BESS units.
4. Minor modifications to the Development Footprint and internal layout including:
    - Removal of travelling stock route (TSR) 4481 from within the Project Area although site access will remain through the TSR with no access upgrades.
    - Relocation and/or removal of solar arrays within the Development Footprint to avoid Regent Honeyeater Habitat, scattered trees and Box Gum Woodland.
    - Increased width of selected internal access roads to accommodate subterranean power cables
5. Construction of an additional transmission tower adjacent the BESS/substation.

As a result of these modifications the Development Footprint is approximately 792 hectares (ha), a reduction of 7 ha from the EIS.

In 2022–2023 OzArk completed the Aboriginal Cultural Heritage Assessment Report (ACHAR) for the Project (OzArk 2023) and the report was included as part of the Project's EIS. This Addendum ACHAR should be read in conjunction with the ACHAR for the EIS (OzArk 2023).

OzArk 2023 included survey and reporting of upgrades to sections of Wollara Road and Ringwood Road, as well as the landforms proposed for the relocated solar arrays and the additional transmission tower. The upgrade to the intersection of the Golden Highway and Ringwood Road was not included in OzArk 2023. This Addendum ACHAR repeats the results of the upgrades to sections of Wollara Road and Ringwood Road to remain consistent with other specialist reports discussing the Amended Project.

The Addendum study area includes the intersection of the Golden Highway with Ringwood Road, located approximately seven kilometres from Merriwa and the current road corridor along Ringwood Road and Wollara Road, connecting the Project area with the Golden Highway. The Addendum study area also includes landforms proposed for the realigned Development Footprint, the relocated solar arrays, and the additional transmission tower that are located within the previously assessed Development Footprint.

Survey of the Wollara Road and Ringwood Road portions of the Addendum study area, as well as the landforms proposed for the realigned Development Footprint, the relocated solar arrays, and the additional transmission tower, took place with the assistance of representatives from Registered Aboriginal Parties (RAPs) in August 2022.

Assessment of the intersection of the Golden Highway with Ringwood Road has been completed at a desktop level using knowledge gained from the survey of identical and contiguous landforms as part of the survey of Ringwood Road, as well as photographs and information provided by ecologists working for the Project who inspected the intersection study area on foot.

The survey of the Development Footprint during 2022 recorded 11 previously unidentified sites consisting of a grinding groove site, four artefact scatters, and six isolated finds.

Within the Addendum study area, a grinding groove site, 37-1-1033 (Killoe Creek GG1), was recorded in 2022. The grinding groove site was recorded approximately 50 metres (m) east of the Killoe Creek crossing, therefore outside the impact area of the Amended Project. It has limited scientific research potential and the significance of the grooves primarily relates to their educational and aesthetic values based on their association with Killoe Creek.

The survey in 2022 identified eight Aboriginal sites within the Development Footprint (OzArk 2023). The Amended Project has realigned the Development Footprint and is able to avoid 37-1-1027 (Redlynch Creek IF1) and this site will no longer be harmed by the Amended Project. This changes Recommendations 2 and 3 in the ACHAR to read:

> ACHAR Recommendation 2 now reads: 37-1-1027 (Redlynch Creek IF1), 37-1-1032 (Ringwood Gully IF6), 37-1-1033 (Killoe Creek GG1), and 37-1-1037 (Rocky Creek Gully OS4) will not be harmed by the Project as they are located the Development Footprint.
>
> ACHAR Recommendation 3 now reads: Seven Aboriginal sites, 37-1-1028 (Rocky Creek Slope IF2), 37-1-1029 (Wollara Road IF3), 37-1-1030 (Monaghans Creek IF4), 37-1-1031 (Rocky Creek Gully IF5), 37-1-1034 (Redlynch Creek OS2), 37-1-1035 (Redlynch Creek OS1), and 37-1-1036 (Redlynch Creek OS3) will be salvaged by a surface collection of visible artefacts. The recommended methodology for the salvage will be set out in the Aboriginal Cultural Heritage Management Plan (ACHMP) and will include the measures outlined in Section 9.2.1 of the ACHAR.

The additional recommendations concerning Aboriginal cultural values associated with the Amended Project build upon those provided in OzArk 2023:

1. 37-1-1027 (Redlynch Creek IF1) and 37-1-1033 (Killoe Creek GG1) will not be harmed by the Amended Project as they are located outside the Development Footprint. The location of these sites must be shown on all applicable Project plans to ensure that they are not inadvertently harmed.
2. Further recording and investigation of the grinding groove site (Killoe Creek GG1) prior to construction activities will be conducted. The methodology of this investigation will be set out in the ACHMP that will be developed following Project approval but will include detailed mapping and photography of the site by a suitably qualified archaeologist.
3. All land-disturbing activities must be confined to within the Development Footprint. Should the parameters of the proposed work extend beyond this, then further archaeological assessment will be required.

CONTENTS

FIGURES

TABLES

1 INTRODUCTION

OzArk Environment & Heritage (OzArk) has been engaged by Umwelt (Australia) Pty Ltd on behalf of Lightsource Development Services Australia Pty Ltd (Lightsource bp) (the proponent) to complete an Addendum Aboriginal Cultural Heritage Assessment Report for proposed amendments associated with the Goulburn River Solar Farm (SSD-33951458) (the Project) (the Amended Project). The Amended Project is in the Upper Hunter Local Government Area (LGA).

This assessment has been completed as an addendum to the *Aboriginal Cultural Heritage Assessment Report – Goulburn River Solar Farm* (ACHAR, OzArk 2023) which reports on the results of the Aboriginal cultural heritage assessment completed for the Project in August 2022. Following the finalisation of the ACHAR, the report was included in the Environmental Impact Statement (EIS) for the Project and placed on public exhibition from Tuesday 13 June 2023 until Monday 10 July 2023.

1.1 BACKGROUND

The ACHAR prepared by OzArk in 2023 formed part of the EIS prepared by Umwelt to accompany an application for development consent for the Goulburn River Solar Farm under Division 4.7 of Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

Assessment of the Amended Project follows the *Secretary's Environmental Assessment Requirements* (SEARs) that were issued for the Project on 1 February 2022. The SEARs indicate that assessment must follow the *Code of Practice for the Investigation of Aboriginal Objects in New South Wales* (the Code of Practice; DECCW 2010a) and the *Aboriginal cultural heritage consultation requirements for proponents* (the ACHCRs; DECCW 2010b).

1.2 ADDENDUM STUDY AREA

The Addendum study area comprises the intersection of the Golden Highway with Ringwood Road, located approximately 7 km from Merriwa and the current road corridor and shoulders along Ringwood Road and Wollara Road, connecting the Project Area with the Golden Highway (**Figure 1-1**). The road corridor crosses two named waterways, the Bow River and Killoe Creek and several smaller ephemeral creeks. The Addendum study area is situated on mostly cleared, flat to gently undulating slopes.

Figure 1-1: Map showing the location of the Addendum study area.

1.3 REFERENCE TO OZARK 2023

OzArk 2023 provides the legislative and archaeological context for the Addendum study area and should be referred to for further information on these subjects.

OzArk 2023 also includes the results of the survey of the Development Footprint that includes the amendments for the BESS design amendments, the realignment of the Development Footprint, the relocation of solar arrays, the increased width of internal access roads, and the installation of a transmission tower and should be referred to for survey data.

OzArk 2023 also documents the survey of Ringwood and Wollar Roads (but not the intersection with the Golden Highway). This data is repeated in this Addendum ACHAR as it applies to the Addendum study area.

1.4 DESCRIPTION OF THE AMENDED PROJECT

Proposed amendments to the Project following public exhibition of the EIS and additional design refinements are summarised below.

1. Transport route amendments and upgrade of the intersection of the Golden Highway and Ringwood Road.
2. Upgrades to additional parts of Wollara Road and Ringwood Road.
3. Increased BESS capacity and option of a decentralised BESS and the choice to host both centralised and decentralised BESS units.
4. Minor modifications to the Development Footprint and internal layout including:
    - Removal of travelling stock route (TSR) 4481 from within the Project Area although site access will remain through the TSR with no access upgrades.
    - Relocation and/or removal of solar arrays within the Development Footprint to avoid Regent Honeyeater Habitat, scattered trees and Box Gum Woodland.
    - Increased width of selected internal access roads to accommodate subterranean power cables
5. Construction of an additional transmission tower adjacent the BESS/substation.

As a result of these modifications the Development Footprint is approximately 792 hectares (ha), a reduction of approximately 7 ha from the EIS.

In terms of Aboriginal cultural heritage, these amendments did not require additional field survey. The reasons for this are set out below.

- Upgrades to the intersection of the Golden Highway and Ringwood Road (Amendment 1) include additional areas that were not previously surveyed. Assessment of the intersection of the Golden Highway with Ringwood Road was able to be completed at a desktop level using knowledge gained from the survey of identical and contiguous landforms as part of the previous survey of Ringwood Road (August 2022), as well as photographs and information provided by Umwelt ecologists who inspected the intersection study area on

foot. Previous survey effort comprised the relevant landforms and as such, no further field survey was required or undertaken.

- Upgrades to Wollara and Ringwood Road (Amendment 2) include areas that were part of the original survey completed by OzArk in August 2022 (termed the Access Route). The August 2022 survey included the road corridor of Ringwood and Wollara Roads from the Golden Highway to the Development Footprint (**Figure 1-1**). This survey included the waterway crossings associated with the Bow River and Killoe Creek, as well as several unnamed waterway crossings. In addition, several spot checks were undertaken in landforms along the road corridor that are more distant to waterways. Previous survey effort covers this amendment and as such, no further field survey was required or undertaken.

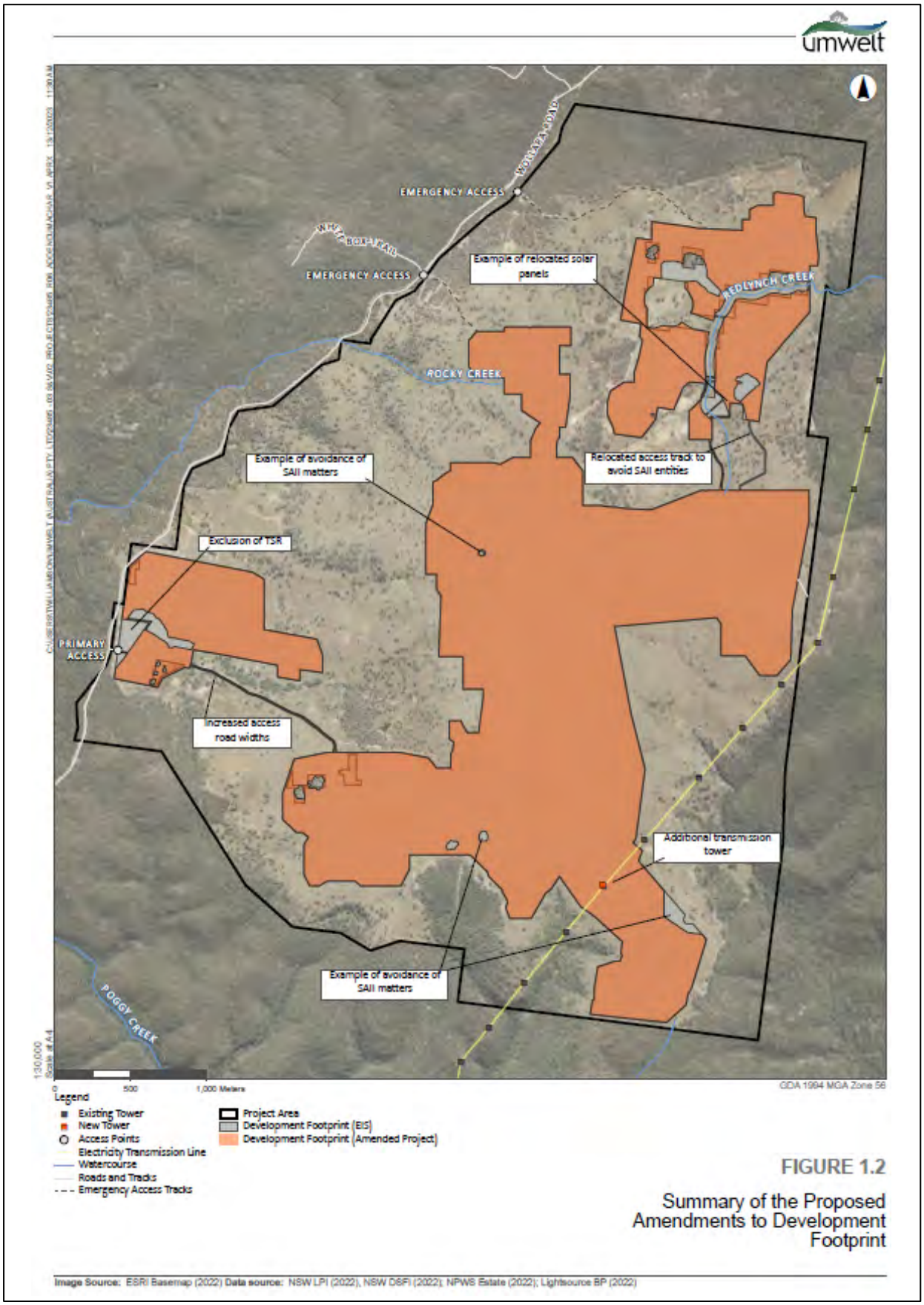
- Amendments 3 to 5 are located within the Development Footprint that was fully assessed by pedestrian survey during August 2022. As no unsurveyed landforms are impacted by these amendments, no further survey was required or undertaken.

OzArk assessed the Access Route from the Golden Highway to the Development Footprint, as well as the Development Footprint itself in the ACHAR (OzArk 2023).

The Addendum ACHAR specifically addresses the amendments to the Project, but the survey results will remain unchanged. Recommendations contained in the ACHAR have been altered to account for the fact that the realigned Development Footprint and is able to avoid 37-1-1027 (Redlynch Creek IF1) and this site will no longer be harmed by the Amended Project. In addition, a new recommendation is made based on the Heritage NSW submission on the ACHAR made during the consultation period that further recording and investigation by a suitably qualified archaeologist of the grinding groove site 37-1-1033 (Killoe Creek GG1) takes place prior to construction activities.

Details of each of the key changes associated with the Amended Project are described below and a summary of the amendments are shown on **Figure 1-2**.

Figure 1-2: Summary of proposed amendments.

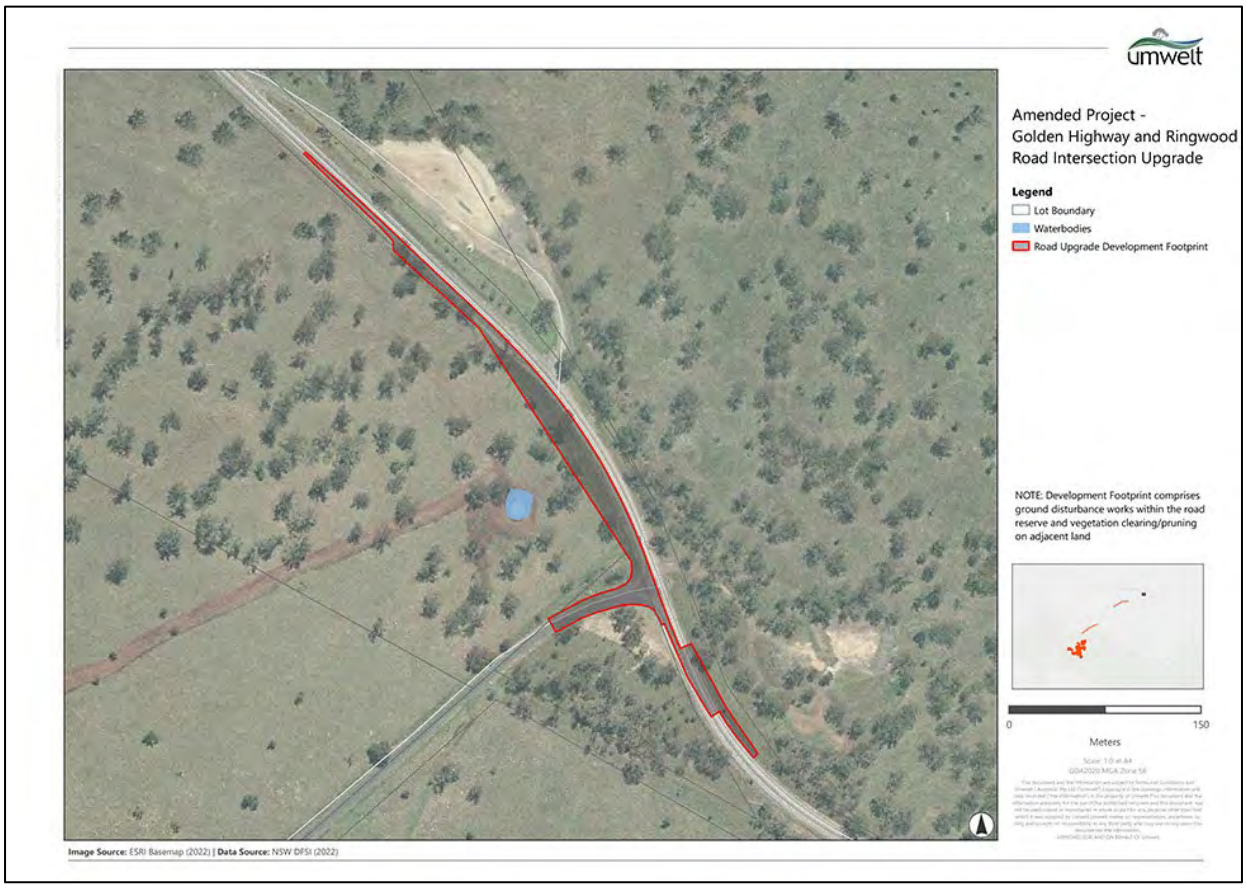


1.4.1 Golden Highway and Ringwood Road intersection upgrade

The proponent proposes an upgrade to the intersection of the Golden Highway and Ringwood Road in line with Austroads Safe Intersection Site Distance (SISD) standards. These upgrades would include (**Figure 1-3**):

- Pruning and removal of vegetation and select trees on the western side of the intersection on Lot 1 DP34496. Currently estimated at six established trees
- The construction of a 325 m acceleration/merge lane to allow vehicles to safely turn left onto the Golden Highway from Ringwood Road (Lot 1 DP34496)
- Realignment of the existing low voltage power line to provide clearance to the acceleration lane (if required and subject to detailed design)
- Extension of the existing Golden Highway westbound and Ringwood Road left-in deceleration lane taper to 30 m and widening of the intersection
- Pruning of vegetation on the eastern side of the intersection wholly within the road reserve
- Formalisation of the informal bus stop on Ringwood Road at the intersection with Golden Highway (Lot 7303 / DP 1146691).

Figure 1-3: Indicative Golden Highway and Ringwood Road intersection upgrade.



1.4.2 Wollara and Ringwood Roads upgrades

The proponent is proposing additional road upgrades as community benefits under the Voluntary Planning Agreement with the Upper Hunter Shire Council. These works would also facilitate further improvements to enable the safe movement of heavy vehicles associated with the Project. The proposed upgrades include:

- Realignment, widening and sealing an additional 1.6 km section of Ringwood Road between Killoe Creek and Binks Road
- Realignment, widening and sealing a 4.7 km unpaved section of Wollara Road between the Goulburn River National Park boundary and 1621 Wollara Road. No upgrades are proposed in the portion of Wollara Road within the Goulburn River National Park.

The proposed road upgrades are shown on **Figure 1-4** and **Figure 1-5**.

The existing condition of these roads comprise:

- Ringwood Road – a local road that is sealed and generally flat with low vertical grades and varying road width and a maximum road width of approximately 5 m along the alignment
- Wollara Road – a local road that comprises a combination of sealed and unsealed sections north of the site and unsealed sections south of the site. The road width varies along the length of the road.

These upgrades will include 8 m bitumen-sealed formation with a minimum of 500 millimetre (mm) unsealed shoulders. The horizontal and vertical alignment of the proposed road will ensure safe sight distance and an improved road network for the users.

Figure 1-4: Proposed additional upgrade works along Wollara and Ringwood Roads.

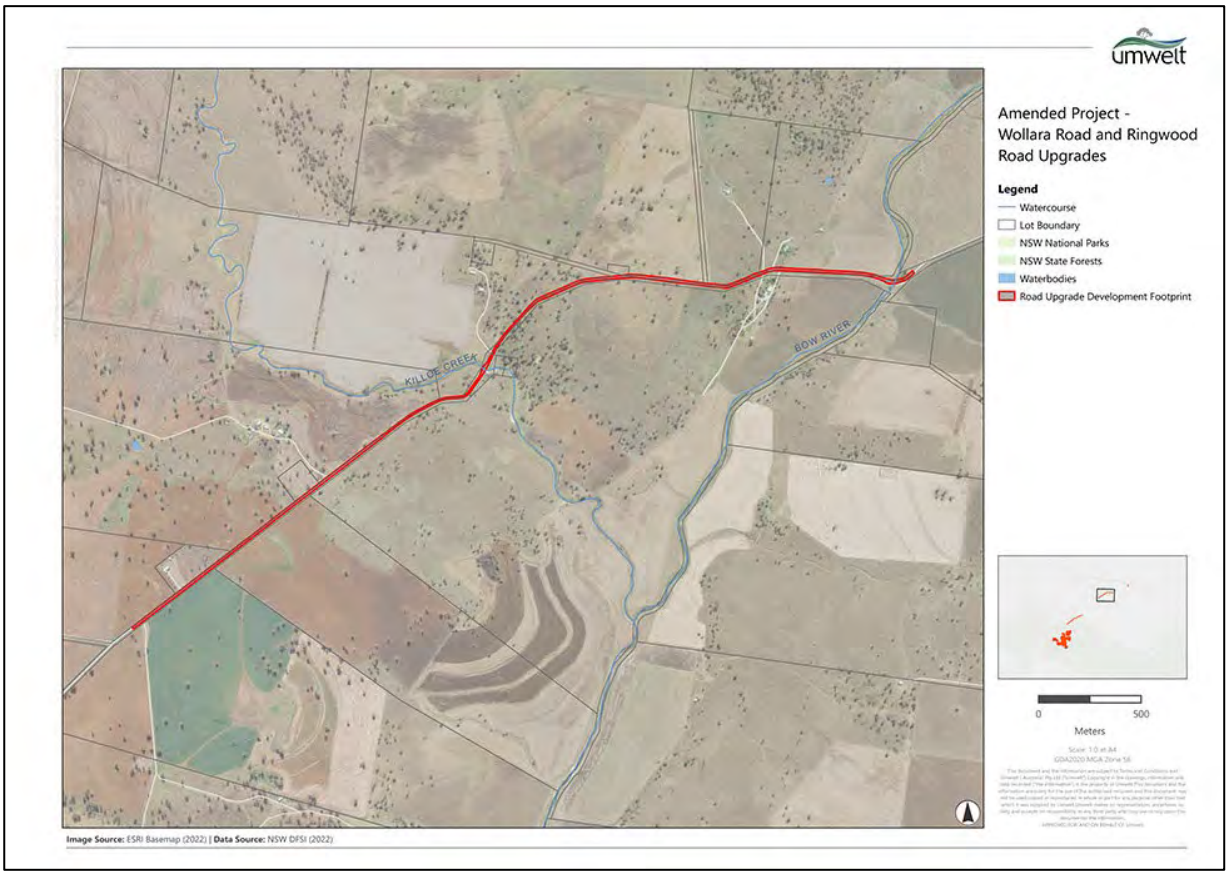
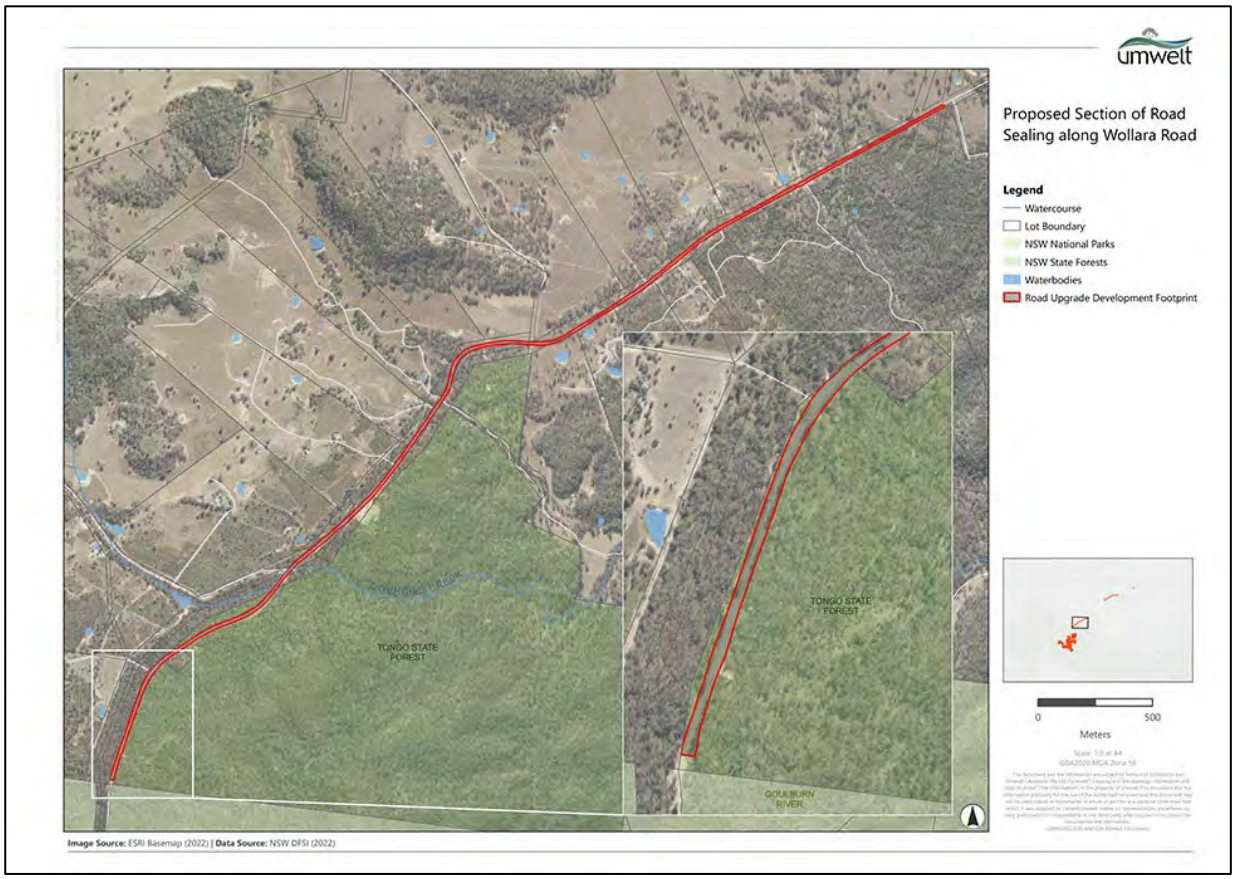


Figure 1-5: Proposed section of road sealing along Wollara Road.



1.4.3 BESS design amendments

The proponent is proposing to amend the centralised BESS design as documented in the EIS to allow for increased capacity. The capacity of the centralised BESS is proposed to increase to 450MWp / 900MWh from 280MWp / 570MWh (as per the Project EIS) to allow for greater energy storage capacity, required to safely and cost effectively decarbonise Australia's energy network.

The proponent is also seeking to amend the Project EIS to include the option of a decentralised BESS, to allow for greater flexibility in the design of the final BESS facility. The decentralised BESS option involves 560 individual 6.1 m battery containers and DC-DC converters, and associated infrastructure being situated next to the photovoltaic (PV) inverter stations located throughout the solar arrays, rather than in a centralised location as proposed in the EIS.

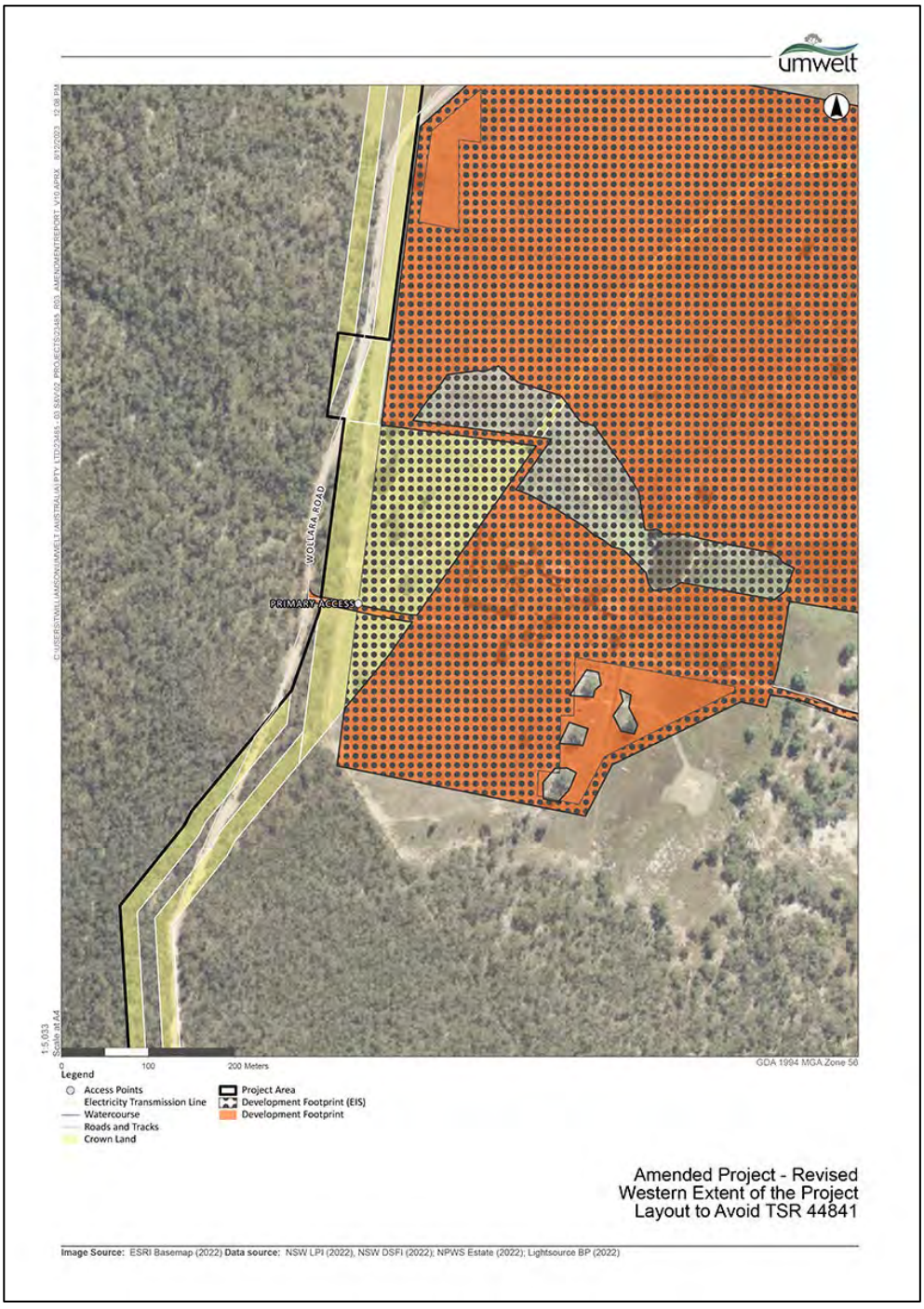
All infrastructure is proposed to reside entirely within the existing Project Area and the Development Footprint as assessed under the EIS. As this amendment does not include land that was not surveyed for the ACHAR (OzArk 2023), it is not discussed further in this Addendum ACHAR.

1.4.4 Development Footprint Realignment

Following further consultation with the Department of Planning and Environment (DPE) and Crown Lands following public exhibition of the Project EIS, a minor realignment of the Development Footprint is proposed to avoid overlapping with the Traveling Stock Reserve (TSR) 44841. The western extent of the Development Footprint is now proposed to extend towards the east and will avoid TSR 44841 (**Figure 1-6**).

This realignment involves a reduction of the Development Footprint and is wholly within land surveyed as part of OzArk 2023 for the EIS.

Figure 1-6: Aerial showing the realignment of the southwest of the Development Footprint.



1.4.5 Relocated solar panels

Following consultation with NSW Biodiversity and Conservation Division (BCD) during the Response to Submissions phase, additional areas of solar panels throughout the Development Footprint are proposed to be relocated to previously unused areas within the Project Area or removed, to increase avoidance of Plant Community Types and threatened species habitat and particularly, on Serious and Irreversible Impacts (SAII) entities.

As this amendment is wholly within land surveyed as part of the ACHAR (OzArk 2023), additional survey was not required.

Because of the realignment of the Development Footprint, 37-1-1027 (Redlynch Creek IF1) will no longer be harmed by the Amended Project (**Figure 1-7**).

As a result, a total of four recorded sites will now not be harmed by the Amended Project as they are located outside the Development Footprint: 37-1-1027 (Redlynch Creek IF1), 37-1-1032 (Ringwood Gully IF6), 37-1-1033 (Killoe Creek GG1), and 37-1-1037 (Rocky Creek Gully OS4).

Seven Aboriginal sites, 37-1-1028 (Rocky Creek Slope IF2), 37-1-1029 (Wollara Road IF3), 37-1-1030 (Monaghans Creek IF4), 37-1-1031 (Rocky Creek Gully IF5), 37-1-1034 (Redlynch Creek OS2), 37-1-1035 (Redlynch Creek OS1), and 37-1-1036 (Redlynch Creek OS3) will be harmed by the Amended Project and will be appropriately managed.

1.4.6 Increased width of selected internal access roads

An increase in the width of the internal access road corridors is also proposed to accommodate the revised design of the internal reticulation work. It is now proposed that subterranean transmission corridors would be used as part of the internal reticulation network, which are proposed to travel adjacent to the internal access roads, in turn increasing the width of the internal access road corridors.

As this amendment only includes land that was surveyed for the ACHAR (OzArk 2023), and does not result in additional impacts, it is not discussed further in this Addendum ACHAR.

1.4.7 Additional transmission tower

An additional transmission tower may be required on the current transmission line near the proposed substation to accommodate the connection of the Project to the national electricity market. Further consultation undertaken with Transgrid during exhibition of the Project EIS has determined that the additional tower would now form part of the Project.

The transmission tower is proposed to be located within land that was surveyed for the ACHAR (OzArk 2023) and does not result in additional impacts, it is not discussed further in this Addendum ACHAR.

Figure 1-7: Recorded sites in relation to the realigned Development Footprint.

2 ABORIGINAL COMMUNITY CONSULTATION

The Aboriginal cultural heritage assessment of the Goulburn River Solar Farm has followed the ACHCRs (DECCW 2010b). The consultation log, copies of correspondence with Aboriginal community stakeholders and its results are presented in Section 3 of the ACHAR (OzArk 2023). Further consultation undertaken for the finalisation of OzArk 2023 is shown in **Appendix 1 Figure 1**.

An update letter was sent to all RAPs on 29 August 2023 summarising the status of the Project and providing notification that further assessment for an Addendum study area would be undertaken. The update letter is included as **Appendix 1 Figure 2**.

2.1 CULTURAL VALUES IDENTIFIED THROUGHOUT THE ACHCR PROCESS

No specific cultural values were identified by the RAPs regarding the Addendum study area, however, the strong cultural values of Aboriginal communities towards landscapes and cultural heritage sites are recognised.

3 LANDSCAPE CONTEXT

An understanding of the environmental context of a study area is requisite in any Aboriginal archaeological investigation (DECCW 2010). It is a particularly important consideration in the development and implementation of survey strategies for the detection of archaeological sites. In addition, natural geomorphic processes of erosion and/or deposition, as well as human-activated landscape processes, influence the degree to which the remains of material culture are retained in the landscape as archaeological sites; and the degree to which they are preserved, revealed and/or conserved in present environmental settings.

3.1 TOPOGRAPHY AND HYDROLOGY

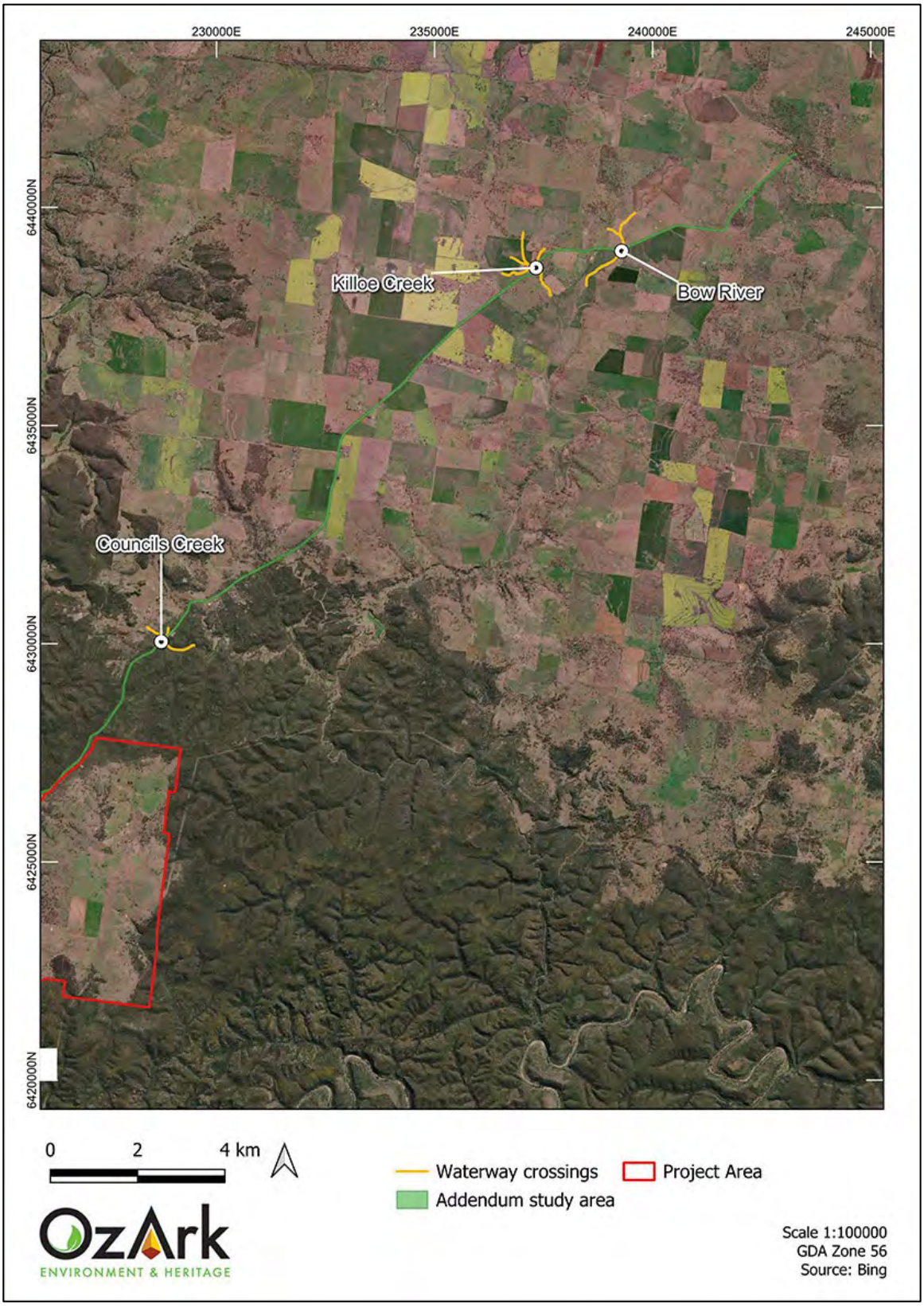
The topography of the Addendum study area is generally flat, cleared agricultural land and road reserves with some moderate gradient undulating hills (**Figure 3-1**).

Figure 3-1: Topography of the Addendum study area.

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>1. View of Bow River from Ringwood Road.</td><td>2. View of causeway over Killoe Creek, Ringwood Road.</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>3. Vegetation along western end of road corridor, Wollara Road.</td><td>4. View towards causeway over Councils Creek, Wollara Road.</td></tr>
</table>

The waterways of Bow River (approximately 4.5 km from the Golden Highway intersection), Killoe Creek (approximately 6.5 km from the Golden Highway intersection) and Councils Creek (approximately 17.5 km from the Golden Highway intersection), traverse the road corridor of the Addendum study area (**Figure 3-2**).

Figure 3-2: Hydrology of Addendum study area.



3.2 GEOLOGY AND SOILS

The Addendum study area is located within the Brigalow Belt South Bioregion. The geology and geomorphology of the region is layered sedimentary rock that has weather to produce a dissected landscape consisting of gently sloping foothills that grade into sandstone escarpments and ridge tops surrounding the lower-lying river flats of the permanently flowing Goulburn and Munmurra Rivers (Cumberland Ecology 2013).

3.3 VEGETATION

The Addendum study area supports exotic and native vegetation; however, this has been heavily disturbed due to agricultural activity and road construction. Ringwood and Wollara Roads are mostly bordered by open agricultural fields with few remaining native trees. The roadside vegetation becomes denser in the southwestern portion of the Addendum study area, towards the boundary with Tongo State Forest.

Prior to agricultural land clearing the Addendum study area would have supported a woodland of rough-barked apple (*Angophora floribunda*), Blakely's red gum (*Eucalyptus blakelyi*), narrow-leaved red ironbark (*Eucalyptus crebra*), grey box (*Eucalyptus microcarpa*), Yellow box (*Eucalyptus melliodora*), white box (*Eucalyptus albens*) and blackbutt (*Eucalyptus pilularis*). Sandstone gullies included narrow-leaved stringybark (*Eucalyptus sparsifolia*), broad-leaved ironbark (*Eucalyptus fibrosa* ssp. *fibrosa*), currawang (*Acacia doratoxylon*), forest phebalium *(Phebalium ambiens*), Australian boxthorn (*Bursaria spinosa*), hopbush (*Dodonaea* sp.), and River oak (*Casuarina cunninghamiana*). In the creeks on northern aspects Belah (*Casuarina cristata*) was also likely to be present with fern understorey along creek lines at the eastern end of the range (Kovac and Lawrie 1991 and Mitchell 2002).

3.4 LAND USE HISTORY AND EXISTING LEVELS OF DISTURBANCE

The Addendum study area consists of road corridors through grazing land, most of which has been subjected to extensive vegetation clearing.

3.5 CONCLUSION

The review of the environmental factors associated with the Addendum study area allows the following conclusions to be drawn in terms of past Aboriginal occupation:

- Topography and hydrology: The flat to gently undulating landforms which dominate the Addendum study area would have been hospitable to Aboriginal people. The semi-permanent watercourses would have provided limited freshwater and subsistence requirements to support occupation of the area, however this occupation was probably short-term or sporadic.

- Geology and soils: The predominate geology of the Addendum study area is sandstone, which was frequently used as a surface for sharpening axes when in close association

with water. Thus, areas with outcropping sandstone could contain evidence of past Aboriginal activity. The fertile soils of the region would have supported various resources that attracted the traditional Aboriginal people to the area. However, colonial use of the fertile soil has resulted in long-term impacts to the environment, including the clearing of vegetation to provide open spaces for intensive grazing. These impacts could have removed certain site types (such as culturally modified trees) or the disturbed artefact sites through soil loss, ploughing, and stock trampling. Gully and sheetwash erosion, particularly along the drainage and gully landforms, indicate preservation of artefacts in their original depositional context is unlikely.

- Vegetation: The Addendum study area would have once supported an open woodland which would have provided some resources for Aboriginal subsistence in the past and the evidence suggests that this was a managed landscape, possibly to use the plateau as a hunting ground. These vegetation types had several utilitarian, medicinal, and subsistence uses. Wood from Eucalypts were used for dish and bowl manufacture, bark used to make shelters and canoes, oil to sooth colds, aches, and fevers and as a general antiseptic and honey, nectar, and manna from some species for food (Stewart & Percival 1997). However, resources likely to have supported a large population of people would have been present closer to the banks of more permanent water sources including the Bow and Goulburn Rivers. The broad-scale vegetation clearance which has taken place across the Addendum study area for agricultural purposes and road construction reduces the likelihood that any culturally modified trees remain present, however, should mature native vegetation remain, particularly along the ephemeral drainages, culturally modified trees may be present.

- Land use: Activities such as vegetation clearance, grazing, and cultivation are the dominant types of disturbance to have taken place across the Addendum study area. These activities are likely to have displaced Aboriginal objects or sites or removed them entirely i.e. modified trees. Further, cultivation reduces the potential for intact subsurface archaeological material to remain. In areas where farming and agriculture is less intensive, Aboriginal objects are likely to be in a secondary context due to slope wash.

4 ARCHAEOLOGICAL CONTEXT

4.1 DESKTOP DATABASE SEARCHES CONDUCTED

The Aboriginal Heritage Information Management System (AHIMS) was searched on 1 June 2022 for OzArk 2023. As this search is over 12 months old, an additional search was conducted for the Addendum study area on 16 October 2023 covering the same coordinates as the 2022 search. The search results are shown in **Appendix 2**.

The results of the search are displayed on **Figure 4-1**. The 2022 AHIMS search returned 106 entries whereas the 2023 search includes 117 entries. This is explained by the fact that the 2023 search includes the 11 sites recorded in the 2022 survey for the Project (37-1-1033 [Killoe Creek GG1], 37-1-1035 [Redlynch Creek OS1], 37-1-1034 [Redlynch Creek OS2], 37-1-1036 [Redlynch Creek OS3], 37-1-1037 [Rocky Creek Gully OS4], 37-1-1027 [Redlynch Creek IF1], 37-1-1028 [Rocky Creek Slope IF2], 37-1-1029 [Wollara Road IF3], 37-1-1030 [Monaghans Creek IF4], 37-1-1031 [Rocky Creek Gully IF5], and 37-1-1032 [Ringwood Gully IF6]). Other than these 11 sites, no new sites have been registered in the AHIMS search area and no new sites have been recorded within or near the Project area that are not discussed in OzArk 2023.

It is noted that the Addendum study area includes land currently subject to a Native Title claim (NC2011/006, NSD37/2019, Gomeroi People) (**Figure 4-2**).

4.2 REGIONAL AND LOCAL CONTEXT: CONCLUSION

A review of the studies conducted in the broader region of the Addendum study area is presented in OzArk 2023. The results of these investigations provide the following regional synthesis:

- Archaeological sites, even where surface evidence is not present, occur on most landforms
- Site frequency and density are dependent on their location in the landscape. This theme is consistent throughout NSW and is influenced by a range of factors, the most relevant of which is the existing level of disturbance. More specifically, the potential for undisturbed *in situ* deposits remaining in the upper Hunter Valley is generally low
- The highest concentration of Aboriginal sites on the valley floor surrounds creeks and waterways. Sites located away from water sources tend to have a low artefact density and site complexity
- Few scarred trees are recorded reflecting the high degree of tree clearing in the region
- The most frequently recorded raw material is indurated mudstone/tuff (a fine-grained siliceous material) associated with Hunter River gravels. Other frequently recorded materials include locally sourced silcrete, quartz, chert, and volcanic stone.

Figure 4-1: Location of previously recorded AHIMS sites in relation to the Addendum study area (2023 data).

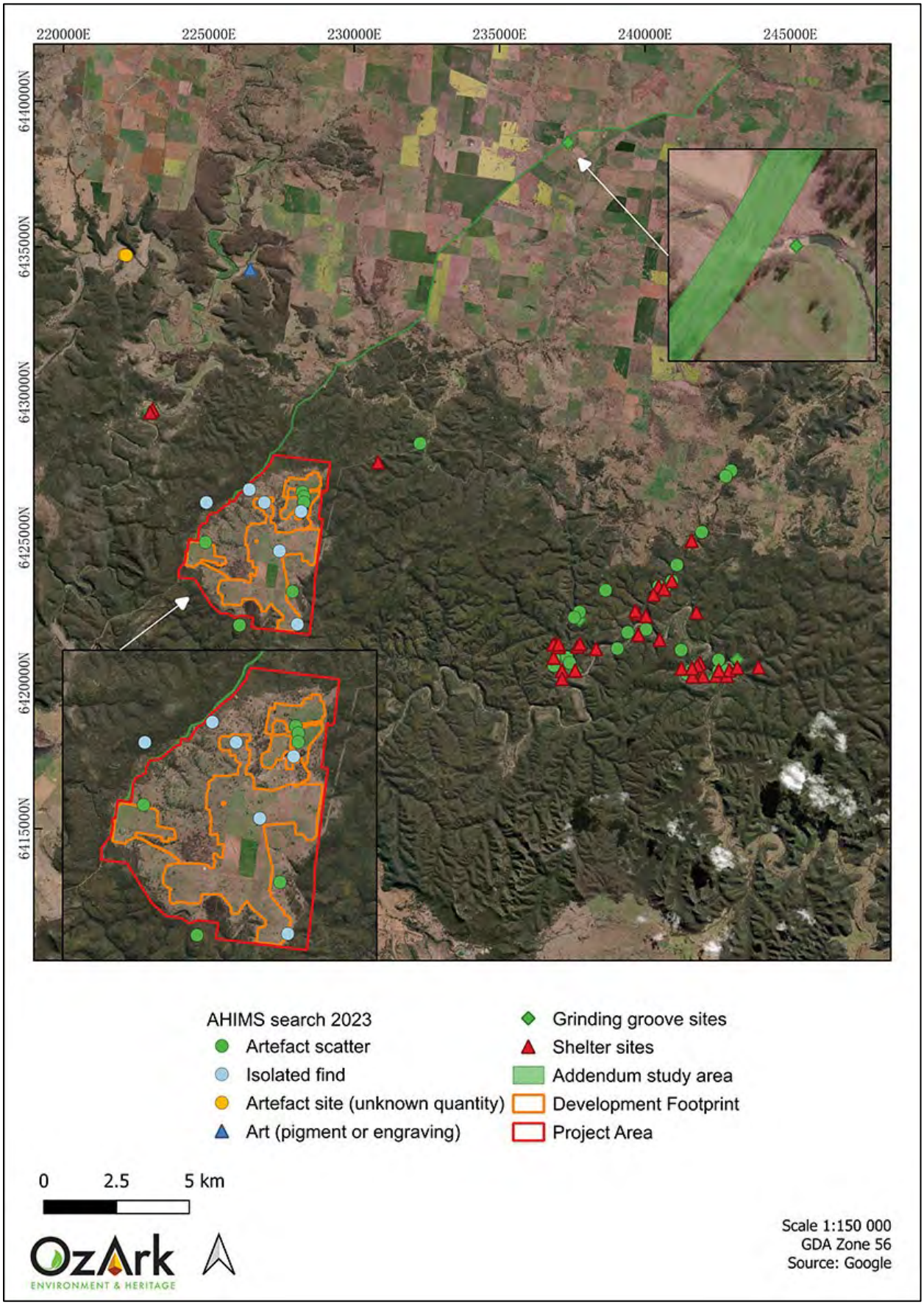


Figure 4-2: The Project Area in relation to Gomeroi People Native Title claim (NC2011/006, NSD37/2019).

5 RESULTS OF ABORIGINAL ARCHAEOLOGICAL ASSESSMENT

5.1 SAMPLING STRATEGY AND FIELD METHODS

OzArk 2023 records the survey of the Development Footprint and the Access Route. The Access Route assessment aligns with the Ringwood and Wollara Roads upgrades proposed in the Amended Project. The results of this survey will be repeated here for consistency with other specialist reports for the amendment.

The field survey for OzArk 2023 was undertaken by OzArk over one week from 15 August to 19 August 2022.

The survey strategy in 2022 for Ringwood and Wollar Roads involved sample surveys along the edges of the road corridor within the Addendum study area with care taken to inspect all waterway crossings.

The intersection of Ringwood Road and the Golden Highway was not specifically surveyed in 2022, although identical and contiguous landforms along Ringwood Road were surveyed. Information on the topography and the levels of disturbance at the intersection study area was supplied to OzArk by ecologists who visited the study area. As such, additional field survey was not required or undertaken.

5.2 PROPOSAL CONSTRAINTS

As most of the Addendum study area along Ringwood and Wollara Roads has been previously disturbed by road construction including roadside drainage features, survey involved only targeted pedestrian inspection of creek crossings and sections determined to have elevated archaeological potential or minimal evidence of previous disturbances. The remainder of the road corridor was inspected from a vehicle.

5.3 INTERSECTION OF RINGWOOD ROAD AND THE GOLDEN HIGHWAY

The impact footprint for the intersection study area was inspected on foot by ecologists who were instructed to note items such as topography and previous disturbances to allow an appraisal of the area's archaeological potential.

The intersection study area is within slopes with a moderate gradient. To the east of the Golden Highway are the remains of a bitumen road, cuttings, and steel bins (**Figure 5-1**). All tree vegetation is immature regrowth.

The sloping terrain and widespread disturbances indicates that Aboriginal sites are unlikely to be recorded within the intersection study area. The lack of mature trees indicates that culturally modified trees will not be present.

The assessment of the intersection study area as having low archaeological potential is supported by the survey results along Ringwood Road that also concluded that landforms in this area have a low archaeological potential.

Figure 5-1: Views of the intersection study area.

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>1. View of the Golden Highway to the north of Ringwood Road.</td><td>2. View to the Golden Highway from the eastern side of the road.</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>3. View of a disused bitumen road to the east of the Golden Highway.</td><td>4. View of steel bins and cuttings to the east of the Golden Highway.</td></tr>
</table>

5.4 ABORIGINAL SITES RECORDED

Table 5-1 summarises the Aboriginal cultural heritage sites recorded during the August 2022 survey.

One site is within the Addendum study area, 37-1-1033 (Killoe Creek GG1), and further details on the site follows.

Table 5-1: Aboriginal cultural heritage site recorded during the survey.

AHIMS ID	Site name	Site type	Coordinates (GDA Zone 56) East	Coordinates (GDA Zone 56) North	Within Addendum study area?	Within Development Footprint?
37-1-1033	Killoe Creek GG1	Grinding Grooves	237357	6438576	Yes	No
37-1-1035	Redlynch Creek OS1	Artefact Scatter	228219	6426563	No	Yes
37-1-1034	Redlynch Creek OS2	Artefact Scatter	228274	6426411	No	Yes
37-1-1036	Redlynch Creek OS3	Artefact Scatter	228272	6426217	No	Yes
37-1-1037	Rocky Creek Gully OS4	Artefact Scatter	224888	6424844	No	No
37-1-1027	Redlynch Creek IF1	Isolated Find	228173	6425902	No	No
37-1-1028	Rocky Creek Slope IF2	Isolated Find	226913	6426210	No	Yes
37-1-1029	Wollara Road IF3	Isolated Find	226394	6426654	No	Yes
37-1-1030	Monaghans Creek IF4	Isolated Find	227432	6424546	No	Yes
37-1-1031	Rocky Creek Gully IF5	Isolated Find	224916	6426210	No	Yes
37-1-1032	Ringwood Gully IF6	Isolated Find	228045	6422023	No	No

37-1-1033 (Killoe Creek GG1)

Site type: Grinding grooves

GPS coordinates: GDA 2020 Zone 56 237357 E, 6438576 N

Location of site: Located 7.1 km south along Ringwood Road from the intersection of the road and Golden Highway. Situated on the southern bank of Killoe Creek, approximately 50 m east of Ringwood Road.

Description of site: The site is on the southern creek bank of Killoe Creek, approximately 50 m east of the creek crossing on Ringwood Road (**Figure 5-2**). The site consists of at least 20 very weathered grooves on a flat sandstone slab next to the creek. Four of the better-preserved grooves measure 27 x 7 millimetres (mm), 26 x 5 mm, 28 x 7 mm, and 21 x 5 mm (**Figure 5-3**).

Figure 5-2: Location of Killoe Creek GG1.

Figure 5-3: Killoe Creek GG1. View of site and selection of grinding grooves.

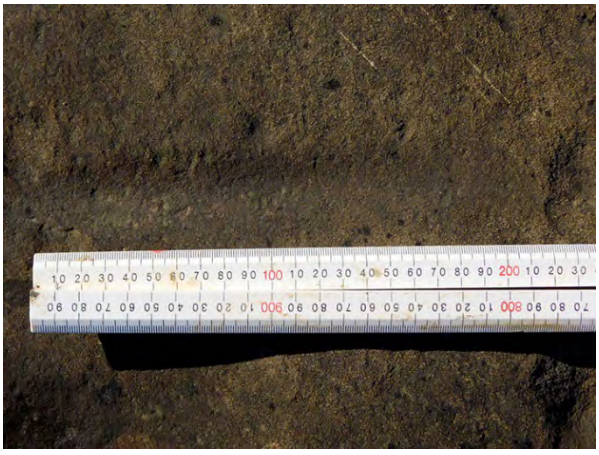
1. View north of Killoe Creek GG1. Range pole marks recorded location of site.

2. View west from Killoe Creek GG1 towards Killoe Creek crossing on Ringwood Road.

3. View of some of the better preserved grooves at Killoe Creek GG1.

4. View of some of the better preserved grooves at Killoe Creek GG1.

5. Detail of a group of grooves at Killoe Creek GG1.



6. Detail of a worn groove at Killoe Creek GG1.

5.5 SUMMARY OF SURVEY RESULTS

One grinding groove site was identified during the survey. The grinding groove site is located approximately 50 m from the creek crossing and is outside the Development Footprint of the Addendum study area. Therefore, it will not be harmed during the proposed upgrade of Ringwood Road.

Consistent with previous studies within the broader region, the grinding grooves were near a waterway with sandstone outcropping. This is expected as these areas, near watercourses, are generally associated with increased levels of past resource and camping activities. The grinding grooves indicate that hatchet manufacture/curation is occurring within the broader area. Hatchets would likely have been utilised for the purpose of removing wood and bark from trees for the purposes of construction of shelters, shields, canoes, and coolamons.

5.6 ASSESSED SIGNIFICANCE OF THE RECORDED SITE

Table 5-2 presents a summary of the significance assessment of Aboriginal cultural heritage site recorded near the Addendum study area. Further details of each of the assessment criteria are provided below.

Social or Cultural Value

Cultural and social values can only be determined by the local Aboriginal people.

Generally, however, all sites hold cultural value to the Aboriginal community. Wonnarua man, Victor Perry (2001), notes that: '*the Wonnarua people consider that all sites within their traditional homeland (to be) of high importance and …in need of proper care and protection'*. Further, Perry 2001 notes: '*the Wonnarua wish to protect their history and culture wherever possible,and maintain a connection with the land by providing recommendations in regards to Wonnarua Koori Heritage. The land and its stories were passed down from father to son over 200 generations before the arrival of Cook from England.*'

For these reasons, the Aboriginal objects recorded during the survey have high cultural value and the conservation of these objects is a central aspect of Aboriginal tribal lore.

No further cultural values were identified following the RAP review of OzArk 2023.

Archaeological/Scientific Value

The grinding grooves site (Killoe Creek GG1) located outside the Development Footprint of the Amended Project has limited scientific research potential and the significance of the grooves primarily relates to their educational value. The grinding groove site type is less common in the local and regional areas in terms of representativeness, and this raises its scientific significance to a moderate value.

Aesthetic Value

The grinding grooves site at Killoe Creek GG1 has moderate aesthetic values as the site remains interpretable by the layperson and the grooves maintain their association with the flowing waters of Killoe Creek.

Historic Value

None of the archaeological sites recorded during the survey have historic values associated with important persons, places, or events.

Table 5-2: Significance assessment of sites in the Addendum study area.

AHIMS ID	Site Name	Social or Cultural Value	Archaeological / Scientific Value	Aesthetic Value	Historic Value
37-1-1033	Killoe Creek GG1	High	Moderate	Moderate	Nil

5.6.1 Statement of significance

The Addendum study area holds cultural significance to the local Aboriginal community as Aboriginal people value their heritage as tangible links with the lifestyles and values of their ancestors (Perry 2001:13).

Perry 2001 notes that the land and the water running through it are the '*lifeblood*' of Aboriginal culture and that the forest and mountains of the region provided the resources needed to survive. Perry 2001 records that tribal lore requires that Aboriginal people are obliged to care for the environment and that this includes the aesthetic values of the land. Therefore, the land itself has aesthetic significance and its care and maintenance are core aspects of Aboriginal culture.

37-1-1033 (Killoe Creek GG1) has aesthetic significance as the grinding grooves are visible to the layperson and the grooves maintain their association with Killoe Creek. Thus, the association of running water and visible grooves have a strong aesthetic significance.

6 ASSESSING HARM

6.1 AVOIDING AND MINIMISING HARM

6.1.1 Conserving significant Aboriginal cultural heritage

An object of the NPW Act is the '*conservation of objects places and features… of cultural value within the landscape, including… places, objects and features of significance to Aboriginal people*' (s.2A(1(b)(i)).

As heritage professionals, OzArk, strives for good conservation outcomes. In particular, OzArk is primarily concerned with the conservation and protection of Aboriginal cultural heritage that is of significance to Aboriginal people.

Two primary objectives when managing harm to an Aboriginal object are:

- Impacts to significant Aboriginal objects and places should always be avoided wherever possible
- Where impacts to Aboriginal objects and places cannot be avoided, proposals should be amended to reduce the extent and severity of impacts to significant Aboriginal objects and places using reasonable and feasible measures.

6.1.2 Opportunities to conserve Aboriginal cultural heritage values

The grinding groove site, 37-1-1033 (Killoe Creek GG1) was recorded approximately 50 m east of the Killoe Creek crossing and is therefore outside the Development Footprint of the Amended Project. There are no further known Aboriginal sites or cultural values associated with the Addendum study area.

Outside of the Addendum study area, but as a result of the Amended Project, an additional Aboriginal site, 37-1-1027 (Redlynch Creek IF1), will no longer be harmed because of the realignment of the Development Footprint. As a result, four recorded sites will not be harmed by the Amended Project as they are located outside the Development Footprint: 37-1-1027 (Redlynch Creek IF1), 37-1-1032 (Ringwood Gully IF6), 37-1-1033 (Killoe Creek GG1), and 37-1-1037 (Rocky Creek Gully OS4).

6.2 LIKELY IMPACTS TO ABORIGINAL HERITAGE FROM THE AMENDED PROJECT

Table 6-1 presents a summary of potential impacts to Aboriginal cultural heritage associated with the proposal.

Table 6-1: Impact assessment of sites in the Addendum study area.

AHIMS ID	Site Name	Type of Harm (Direct/Indirect / None)	Degree of Harm (Total/Partial / None)	Consequence of Harm (Total/Partial/No Loss of Value)
37-1-1033	Killoe Creek GG1	None	None	None

7 MANAGEMENT OF ABORIGINAL CULTURAL HERITAGE SITES

7.1 MANAGEMENT OF THE RECORDED ABORIGINAL SITES

Management strategies recommended for the recorded sites are included in **Table 7-1**.

Table 7-1: Management strategies for recorded sites.

AHIMS ID	Site name	Site type	Degree of harm	Management strategy
37-1-1033	Killoe Creek GG1	Grinding Grooves	Will not be harmed	Outside of the Development Footprint. Should works need to take place at the Killoe Creek crossing on Ringwood Road, the site should be included on all applicable construction plans and the location made known to all work crews working in the vicinity of the site to ensure the site is not inadvertently harmed. Given the cultural, scientific, and aesthetic significance of the site the Aboriginal Cultural Heritage Management Plan (ACHMP) for the Project will include a methodology for additional documentation of the site prior to construction activities. This will include further photography and accurate planning of the site by a suitably qualified archaeologist.
37-1-1035	Redlynch Creek OS1	Artefact Scatter	Total	Mapping, description, and collection of surface artefacts prior to commencement of construction.
37-1-1034	Redlynch Creek OS2	Artefact Scatter	Total	Mapping, description, and collection of surface artefacts prior to commencement of construction.
37-1-1036	Redlynch Creek OS3	Artefact Scatter	Total	Mapping, description, and collection of surface artefacts prior to commencement of construction.
37-1-1037	Rocky Creek Gully OS4	Artefact Scatter	Will not be harmed	Outside of the Development Footprint. To be included on all applicable construction plans and the location made known to all work crews working in the vicinity of the site to ensure the site is not inadvertently harmed.
37-1-1027	Redlynch Creek IF1	Isolated Find	Will not be harmed	Because of the realignment of the Development Footprint, 37-1-1027 (Redlynch Creek IF1) will no longer be harmed by the Amended Project. To be included on all applicable construction plans and the location made known to all work crews working in the vicinity of the site to ensure the site is not inadvertently harmed.
37-1-1028	Rocky Creek Slope IF2	Isolated Find	Total	Mapping, description, and collection of the surface artefact prior to commencement of construction.
37-1-1029	Wollara Road IF3	Isolated Find	Total	Mapping, description, and collection of the surface artefact prior to commencement of construction.
37-1-1030	Monaghans Creek IF4	Isolated Find	Total	Mapping, description, and collection of the surface artefact prior to commencement of construction.
37-1-1031	Rocky Creek Gully IF5	Isolated Find	Total	Mapping, description, and collection of the surface artefact prior to commencement of construction.
37-1-1032	Ringwood Gully IF6	Isolated Find	Will not be harmed	Outside of the Development Footprint. To be included on all applicable construction plans and the location made known to all work crews working in the vicinity of the site to ensure the site is not inadvertently harmed.

8 RECOMMENDATIONS

Under Section 89A of the NPW Act it is mandatory that all newly recorded Aboriginal sites be registered with AHIMS. As a professional in the field of cultural heritage management it is the responsibility of OzArk to ensure this process is undertaken and the site has been registered with the AHIMS register.

The following recommendations are made based on these impacts and with regard to:

- Legal requirements under the terms of the NPW Act whereby it is illegal to damage, deface or destroy an Aboriginal place or object without an approved ACHMP
- The findings of the current investigations undertaken within the Addendum study area
- The interests of the Aboriginal community.

The survey in 2022 identified eight Aboriginal sites within the Development Footprint (OzArk 2023). The Amended Project has realigned the Development Footprint and is able to avoid 37-1-1027 (Redlynch Creek IF1) and this site will no longer be harmed by the Amended Project. This changes Recommendations 2 and 3 in the ACHAR to read:

> ACHAR Recommendation 2 now reads: 37-1-1027 (Redlynch Creek IF1), 37-1-1032 (Ringwood Gully IF6), 37-1-1033 (Killoe Creek GG1), and 37-1-1037 (Rocky Creek Gully OS4) will not be harmed by the Project as they are located outside the Development Footprint.
>
> ACHAR Recommendation 3 now reads: Seven Aboriginal sites, 37-1-1028 (Rocky Creek Slope IF2), 37-1-1029 (Wollara Road IF3), 37-1-1030 (Monaghans Creek IF4), 37-1-1031 (Rocky Creek Gully IF5), 37-1-1034 (Redlynch Creek OS2), 37-1-1035 (Redlynch Creek OS1), and 37-1-1036 (Redlynch Creek OS3) will be salvaged by a surface collection of visible artefacts. The recommended methodology for the salvage will be set out in the ACHMP and will include the measures outlined in Section 9.2.1 of the ACHAR.

The additional recommendations concerning Aboriginal cultural values associated with the Amended Project build upon those provided in OzArk 2023:

1. 37-1-1027 (Redlynch Creek IF1) and 37-1-1033 (Killoe Creek GG1) will not be harmed by the Amended Project as they are located outside the Development Footprint. The location of these sites must be shown on all applicable Project plans to ensure that they are not inadvertently harmed.
2. Further recording and investigation of the grinding groove site (Killoe Creek GG1) prior to construction activities will be conducted. The methodology of this investigation will be set

out in the ACHMP that will be developed following Project approval but will include detailed mapping and photography of the site by a suitably qualified archaeologist.

3. All land-disturbing activities must be confined to within the Development Footprint. Should the parameters of the proposed work extend beyond this, then further archaeological assessment will be required.

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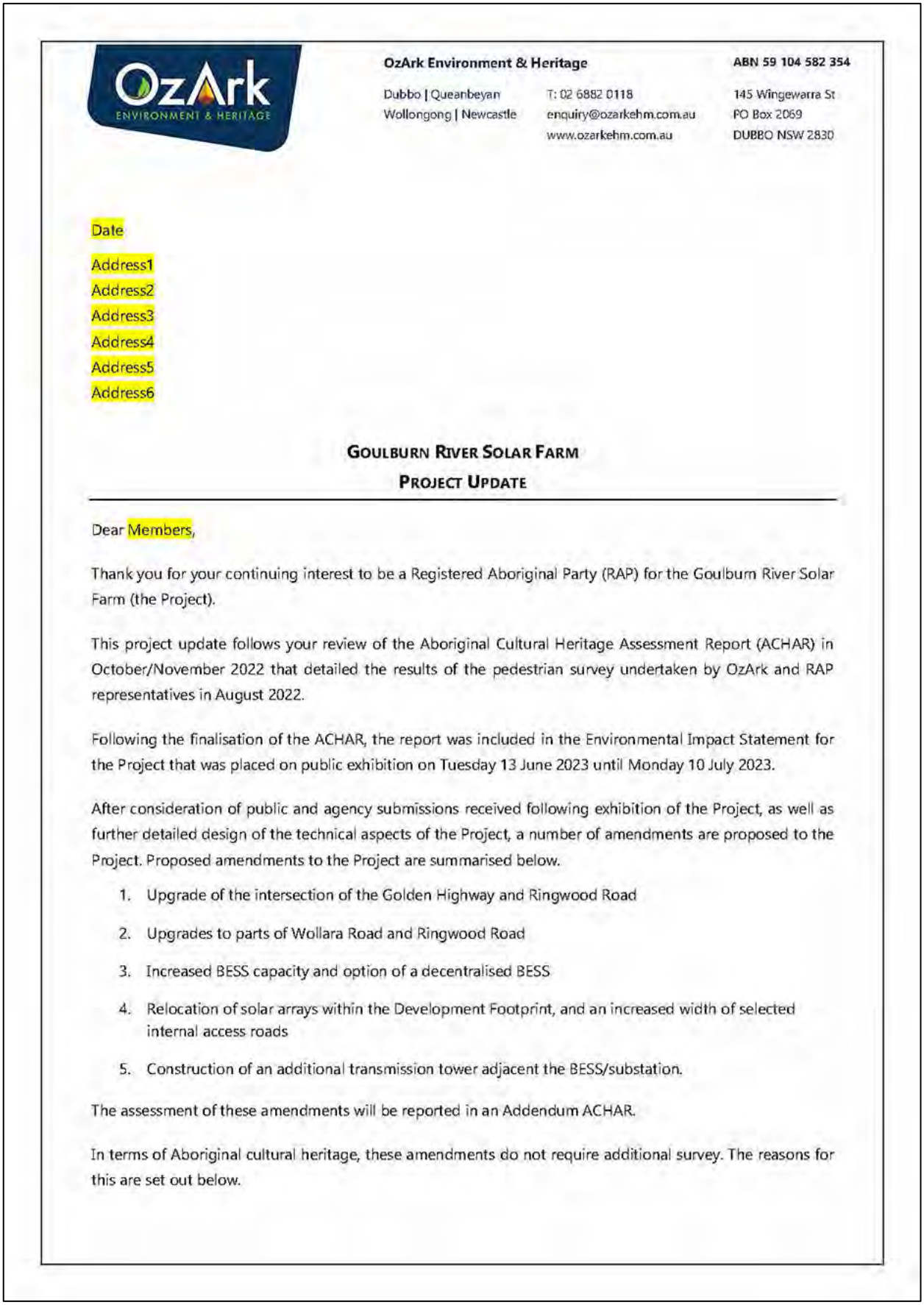
APPENDIX 1: ABORIGINAL COMMUNITY CONSULTATION

Appendix 1 Figure 1: Aboriginal consultation Log (continued from OzArk 2023).

Date	Organisation	Comment	Method
29.8.23	Didge Ngunawal Clan	Project update letter sent	Email
29.8.23	Corroboree Aboriginal Corporation	Project update letter sent	Email
29.8.23	Widescope Indigenous Group	Project update letter sent	Email
29.8.23	Walhallow Local Aboriginal Land Council	Project update letter sent	Email
29.8.23	Rose Nean	Project update letter sent	Email
29.8.23	Ungooroo Aboriginal Corporation	Project update letter sent	Email
29.8.23	Gomeroi People	Project update letter sent	Email
29.8.23	Hunters & Collectors	Project update letter sent	Email
29.8.23	Wanaruah Local Aboriginal Land Council	Project update letter sent	Email
29.8.23	Murra Bidgee Mullangari Aboriginal Corporation	Project update letter sent	Email
29.8.23	Merrigarn	Project update letter sent	Email
29.8.23	Hunter Traditional Owner	Project update letter sent	Email
29.8.23	A1 Indigenous group	Project update letter sent	Email
29.8.23	Junburra Aboriginal Consultancy Services	Project update letter sent	Email
30.8.23	Hunters & Collectors	Catherine Burrowes received email response - *I have read the project information and amendment to the ACHA for the above project, I endorse the recommendations made.*	Email

Appendix 1 Figure 2: Project update letter.



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Date

Address1
Address2
Address3
Address4
Address5
Address6

GOULBURN RIVER SOLAR FARM
PROJECT UPDATE

Dear Members,

Thank you for your continuing interest to be a Registered Aboriginal Party (RAP) for the Goulburn River Solar Farm (the Project).

This project update follows your review of the Aboriginal Cultural Heritage Assessment Report (ACHAR) in October/November 2022 that detailed the results of the pedestrian survey undertaken by OzArk and RAP representatives in August 2022.

Following the finalisation of the ACHAR, the report was included in the Environmental Impact Statement for the Project that was placed on public exhibition on Tuesday 13 June 2023 until Monday 10 July 2023.

After consideration of public and agency submissions received following exhibition of the Project, as well as further detailed design of the technical aspects of the Project, a number of amendments are proposed to the Project. Proposed amendments to the Project are summarised below.

1. Upgrade of the intersection of the Golden Highway and Ringwood Road
2. Upgrades to parts of Wollara Road and Ringwood Road
3. Increased BESS capacity and option of a decentralised BESS
4. Relocation of solar arrays within the Development Footprint, and an increased width of selected internal access roads
5. Construction of an additional transmission tower adjacent the BESS/substation.

The assessment of these amendments will be reported in an Addendum ACHAR.

In terms of Aboriginal cultural heritage, these amendments do not require additional survey. The reasons for this are set out below.

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- Amendments 1 and 2 were part of the original survey area completed by OzArk in August 2022 (termed the Access Route). The August 2022 survey included the road corridor of Ringwood and Wollara Roads from the Golden Highway to the Development Footprint (**Figure 1**). This survey included the waterway crossings associated with the Bow River and Killoe Creek, as well as a number of unnamed waterway crossings. In addition, a number of spot checks were undertaken in landforms along the road corridor that are more distant to waterways. As a result of the Access Route assessment, one Aboriginal site was recorded: an axe grinding groove site located on Killoe Creek (Killoe Creek GG1). The site consists of several indistinct grooves on a rock slab that is outside of the proposed disturbance corridor.
- Amendments 3 to 5 are located within the Development Footprint that was fully assessed by pedestrian survey during the main survey in August 2022. As no unsurveyed landforms are impacted by these amendments, further survey is not required.

OzArk included the assessment of the Access Route from the Golden Highway to the Development Footprint in the ACHAR you have received. OzArk will develop an Amendment ACHAR to specifically address the amendments to the Project but the survey results in the current ACHAR will remain unchanged and the Amendment ACHAR will not alter the recommendations contained in the ACHAR you have reviewed, apart from recommending a new initiative: the further recording and investigation of the grinding groove site Killoe Creek GG1 as has been recommended in the Heritage NSW response to the ACHAR.

This Amendment ACHAR will be sent to you for your information when a draft is ready.

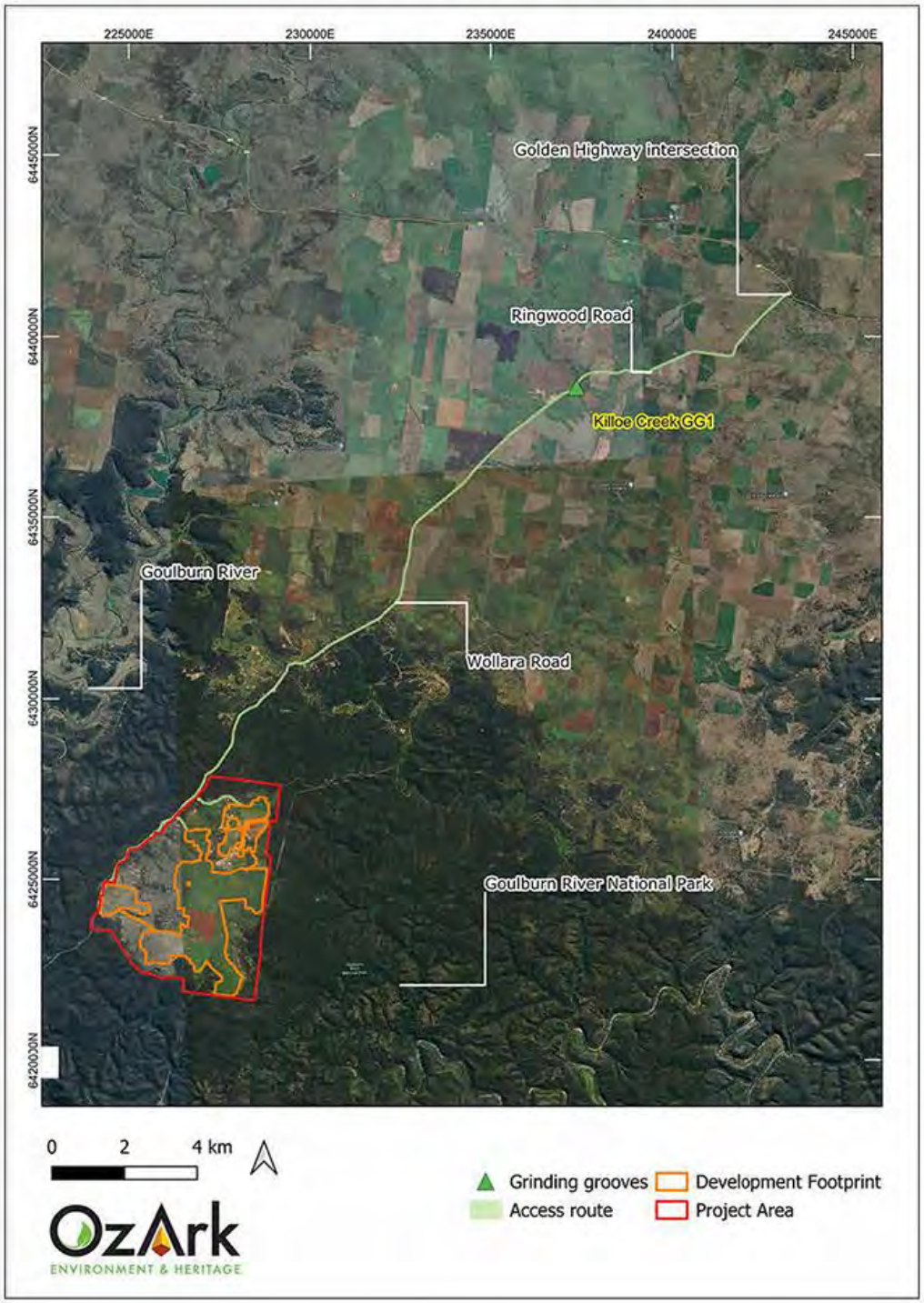
OzArk welcomes any comments you may have at this stage and invites you to contact Catherine Burrowes, OzArk's Consultation Officer (catherine@ozarkehm.com.au) with any questions or responses.

With thanks,

Ben Churcher
OzArk Principal Archaeologist

OzArk Environment & Heritage

Figure 1: Location of the Access Route.



APPENDIX 2: AHIMS SEARCH RESULTS

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : 4098
Client Service ID : 828837

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
37-1-0369	Inniscarra;	AGD	56	240369	6423130	Closed site	Valid	Artefact : -	Shelter with Deposit	
	Contact	Recorders	Unknown Author					Permits		
37-1-0370	Inniscarra;	AGD	56	240369	6423130	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	Recorders	Unknown Author					Permits		
37-1-0363	Inniscarra;	AGD	56	240554	6423042	Closed site	Valid	Artefact : -	Shelter with Deposit	
	Contact	Recorders	Unknown Author					Permits		
37-1-0357	Inniscarra;	AGD	56	240823	6423321	Closed site	Valid	Artefact : -	Shelter with Deposit	
	Contact	Recorders	Unknown Author					Permits		
37-1-0185	Parsons Gully;	AGD	56	241790	6420503	Closed site	Valid	Artefact : -	Shelter with Deposit	380
	Contact	Recorders	Unknown Author					Permits		
37-1-0196	Parsons Gully;	AGD	56	242348	6420856	Closed site	Valid	Artefact : -	Shelter with Deposit	380
	Contact	Recorders	Unknown Author					Permits		
37-1-0212	Parsons Gully;	AGD	56	242714	6420063	Closed site	Valid	Artefact : -	Shelter with Deposit	380
	Contact	Recorders	Unknown Author					Permits		
37-1-0213	Goulburn River;	AGD	56	242714	6420063	Closed site	Valid	Artefact : -	Shelter with Deposit	380
	Contact	Recorders	Unknown Author					Permits		
37-1-0216	Goulburn River;	AGD	56	242802	6420247	Closed site	Valid	Artefact : -	Shelter with Deposit	380
	Contact	Recorders	Unknown Author					Permits		
37-1-0108	Bow River;	AGD	56	237043	6419957	Closed site	Valid	Artefact : -	Shelter with Deposit	380
	Contact	Recorders	Ms Laila Haglund					Permits		
37-1-0052	Goulburn River N.P.;Bow River;	AGD	56	230720	6427400	Closed site	Valid	Artefact : -	Shelter with Deposit	1097
	Contact	Recorders	Laura-Jane Smith,D French					Permits		
37-1-0086	Bow River;	AGD	56	237641	6422255	Open site	Valid	Artefact : -	Open Camp Site	380
	Contact	Recorders	ASRSYS					Permits		
37-1-0116	Bow River;	AGD	56	236838	6421142	Closed site	Valid	Artefact : -	Shelter with Deposit	380
	Contact	Recorders	ASRSYS					Permits		
37-1-0198	Parsons Gully;	AGD	56	242436	6420240	Open site	Valid	Artefact : -	Open Camp Site	380
	Contact	Recorders	Unknown Author					Permits		
37-1-0201	Goulburn River;	AGD	56	242436	6420240	Closed site	Valid	Artefact : -	Shelter with Deposit	380

Report generated by AHIMS Web Service on 16/10/2023 for Imogen Crome for the following area at Datum :GDA, Zone : 56, Eastings : 221988.0 - 244053.0, Northings : 6420122.0 - 6441749.0 with a Buffer of 0 meters.. Number of Aboriginal sites and Aboriginal objects found is 117

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AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : 4098
Client Service ID : 828837

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
	Contact	Recorders	Unknown Author					Permits		
37-1-1035	Redlynch Creek OS1	GDA	56	228219	6426563	Open site	Valid	Artefact : -		
	Contact	Recorders	OzArk Environmental and Heritage Management - Dubbo,Mr.YEKUN ZHANG					Permits		
37-1-1034	Redlynch Creek OS2	GDA	56	228274	6426411	Open site	Valid	Artefact : -		
	Contact	Recorders	OzArk Environmental and Heritage Management - Dubbo,Mr.YEKUN ZHANG					Permits		
37-1-0022	Tunbridge Creek;	AGD	56	240403	6421300	Closed site	Valid	Artefact : -	Shelter with Deposit	380
	Contact	Recorders	Unknown Author					Permits		
37-1-0358	Inniscarra;	AGD	56	240369	6423130	Closed site	Valid	Artefact : -	Shelter with Deposit	
	Contact	Recorders	Unknown Author					Permits		
37-1-0361	Inniscarra;	AGD	56	240554	6423042	Closed site	Valid	Artefact : -	Shelter with Deposit	
	Contact	Recorders	Unknown Author					Permits		
37-1-0177	parsons gully;	AGD	56	241519	6420315	Closed site	Valid	Artefact : -	Shelter with Deposit	380
	Contact	Recorders	Ms Laila Haglund					Permits		
37-1-0179	Parsons Gully;	AGD	56	241519	6420315	Closed site	Valid	Artefact : -	Shelter with Deposit	380
	Contact	Recorders	Unknown Author					Permits		
37-1-0218	Parsons Gully;	AGD	56	242802	6420247	Closed site	Valid	Artefact : -	Shelter with Deposit	380
	Contact	Recorders	Unknown Author					Permits		
37-1-0378	Tunbridge Creek;	AGD	56	238945	6420999	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	Recorders	Unknown Author					Permits		
37-1-0377	Tunbridge Creek;	AGD	56	239301	6421554	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	Recorders	Unknown Author					Permits		
37-1-0974	MTW/2019PP/GRBA/17	GDA	56	222161	6434705	Open site	Valid	Artefact : -		
	Contact	Recorders	Yancoal Australia Ltd,Miss Jessica Blackman					Permits		
37-1-0975	MTW/2019PP/GRBA/18	GDA	56	222183	6434695	Open site	Valid	Artefact : -		
	Contact	Recorders	Yancoal Australia Ltd,Miss Jessica Blackman					Permits		
37-1-0051	Goulburn River N.P.;Bow River;	AGD	56	232160	6428050	Open site	Valid	Artefact : -	Open Camp Site	1097
	Contact	Recorders	Margrit Koettig,R French					Permits		
37-1-1037	Rocky Creek Gully OS4	GDA	56	224888	6424844	Open site	Valid	Artefact : -		
	Contact	Recorders	OzArk Environmental and Heritage Management - Dubbo,Mr.YEKUN ZHANG					Permits		
37-1-0023	Tunbridge Creek;	AGD	56	239939	6421658	Open site	Valid	Artefact : -	Open Camp Site	380
	Contact	Recorders	Unknown Author					Permits		
37-1-0353	Inniscarra;KD/226;	AGD	56	241500	6424700	Closed site	Valid	Artefact : -	Shelter with Deposit	1197

Report generated by AHIMS Web Service on 16/10/2023 for Imogen Crome for the following area at Datum :GDA, Zone : 56, Eastings : 221988.0 - 244053.0, Northings : 6420122.0 - 6441749.0 with a Buffer of 0 meters.. Number of Aboriginal sites and Aboriginal objects found is 117

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AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : 4098
Client Service ID : 828837

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
	Contact	Recorders	Margrit Koettig					Permits		
37-1-0359	Inniscarra;	AGD	56	240554	6423042	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	Recorders	Unknown Author					Permits		
37-1-0366	Inniscarra;	AGD	56	240554	6423042	Closed site	Valid	Artefact : -	Shelter with Deposit	
	Contact	Recorders	Unknown Author					Permits		
37-1-0049	MPB18/BMP18;Turnbridge Creek;	AGD	56	241860	6424990	Open site	Valid	Artefact : -	Open Camp Site	1097
	Contact	Recorders	Margrit Koettig;					Permits		
37-1-0194	Parsons Gully;	AGD	56	242258	6419963	Open site	Valid	Grinding Groove : -	Axe Grinding Groove	380
	Contact	Recorders	Unknown Author					Permits		
37-1-0211	Parsons Gully;	AGD	56	242714	6420063	Closed site	Valid	Artefact : -	Shelter with Deposit	380
	Contact	Recorders	Unknown Author					Permits		
37-1-0102	Bow River;	AGD	56	237213	6420692	Open site	Valid	Artefact : -	Open Camp Site	380
	Contact	Recorders	Unknown Author					Permits		
37-1-0099	Bow River;	AGD	56	237307	6420511	Open site	Valid	Artefact : -	Open Camp Site	380
	Contact	Recorders	Ms.Laila Haglund					Permits		
37-1-0096	Bow River;	AGD	56	237496	6420240	Closed site	Valid	Artefact : -	Shelter with Deposit	380
	Contact	Recorders	Unknown Author					Permits		
37-1-0001	Lees Pinch;	AGD	56	223489	6420710	Closed site	Valid	Art (Pigment or Engraved) : -	Shelter with Art	
	Contact	Recorders	Unknown Author					Permits		
37-1-0373	Goulburn River;	AGD	56	239668	6421470	Closed site	Valid	Artefact : -	Shelter with Deposit	
	Contact	Recorders	Unknown Author					Permits		
37-1-0375	Policemans Track;	AGD	56	239668	6421470	Open site	Valid	Grinding Groove : -	Axe Grinding Groove	
	Contact	Recorders	Unknown Author					Permits		
37-1-0973	MTW/2019PP/GRBA/15	GDA	56	222098	6434717	Open site	Valid	Artefact : -		
	Contact	Recorders	Yancoal Australia Ltd,Miss Jessica Blackman					Permits		
37-1-0123	Bow River;	AGD	56	236755	6420683	Closed site	Valid	Artefact : -	Shelter with Deposit	380
	Contact	Recorders	ASRSYS					Permits		
37-1-0122	Bow River;	AGD	56	236747	6421141	Closed site	Valid	Artefact : -	Shelter with Deposit	380
	Contact	Recorders	ASRSYS					Permits		
37-1-1036	Redlynch Creek OS3	GDA	56	228272	6426217	Open site	Valid	Artefact : -		
	Contact	Recorders	OzArk Environmental and Heritage Management - Dubbo,Mr.YEKUN ZHANG					Permits		

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AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : 4098
Client Service ID : 828837

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
37-1-0367	Inniscarra;	AGD	56	240369	6423130	Closed site	Valid	Artefact : -	Shelter with Deposit	
	Contact	Recorders	Unknown Author					Permits		
37-1-0364	Inniscarra;	AGD	56	240554	6423042	Closed site	Valid	Artefact : -	Shelter with Deposit	
	Contact	Recorders	Unknown Author					Permits		
37-1-0181	Parsons Gully;	AGD	56	241519	6420315	Closed site	Valid	Artefact : -	Shelter with Deposit	380
	Contact	Recorders	Unknown Author					Permits		
37-1-0187	Parsons Gully;	AGD	56	241890	6420047	Closed site	Valid	Artefact : -	Shelter with Deposit	380
	Contact	Recorders	Unknown Author					Permits		
37-1-0217	Goulburn River;	AGD	56	242802	6420247	Closed site	Valid	Artefact : -	Shelter with Deposit	380
	Contact	Recorders	Unknown Author					Permits		
37-1-0109	Bow River;	AGD	56	237038	6420231	Closed site	Valid	Artefact : -	Shelter with Deposit	380
	Contact	Recorders	Ms.Laila Haglund					Permits		
37-1-0110	Bow River;	AGD	56	237038	6420231	Closed site	Valid	Artefact : -	Shelter with Deposit	380
	Contact	Recorders	Ms.Laila Haglund					Permits		
37-1-0111	Bow River;	AGD	56	237038	6420231	Closed site	Valid	Artefact : -	Shelter with Deposit	380
	Contact	Recorders	Ms.Laila Haglund					Permits		
37-1-0095	Bow River;	AGD	56	237496	6420240	Closed site	Valid	Artefact : -, Grinding Groove : -	Axe Grinding Groove,Shelter with Deposit	380
	Contact	Recorders	Unknown Author					Permits		
37-1-0092	Bow River;	AGD	56	237461	6422069	Open site	Valid	Artefact : -	Open Camp Site	380
	Contact	Recorders	ASRSYS					Permits		
37-1-0379	Inniscarra;	AGD	56	238542	6423004	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	Recorders	Unknown Author					Permits		
37-1-0089	Bow River;	AGD	56	237646	6421981	Open site	Valid	Grinding Groove : -	Axe Grinding Groove	380
	Contact	Recorders	ASRSYS					Permits		
37-1-0344	Inniscarra;	AGD	56	242856	6427110	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	Recorders	ASRSYS					Permits		
37-1-0124	Bow River;	AGD	56	236760	6420409	Open site	Valid	Artefact : -	Open Camp Site	380
	Contact	Recorders	Unknown Author					Permits		
37-1-0115	Bow River;	AGD	56	236847	6420685	Open site	Valid	Grinding Groove : -	Axe Grinding Groove	380

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AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : 4098
Client Service ID : 828837

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
	Contact	Recorders	ASRSYS					Permits		
37-1-1029	Wollara Road IF3	GDA	56	226394	6426654	Open site	Valid	Artefact : -		
	Contact	Recorders	OzArk Environmental and Heritage Management - Dubbo,Mr.YEKUN ZHANG					Permits		
37-1-0368	Inniscarra;	AGD	56	240369	6423130	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	Recorders	Unknown Author					Permits		
37-1-0356	Inniscarra;	AGD	56	240823	6423321	Open site	Valid	Grinding Groove : -	Axe Grinding Groove	
	Contact	Recorders	Unknown Author					Permits		
37-1-0171	Goulburn River;	AGD	56	241142	6420948	Open site	Valid	Artefact : -	Open Camp Site	380
	Contact	Recorders	Unknown Author					Permits		
37-1-0175	Goulburn River;	AGD	56	241430	6420222	Open site	Valid	Artefact : -	Open Camp Site	380
	Contact	Recorders	Unknown Author					Permits		
37-1-0182	Parsons Gully;	AGD	56	241701	6420410	Closed site	Valid	Artefact : -	Shelter with Deposit	380
	Contact	Recorders	Unknown Author					Permits		
37-1-0054	Goulburn River National Park;Mt Misery;Poggy Creek;	AGD	56	225950	6421800	Open site	Valid	Artefact : -	Open Camp Site	1097
	Contact	Recorders	Margrit Koettig					Permits		
37-1-0215	Parsons Gully;	AGD	56	242802	6420247	Open site	Valid	Artefact : -	Open Camp Site	380
	Contact	Recorders	Unknown Author					Permits		
37-1-0113	Bow River;	AGD	56	236931	6421053	Closed site	Valid	Artefact : -	Shelter with Deposit	380
	Contact	Recorders	ASRSYS					Permits		
37-1-0094	Bow River;	AGD	56	237496	6420240	Closed site	Valid	Artefact : -	Shelter with Deposit	380
	Contact	Recorders	Unknown Author					Permits		
37-1-0043	The Hulks;	AGD	56	222874	6429116	Closed site	Valid	Shell : -, Artefact : -	Shelter with Midden	
	Contact	Recorders	ASRSYS					Permits		
37-1-0044	The Hulks;	AGD	56	222874	6429116	Closed site	Valid	Shell : -, Artefact : -, Grinding Groove : -	Axe Grinding Groove,Shelter with Midden	
	Contact	Recorders	ASRSYS					Permits		
37-1-0025	Tunbridge Creek;	AGD	56	239655	6422201	Closed site	Valid	Artefact : -	Shelter with Deposit	380
	Contact	Recorders	Unknown Author					Permits		
37-1-1033	Killoe Creek GG1	GDA	56	237357	6438576	Open site	Valid	Grinding Groove : -		
	Contact	Recorders	OzArk Environmental and Heritage Management - Dubbo,Mr.YEKUN ZHANG					Permits		
37-1-0199	Parsons Gully;	AGD	56	242436	6420240	Closed site	Valid	Artefact : -	Shelter with Deposit	380
	Contact	Recorders	Unknown Author					Permits		

Report generated by AHIMS Web Service on 16/10/2023 for Imogen Crome for the following area at Datum :GDA, Zone : 56, Eastings : 221988.0 - 244053.0, Northings : 6420122.0 - 6441749.0 with a Buffer of 0 meters.. Number of Aboriginal sites and Aboriginal objects found is 117

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AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : 4098
Client Service ID : 828837

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
37-1-0200	Goulburn River;	AGD	56	242436	6420240	Closed site	Valid	Artefact : -	Shelter with Deposit	380
	Contact	Recorders	Unknown Author					Permits		
37-1-1032	Ringwood Gully IF6	GDA	56	228045	6422023	Open site	Valid	Artefact : -		
	Contact	Recorders	OzArk Environmental and Heritage Management - Dubbo,Mr.YEKUN ZHANG					Permits		
37-1-1027	Redlynch Creek IF1	GDA	56	228173	6425902	Open site	Valid	Artefact : -		
	Contact	Recorders	OzArk Environmental and Heritage Management - Dubbo,Mr.YEKUN ZHANG					Permits		
37-1-0365	Inniscarra;	AGD	56	240554	6423042	Closed site	Valid	Artefact : -	Shelter with Deposit	
	Contact	Recorders	Unknown Author					Permits		
37-1-0355	Inniscarra;	AGD	56	240823	6423321	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	Recorders	Unknown Author					Permits		
37-1-0380	Inniscarra;	AGD	56	240823	6423321	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	Recorders	Unknown Author					Permits		
37-1-0172	Goulburn River;	AGD	56	241154	6420308	Closed site	Valid	Artefact : -	Shelter with Deposit	380
	Contact	Recorders	Unknown Author					Permits		
37-1-0040	Tunbridge Creek Myrtle Gully	AGD	56	241667	6422239	Closed site	Valid	Artefact : -	Shelter with Deposit	380
	Contact	Recorders	Unknown Author					Permits		
37-1-0345	Inniscarra;	AGD	56	242677	6426924	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	Recorders	Unknown Author					Permits		
37-1-0699	Eagles Drift Art Site	GDA	56	226425	6434233	Open site	Valid	Art (Pigment or Engraved) : 1		
	Contact	Recorders	Jumburra Aboriginal Consultancy Services					Permits		
37-1-0053	Poggy;Mt Misery;	AGD	56	227770	6422960	Open site	Valid	Artefact : -	Open Camp Site	1097
	Contact	Recorders	Margrit Koettig,D French					Permits		
37-1-0093	Bow River;	AGD	56	237496	6420240	Closed site	Valid	Artefact : -	Shelter with Deposit	380
	Contact	Recorders	ASRSYS					Permits		
37-1-0343	The Hulks;	AGD	56	222964	6429210	Closed site	Valid	Art (Pigment or Engraved) : -	Shelter with Art	
	Contact	Recorders	ASRSYS					Permits		
37-1-0228	Parsons Gully;	AGD	56	243069	6420618	Open site	Valid	Grinding Groove : -	Axe Grinding Groove	380
	Contact	Recorders	Unknown Author					Permits		
37-1-0026	Tunbridge Creek;	AGD	56	239931	6422115	Closed site	Valid	Artefact : -	Shelter with Deposit	380
	Contact	Recorders	Unknown Author					Permits		

Report generated by AHIMS Web Service on 16/10/2023 for Imogen Crome for the following area at Datum :GDA, Zone : 56, Eastings : 221988.0 - 244053.0, Northings : 6420122.0 - 6441749.0 with a Buffer of 0 meters.. Number of Aboriginal sites and Aboriginal objects found is 117

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AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : 4098
Client Service ID : 828837

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
37-1-0240	Parsons Gully;	AGD	56	243806	6420358	Closed site	Valid	Artefact : -	Shelter with Deposit	380
Contact	Recorders	Unknown Author						Permits		
37-1-1028	Rocky Creek Slope IF2	GDA	56	226913	6426210	Open site	Valid	Artefact : -		
Contact	Recorders	OzArk Environmental and Heritage Management - Dubbo,Mr.YEKUN ZHANG						Permits		
37-1-0362	Inniscarra;	AGD	56	240554	6423042	Open site	Valid	Artefact : -	Open Camp Site	
Contact	Recorders	Unknown Author						Permits		
37-1-0354	Inniscarra;	AGD	56	240996	6423873	Open site	Valid	Artefact : -	Open Camp Site	
Contact	Recorders	Unknown Author						Permits		
37-1-0178	Parsons Gully;	AGD	56	241519	6420315	Closed site	Valid	Artefact : -	Shelter with Deposit	380
Contact	Recorders	Unknown Author						Permits		
37-1-0112	Bow River;	AGD	56	236930	6421144	Closed site	Valid	Artefact : -	Shelter with Deposit	380
Contact	Recorders	ASRSYS						Permits		
37-1-0091	Bow River;	AGD	56	237572	6421065	Closed site	Valid	Artefact : -	Shelter with Deposit	380
Contact	Recorders	Unknown Author						Permits		
37-1-0374	Goulburn River;	AGD	56	239668	6421470	Closed site	Valid	Artefact : -	Shelter with Deposit	
Contact	Recorders	Unknown Author						Permits		
37-1-0976	MTW/2019PP/GRBA/16	GDA	56	222150	6434708	Open site	Valid	Artefact : -		
Contact	Recorders	Yancoal Australia Ltd,Miss Jessica Blackman						Permits		
37-1-0085	Bow River;	AGD	56	237661	6421158	Closed site	Valid	Artefact : -	Shelter with Deposit	380
Contact	Recorders	ASRSYS						Permits		
37-1-0024	Tunbridge Creek;	AGD	56	239561	6422291	Closed site	Valid	Artefact : -	Shelter with Deposit	380
Contact	Recorders	Unknown Author						Permits		
37-1-1030	Monaghans Creek IF4	GDA	56	227432	6424546	Open site	Valid	Artefact : -		
Contact	Recorders	OzArk Environmental and Heritage Management - Dubbo,Mr.YEKUN ZHANG						Permits		
37-1-0371	Inniscarra;	AGD	56	240369	6423130	Open site	Valid	Artefact : -	Open Camp Site	
Contact	Recorders	Unknown Author						Permits		
37-1-0360	Inniscarra;	AGD	56	240554	6423042	Closed site	Valid	Artefact : -	Shelter with Deposit	
Contact	Recorders	Unknown Author						Permits		
37-1-0174	Parsons Gully;	AGD	56	241340	6420128	Open site	Valid	Artefact : -	Open Camp Site	380
Contact	Recorders	Unknown Author						Permits		
37-1-0176	Parsons Gully;	AGD	56	241525	6420040	Closed site	Valid	Artefact : -	Shelter with Deposit	380

Report generated by AHIMS Web Service on 16/10/2023 for Imogen Crome for the following area at Datum :GDA, Zone : 56, Eastings : 221988.0 - 244053.0, Northings : 6420122.0 - 6441749.0 with a Buffer of 0 meters.. Number of Aboriginal sites and Aboriginal objects found is 117

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AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : 4098
Client Service ID : 828837

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
Contact	Recorders	Unknown Author						Permits		
37-1-0180	Parsons Gully;	AGD	56	241519	6420315	Closed site	Valid	Artefact : -	Shelter with Deposit	380
Contact	Recorders	Unknown Author						Permits		
37-1-0050	MPB19/BMP19;Tunbridge Creek	AGD	56	241850	6425000	Open site	Valid	Artefact : -	Open Camp Site	1097
Contact	Recorders	Margrit Koettig						Permits		
37-1-0210	Goulburn River;	AGD	56	242710	6420246	Open site	Valid	Artefact : -	Open Camp Site	380
Contact	Recorders	Unknown Author						Permits		
37-1-0105	Bow River;	AGD	56	237043	6419957	Closed site	Valid	Artefact : -	Shelter with Deposit	380
Contact	Recorders	Ms.Laila Haglund						Permits		
37-1-0107	Bow River;	AGD	56	237043	6419957	Closed site	Valid	Artefact : -	Shelter with Deposit	380
Contact	Recorders	Unknown Author						Permits		
37-1-1031	Rocky Creek Gully IF5	GDA	56	224916	6426210	Open site	Valid	Artefact : -		
Contact	Recorders	OzArk Environmental and Heritage Management - Dubbo,Mr.YEKUN ZHANG						Permits		
37-1-0068	Tunbridge Creek;	AGD	56	239213	6420985	Closed site	Valid	Artefact : -	Shelter with Deposit	380
Contact	Recorders	K Pratt						Permits		
37-1-0229	Parsons Gully;	AGD	56	243074	6420344	Closed site	Valid	Artefact : -	Shelter with Deposit	380
Contact	Recorders	Unknown Author						Permits		
37-1-0372	Inniscarra;	AGD	56	240191	6422852	Closed site	Valid	Artefact : -	Shelter with Deposit	
Contact	Recorders	Unknown Author						Permits		
37-1-0202	Parsons Gully;	AGD	56	242429	6420606	Open site	Valid	Artefact : -	Open Camp Site	380
Contact	Recorders	Unknown Author						Permits		

** Site Status

Valid - The site has been recorded and accepted onto the system as valid

Destroyed - The site has been completely impacted or harmed usually as consequence of permit activity but sometimes also after natural events. There is nothing left of the site on the ground but proponents should proceed with caution

Partially Destroyed - The site has been only partially impacted or harmed usually as consequence of permit activity but sometimes also after natural events. There might be parts or sections of the original site still present on the ground

Not a site - The site has been originally entered and accepted onto AHIMS as a valid site but after further investigations it was decided it is NOT an aboriginal site. Impact of this type of site does not require permit but Heritage NSW should be notified

Report generated by AHIMS Web Service on 16/10/2023 for Imogen Crome for the following area at Datum :GDA, Zone : 56, Eastings : 221988.0 - 244053.0, Northings : 6420122.0 - 6441749.0 with a Buffer of 0 meters.. Number of Aboriginal sites and Aboriginal objects found is 117

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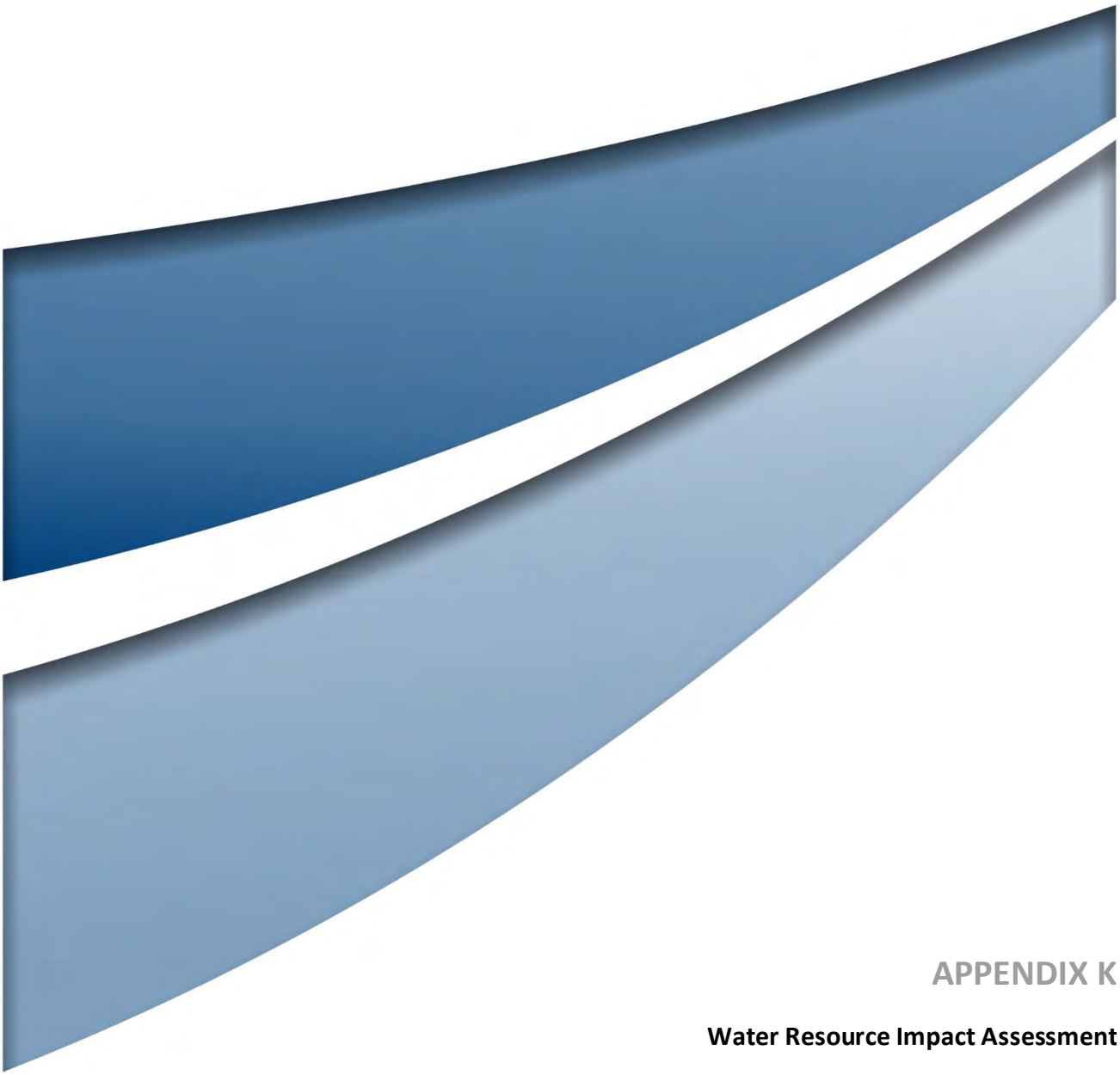


APPENDIX K

Water Resource Impact Assessment

umwelt
Environmental & Social Consultants

lightsource bp

GOULBURN RIVER SOLAR FARM

Amended Water Resources Impact Assessment

FINAL

December 2023

GOULBURN RIVER SOLAR FARM

Amended Water Resources Impact Assessment

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Lightsource bp

Project Director: Malinda Facey
Project Manager: Jessica Henderson Wilson
Technical Manager: Melissa Swan
Report No. 23485/R09
Date: December 2023

Environmental & Social Consultants

This report was prepared using Umwelt's ISO 9001 certified Quality Management System.

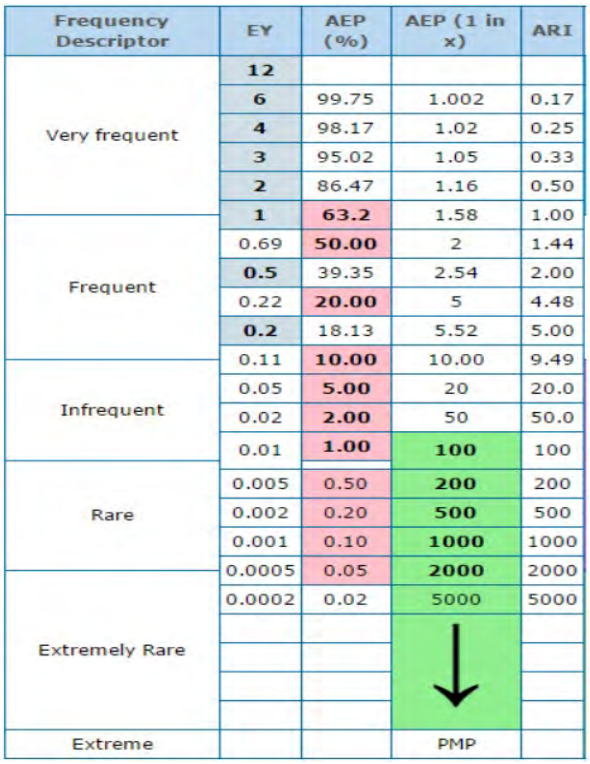
Acknowledgement of Country

Umwelt would like to acknowledge the traditional custodians of the country on which we work and pay respect to their cultural heritage, beliefs, and continuing relationship with the land. We pay our respect to the Elders – past, present, and future.

Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
V0	J Henderson-Wilson	04/12/2023	M Facey	05/12/2023
V1	J Henderson-Wilson	11/12/2023	M Facey	11/12/2023

Glossary and Abbreviations

Term/Abbreviation	Definition
AEP (Annual Exceedance Probability)	Annual Exceedance Probability. The chance of a flood of a given or large size occurring in any one year, usually expressed as a percentage. In this study AEP has been used consistently to define the probability of occurrence of flooding. The following relationships between AEP and ARI applies to this study (ARR, 2019). 
AHD	Australian Height Datum. A common national surface level datum approximately corresponding to mean sea level.
Amended Project	The Amended Project includes the elements of the Project as described in the EIS as well as changes which have been made largely in response to submissions on the EIS. These include: Project site access/egress amendments, upgrades to additional sections of Wollara Road and Ringwood Road, increased BESS capacity and an option of a decentralised BESS, minor Project layout modifications, construction of an additional transmission tower and additional assessment and revised approach for workforce accommodation.
ARR	Australian Rainfall and Runoff. Guidelines prepared by the Institute of Engineers Australia for the estimation of design floods.
ASS / PASS	Acid Sulfate Soils / Potential Acid Sulfate Soils.
BESS	Battery Energy Storage System.
CEMP	Construction Environmental Management Plan.
Development footprint	The maximum extent of ground disturbance associated with the construction and operation of the Project. The development footprint would cover an area of approximately 792.19 ha within the Project Area.

Frequency Descriptor	EY	AEP (%)	AEP (1 in x)	ARI
Very frequent	**12**			
	6	99.75	1.002	0.17
	4	98.17	1.02	0.25
	3	95.02	1.05	0.33
	2	86.47	1.16	0.50
	1	**63.2**	1.58	1.00
Frequent	0.69	**50.00**	2	1.44
	0.5	39.35	2.54	2.00
	0.22	**20.00**	5	4.48
	0.2	18.13	5.52	5.00
	0.11	**10.00**	10.00	9.49
Infrequent	0.05	**5.00**	20	20.0
	0.02	**2.00**	50	50.0
	0.01	**1.00**	**100**	100
Rare	0.005	0.50	**200**	200
	0.002	0.20	**500**	500
	0.001	0.10	**1000**	1000
	0.0005	0.05	**2000**	2000
Extremely Rare	0.0002	0.02	5000	5000
			↓	
Extreme			PMP	

Term/Abbreviation	Definition
Discharge	The rate of flow of water measured in terms of volume per unit time, for example, cubic metres per second (m^3/s). Discharge is different from speed or velocity of flow, which is a measure of how fast the water is moving for example, metres per second (m/s).
Environmental Impact Statement (EIS) Project	The proposed Goulburn River Solar Farm. The Project includes the construction, operation and decommissioning of a solar farm with capacity of up to 550 MW, BESS and associated infrastructure. Including the various road repairs and upgrades to Ringwood Road.
Flood	Relatively high stream flow which overtops the natural or artificial banks in any part of a stream, river, estuary, lake or dam, and/or local overland flooding associated with major drainage before entering a watercourse, and/or coastal inundation resulting from super-elevated sea levels and/or waves overtopping coastline defences excluding tsunami.
Flood risk	Potential danger to personal safety and potential damage to property resulting from flooding. The degree of risk varies with circumstances across the full range of floods. Flood risk in this manual is divided into 3 types, existing, future and continuing risks. They are described below: • Existing flood risk: the risk a community is exposed to as a result of its location on the floodplain. • Future flood risk: the risk a community may be exposed to as a result of new development on the floodplain. • Continuing flood risk: the risk a community is exposed to after floodplain risk management measures have been implemented. For a town protected by levees, the continuing flood risk is the consequences of the levees being overtopped. For an area without any floodplain risk management measures, the continuing flood risk is simply the existence of its flood exposure.
Flood storage areas	Those parts of the floodplain that are important for the temporary storage of floodwaters during passage of a flood. The extent and behaviour of flood storage areas may change with flood severity, and loss of flood storage can increase the severity of flood impacts by reducing natural flood attenuation. Hence, it is necessary to investigate a range of flood sizes before defining flood storage areas.
Floodplain	Area of land which is subject to inundation by floods up to and including the probable maximum flood event, that is flood prone land.
GW	Gigawatt.
GWh	Gigawatt-hour.
Hazard	A source of potential harm or situation with a potential to cause loss. In relation to this manual the hazard is flooding which has the potential to cause damage to the community.
Hydrology	The study of the rainfall and runoff process; in particular, the evaluation of peak flows, flow volumes and the derivation of hydrographs for a range of floods.
ICNIRP	International Commission on Non-Ionizing Radiation Protection.
Involved Dwelling	Dwelling located on land owned by landholders involved in the Project.
Involved landholder	A landholder whose property would have Project infrastructure located on it.
kL	Kilolitre, one thousand litres.
km	Kilometres.
kV	Kilovolt.

Term/Abbreviation	Definition
m AHD	Metres Australian Height Datum (AHD).
m/s	Metres per second. Unit used to describe the velocity of floodwaters.
m^3/s	Cubic metres per second or "cumecs". A unit of measurement of creek or river flows or discharges. It is the rate of flow of water measured in terms of volume per unit time.
MDBA	Murray-Darling Basin Authority.
MHRDC	Maximum Harvestable Right Dam Capacity.
ML	Megalitre, one million litres.
MNES	Matter of National Environmental Significance.
MW	Megawatt.
Non-involved dwelling	Dwelling located on land owned by landholders not involved in the Project.
Non-involved landholder	A landholder whose property is located in proximity to the Project Area but would not have Project infrastructure located on it. Potential impacts to non-involved landholders are investigated in the EIS.
NVR Map	Native Vegetation Regulatory Map.
PMF (Probable maximum flood)	The largest flood that could conceivably occur at a particular location, usually estimated from probable maximum precipitation coupled with the worst flood producing catchment conditions. Generally, it is not physically or economically possible to provide complete protection against this event. The probable maximum flood defines the extent of flood prone land, that is, the floodplain.
Project Area	The total area in which the Project would be developed. The Project Area covers approximately 2,000 ha.
Risk	Chance of something happening that will have an impact. It is measured in terms of consequences and likelihood. In the context of the manual, it is the likelihood of consequences arising from the interaction of floods, communities, and the environment.
Runoff	The amount of rainfall which ends up as a streamflow, also known as rainfall excess.
Scour	Erosion by mechanical action of water, typically of soil.
Sensitive receiver	Non-involved dwellings in proximity to the Project Area that may be sensitive to noise, visual, traffic and other impacts. Potential impacts to sensitive receivers are investigated in the EIS.
TUFLOW	TUFLOW is a computer program which is used to simulate free-surface flow for flood and tidal wave propagation. It provides coupled 1D and 2D hydraulic solutions using a powerful and robust computation. The engine has seamless interfacing with GIS and is widely used across Australia.
WAL	Water Access Licence.
WSP	Water Sharing Plan.

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Figures

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Appendices

1.0 Introduction

1.1 Project Overview

Lightsource Development Services Australia Pty Ltd (Lightsource bp) is seeking to develop the proposed Goulburn River Solar Farm in New South Wales (NSW) (the Project), approximately 28 kilometres (km) southwest of Merriwa within the Upper Hunter Shire Local Government Area (LGA) (refer to **Figure 1.1**). An Environmental Impact Statement (EIS), including a Water Resources Impact Assessment, was submitted to the Department of Planning and Environment (DPE) and publicly exhibited for 28 days over June and July 2023.

The Project, as exhibited in the EIS, included the construction, operation, maintenance and decommissioning of approximately 550 megawatt peak (MWp) of solar photovoltaic (PV) generation along with a Battery Energy Storage System (BESS) with 280 MWp and 570 megawatt hour (MWh) capacity. The Project also comprised supporting infrastructure including a substation and connection to an existing 500 kilovolt (kV) transmission line and road upgrades to parts of Ringwood Road including two culverts at Bow River and Killoe Creek.

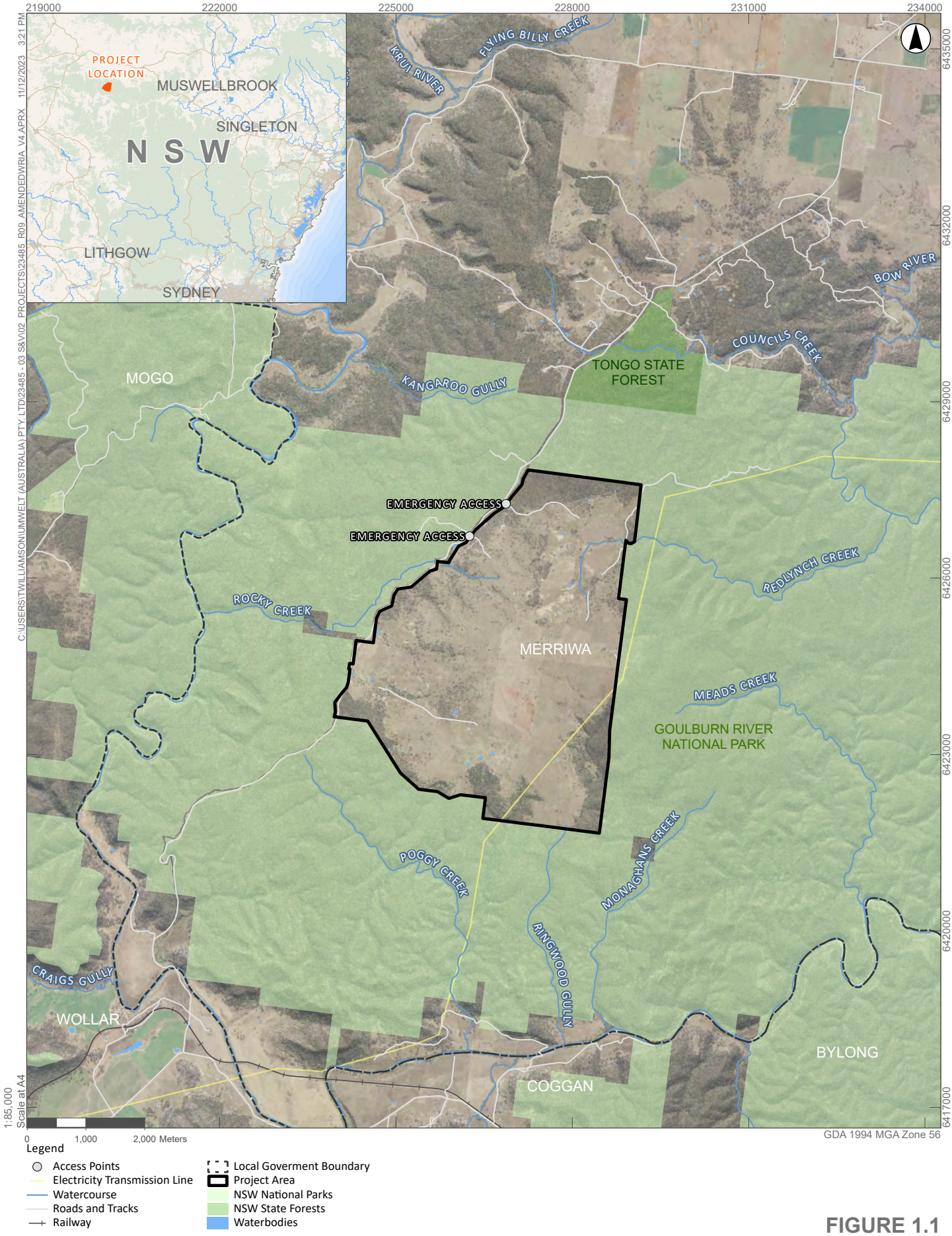
Following public exhibition of the EIS, LSbp has continued to consult with landholders and stakeholders. Ongoing consultation and consideration of the submissions received has resulted in a number of proposed changes to the Project.

Amendments to the Project (hereafter referred to as the Amended Project) are described and assessed within the Amendment Report (Umwelt, 2023a) which should be read in conjunction with the Response to Submissions Report (RtS) (Umwelt, 2023b) prepared for the Project. The conceptual layout for the Amended Project is shown in **Figure 2.2**.

The Project Area is situated on two freehold properties and sections of Crown Land, covering an area of approximately 2,000 hectares (ha), currently primarily used for grazing and cropping activities. The Development Footprint for the Amended Project is approximately 792.19 ha.

The Project is expected to operate for 40 years following an approximately 27-month construction period. After the initial 40-year operating period, the solar farm would either be decommissioned, removing all infrastructure and returning the site to its existing land capability, or repurposed with new equipment subject to technical feasibility and planning consents.

The Project is a State Significant Development (SSD) under the State Environmental Planning Policy (Planning Systems) 2021 (Planning Systems SEPP) as the capital value of the Project is over $30 million. An EIS for the Project was submitted to DPE in May 2023. Public exhibition of the EIS took place between 13 June 2023 and 10 July 2023, with 56 unique submissions made by the public (including one from Mid-Western Regional Council) as well as submissions from the two local councils the Project Site is located within and 11 government agencies.



Legend

- Access Points
- Electricity Transmission Line
- Watercourse
- Roads and Tracks
- Railway
- Local Goverment Boundary
- Project Area
- NSW National Parks
- NSW State Forests
- Waterbodies

FIGURE 1.1

Location and Regional Context

Image Source: ESRI Basemap (2021) **Data source:** NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019); Lightsource BP (2022)

1.2 Description of Amendments to this Assessment

This Water Resources Impact Assessment has been updated in response to the community and stakeholder submissions received on the EIS and subsequent amendments as part of the Amended Project.

- **Section 1.1** has been updated to reflect the details of the Amended Project and the approvals process to date.
- **Section 1.2** (this section) has been added to provide a summary of the updates to the document.
- **Section 1.3** has been updated to reference the Amended Project.
- **Section 2.0** has been updated to include the description of the Amended Project.
- **Section 3.5** has been updated to present the number of Water Access Licences for the 2023/2024 year.
- **Section 7.1.1** has been updated to include reference to the additional road upgrades proposed.
- **Section 7.2** has been updated to include a reference to the Amended Project.
- **Section 8.0** has been updated to include reference to the additional road upgrades proposed.
- **Section 10.0** has been updated to include additional References.

1.3 Purpose and Scope of this Report

This Amended Water Resources Impact Assessment (WRIA) has been prepared by Umwelt in accordance with the Secretary's Environmental Assessment Requirements (SEARs) (amended on 1 February 2022) issued by the DPE and as presented in **Section 1.4** and with consideration of the submissions relating to the public exhibition of the EIS (addressed within the Response to Submissions Report (Umwelt, 2023b)) and associated Project Amendment Report (Umwelt, 2023a)**.**

This report considers the potential impacts of the Project on water resources in the vicinity of the Amended Project Area, and the scope of this report includes:

- Assessments on the following:
    - flooding (including modelling for 10%, 1%, 0.5%, 0.2% Annual Exceedance Probability (AEP) and the Probable Maximum Flood (PMF))
    - groundwater levels
    - potential impacts and mitigation measures for erosion and sedimentation
    - surface and groundwater quality
    - water users
    - water sourcing and licensing.
- Identification of any mitigation and management measures to minimise potential impacts of the Project on water and soil resources.

1.4 Statutory Context, Policy and Guidelines

This report has been prepared in accordance with the following guidelines and legislative requirements:

- NSW *Water Management Act 2000* (WM Act).
- NSW *Water Act 1912* (Water Act).
- Relevant Water Sharing Plans within the Project Area.
- Groundwater:
    - NSW State Groundwater Policy Framework Document and component policies (DPIE).
    - NSW Aquifer Interference Policy 2012 (DPIE).
    - National Water Quality Management Strategy Guidelines for Groundwater Protection in Australia (ARMCANZ/ANZECC).
- Flooding:
    - Floodplain Development Manual (OEH).
    - Floodplain Risk Management Guideline (OEH).
    - Australian Rainfall and Runoff Guidelines 2019.
- Surface Water:
    - NSW State Rivers and Estuary Policy (DPIE Water).
    - NSW Government Water Quality and River Flow Objectives at [http://www.environment.nsw.gov.au/ieo/].
    - Using the ANZECC Guideline and Water Quality Objectives in NSW (DEC, 2006).
    - National Water Quality Management Strategy: Australian Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ).
    - Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (DECC, 2008).
    - Managing Urban Stormwater: Soils and construction (Landcom).
    - Technical Guidelines: Bunding and Spill Management (EPA).
    - NSW Guidelines for Controlled Activities (Various) (DPIE).
    - NSW Water Quality Objectives (DECCW, 2006).
    - ANZECC (2000) Guidelines for Fresh and Marine Water Quality.
    - Approved Methods for the Sampling and Analysis of Water Pollutant in NSW (DECC, 2004).

- Guidelines for Controlled Activities on Waterfront Land: There a number of guidelines for Controlled Activities under the WM Act, developed by the former NSW Office of Water (now DPE – Water).
    - *Guidelines for riparian corridors on waterfront land.*
    - *Guidelines for instream works on waterfront land.*
    - *Guidelines for vegetation management plans on waterfront land.*
    - *Guidelines for watercourse crossings on waterfront land.*
    - *Controlled Activities on Waterfront Land: Controlled activity exemptions on waterfront land.*

Note that there has been no specific engagement with the community or government stakeholders as part of this assessment due to the minor impacts. Broader engagement has been undertaken with the community and government stakeholders as part of the EIS and preparation of the Response to Submissions and Amendment Report.

1.5 Summary of SEARS

The SEARs identify matters that must be addressed in the Environmental Impact Statement (EIS). **Table 1.1** references the relevant requirements for water and where the SEARs have been addressed in this report.

Table 1.1 SEARs Items and Responses

Requirement	Section Where Addressed
Water – including: an assessment of the likely impacts of the development (including flooding) on surface water and groundwater resources and measures proposed to monitor, reduce and mitigate these impacts;	**Section 7.0** and **Section 8.0**
details of water requirements and supply arrangements for construction and operation; and	**Section 3.5**, **Section 4.1**, **Section 7.4**and **Section 8.0**
where the project involves works within 40 metres of any river, lake or wetlands (collectively waterfront land), identify likely impacts to the waterfront land, and how the activities are to be designed and implemented in accordance with the DPI *Guidelines for Controlled Activities on Waterfront Land* (2018) and (if necessary) *Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (DPI 2003), and *Policy & Guidelines for Fish Habitat Conservation & Management* (DPE, 2013); and	**Section 3.1**, **Section 7.1**, **Section 7.2** and **Section 8.0**
a description of the erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with Managing Urban Stormwater: Soils & Construction (Landcom 2004);	**Section 8.0**

The Agency Advice and where in the WRIA it has been addressed is included in **Appendix A**.

1.6 Submissions on the EIS

An EIS for the Project was submitted to DPE in May 2023. Public exhibition of the EIS took place between 13 June 2023 and 10 July 2023. A total of 12 submissions relating to water were received. A Response to Submissions (RtS) report was prepared to provide a summary of the actions since exhibition, detail the comments provided in the public submissions phase of the EIS, analyse the submissions and offer a detailed response to each submission. Where required, the submissions relating to water have been addressed within this Amended WRIA. A summary of the submissions as relating to water and how they have been addressed is presented in **Appendix A**.

2.0 Project Description

2.1 EIS Project

The Project as exhibited within the EIS (the EIS Project) (and as displayed on **Figure 2.1**) included the construction, operation and decommissioning of a photovoltaic (PV) solar farm with a capacity of approximately 550 MWp, which will supply electricity to the national electricity grid. The Project also included a BESS with a proposed capacity of about 570 MWh and an electrical substation to connect the solar farm to the existing 500 kV transmission line that runs through the Project Area. Road upgrades were proposed to the north of the Project Area on Ringwood Road.

Subject to the final design process, the key components of the EIS Project include:

- Approximately 1 million bifacial solar PV modules in an east-west single-axis tracking arrangement with an average height of approximately 3.1 m at full tilt, with a maximum of 4 m in some areas due to undulating site topography.
- A BESS with an approximate 570 MWh capacity.
- Onsite 500 kV switchyard and substation, with underground electrical conduits and cabling leading into the yard and overhead lines reaching above to the existing transmission line.
- A 30 m Communications tower, providing communications, radio and cellular services to the site and the wider region.
- Perimeter and internal gravel access roads allowing for site maintenance.
- Temporary construction facilities and a site office and operations and maintenance building with parking for the operations team.
- Primary access point from existing driveway off Wollara Road, and two access points strictly for emergency access along the north-western boundary of the Project Area (**Figure 2.1**).
- Drainage line crossings, if and where required, to manage existing surface water flows.
- Perimeter security fencing around the solar modules, crossing gates, water tanks and/ or dams, and internal access points around the Project boundary.
- Ringwood Road would include a 1.8 km section to be widened and resealed between Bow River and Killoe Creek. These repairs will include 8 m bitumen-sealed formation with a minimum of 500 mm unsealed shoulders. The horizontal and vertical alignment of the proposed road will ensure safe sight distance, safe movement of longer vehicles, and an improved road network for the users.
- Culvert Upgrades: Two locations on Ringwood Road have been identified for upgrade to the water crossings at Bow River and Killoe Creek. The culvert upgrades will include:
    - installing culverts designed to accommodate B doubles and various farm machinery
    - culvert width 7 m (3.5 m lane width) sealed carriageway with suitable guardrail and signage

- associated drainage works
- stockpile site to be located on disturbed land within the road reserve in consultation with Upper Hunter Council
- temporary side track at both locations to facilitate access during construction.

2.2 The Amended Project

Proposed amendments to the Project are summarised below and addressed further in the Amendment Report (Umwelt, 2023a) which should be read in conjunction with this assessment. **Figure 2.2** displays the Amended Project and **Figure 2.3** highlights the differences between the Amended Project and the EIS Project. The Amended Project includes:

- Amendments to the transport route, including:
  - A revised transport access/egress route, including the diversion of construction vehicles egress west at the Golden Highway and Ringwood Road intersection to a vehicle turning area on Barnett Street, Merriwa.
  - An upgrade of the intersection of the Golden Highway and Ringwood Road to support these movements.
- Upgrades to additional sections of Wollara Road and Ringwood Road.
- Increased BESS capacity and option of a decentralised BESS including the option to host both centralised and decentralised BESS units.
- Minor modifications to the Development Footprint and internal layout, including:
  - A re-alignment of the Development Footprint to avoid Travelling Stock Route (TSR) 44841 although maintaining existing access through TSR 44841.
  - Relocation or removal of solar arrays within the Development Footprint to further avoid serious and irreversible impacts (SAII) to important habitat for the Regent Honeyeater and Box Gum Woodland.
  - Relocation of the access road connecting the northern portions of the site to further avoid biodiversity impacts.
  - An increase in the width of two (2) internal access roads which connect the western and northern portions of the site from 6 m (as originally proposed in the Project EIS) to 10 m, to allow for underground transmission corridors as part of the internal reticulation network, rather than overhead transmission cables.
  - Reduction of the development footprint to 792.19 ha as a result of the above modifications.
- Construction of an additional transmission tower within the existing easement of the 500 kV transmission line adjacent the BESS/substation.
- Additional assessment and revised approach for workforce accommodation.

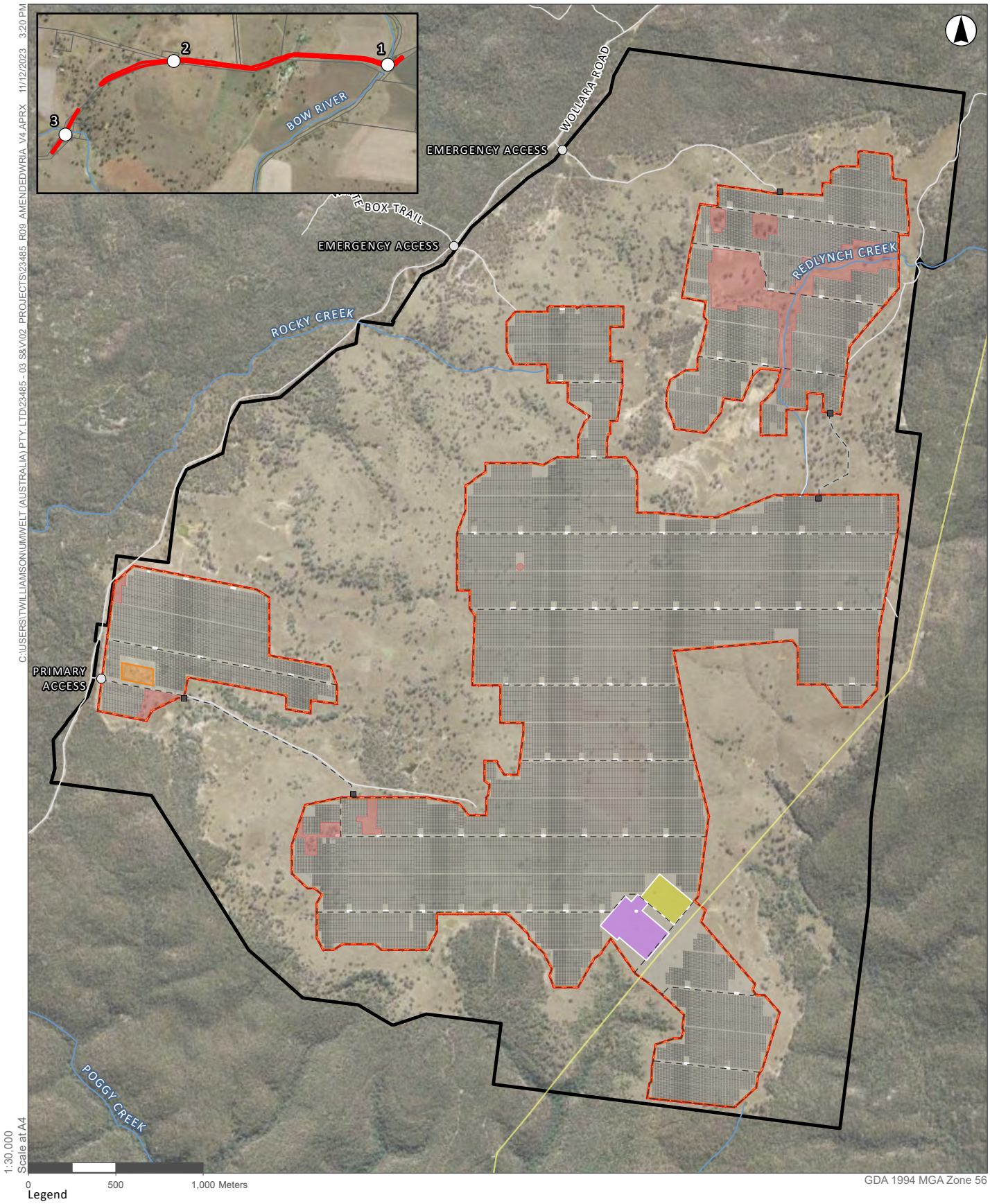


FIGURE 2.1

EIS Project Development Footprint

Image Source: ESRI Basemap (2022) **Data source:** NSW LPI (2022), NSW DSFI (2022); NPWS Estate (2022); Lightsource BP (2022)

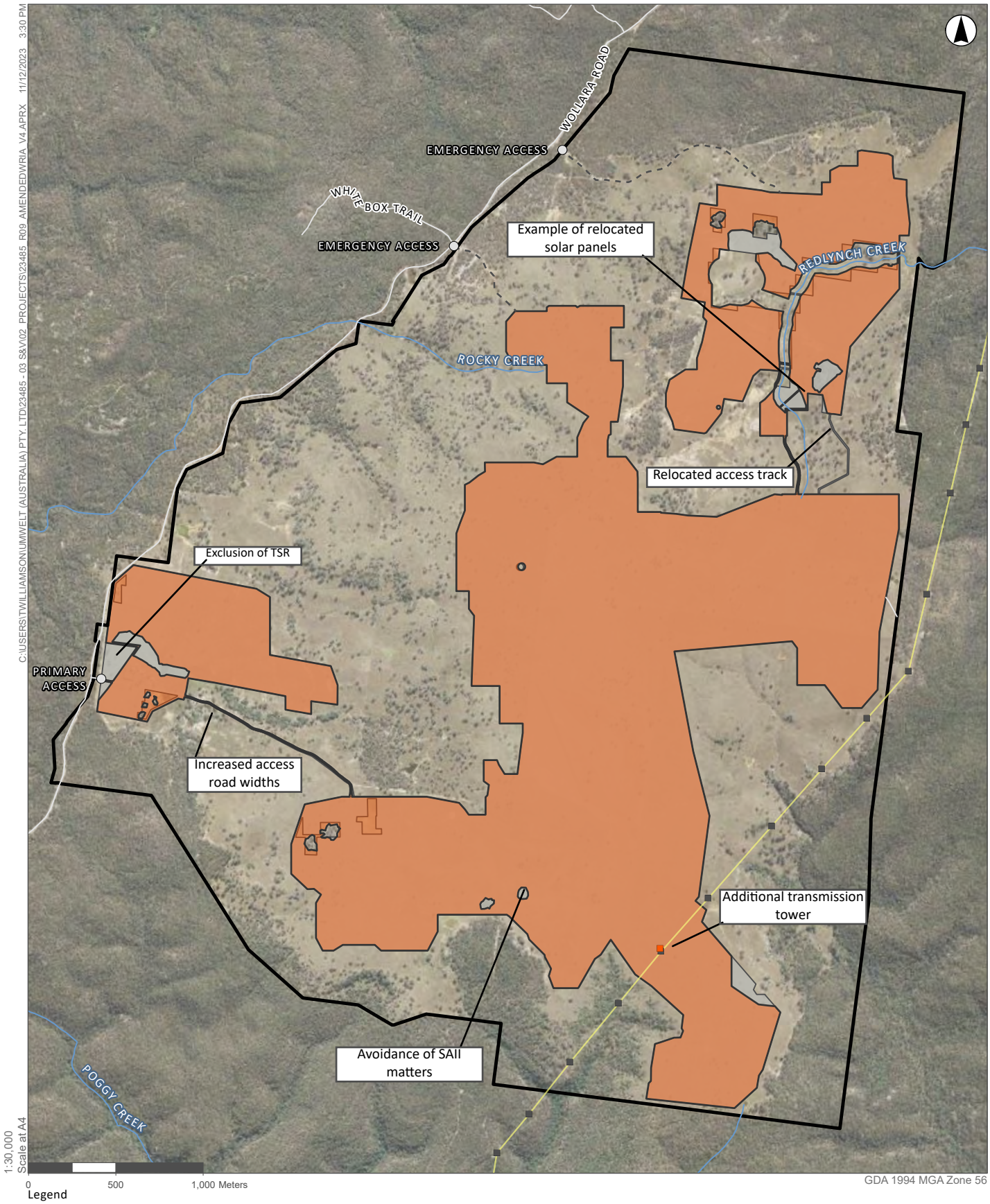


FIGURE 1.4

Summary of the Proposed Amendments to Development Footprint

Image Source: ESRI Basemap (2022) **Data source:** NSW LPI (2022), NSW DSFI (2022); NPWS Estate (2022); Lightsource BP (2022)

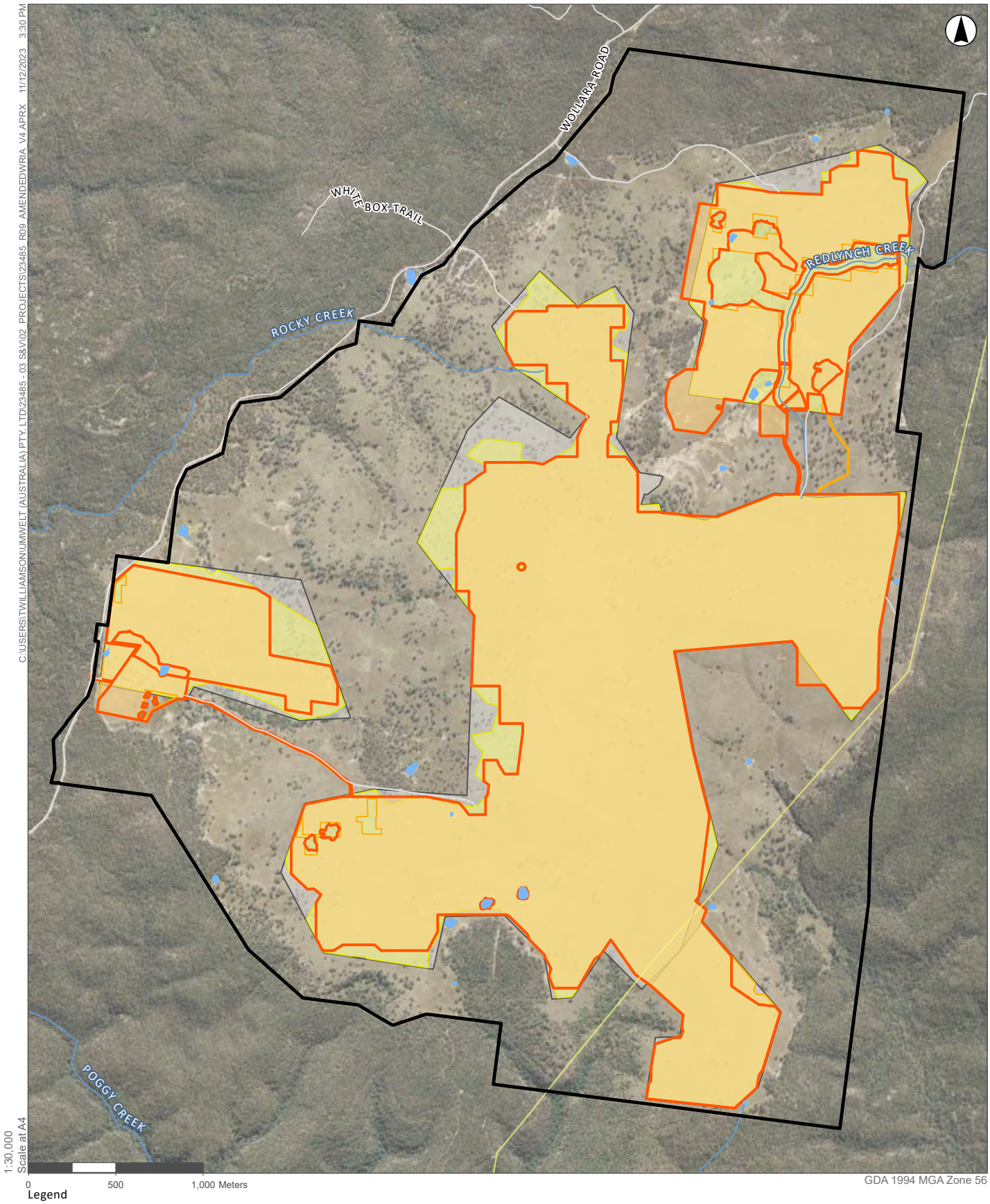


FIGURE 2.3

Summary of the Proposed Amendments to the Development Footprint

Image Source: ESRI Basemap (2022) **Data source:** NSW LPI (2022), NSW DSFI (2022); NPWS Estate (2022); Lightsource BP (2022)

3.0 Existing Environment

3.1 Hydrology

The Project Area is located within the Hunter River catchment, within the Goulburn River sub-catchment. In the surrounding area of the Project, Redlynch Creek is located to the northeast, Rocky Creek to the northwest, Poggy Creek to the southwest and Ringwood Gully to the south. Goulburn River is located approximately 3 km to the south and to the west of the Project Area (refer to **Figure 3.1**).

The topography of the Project Area varies, with the majority of the Project Area between 400 mAHD and 440 mAHD, with elevation between 350 mAHD and 390 mAHD in the north and southwest of the Project Area (refer to **Figure 5.1**). The identified watercourse alignments with their corresponding Strahler stream order are shown in **Figure 3.1**. As the Project Area is located on top of a ridge, watercourses and unnamed flow paths within the Project Area are located towards the boundary.

The majority of the watercourses in the Project Area are only 1st and 2nd order watercourses with sections of Redlynch Creek, Rocky Creek and Monaghans Creek also becoming 3rd order watercourses within the Project Area. All watercourses within the Project Area eventually flow into the Goulburn River.

There are approximately 20 to 30 small man-made farm dams present within the Project Area where water pooling occurs for extended periods, as shown in **Figure 3.1**.

The Road Upgrade Area includes two watercourses, Bow River a 6th order watercourse and Killoe Creek a 4th order watercourse. The identified watercourse alignments with their corresponding Strahler stream order are shown in **Figure 3.1A**.

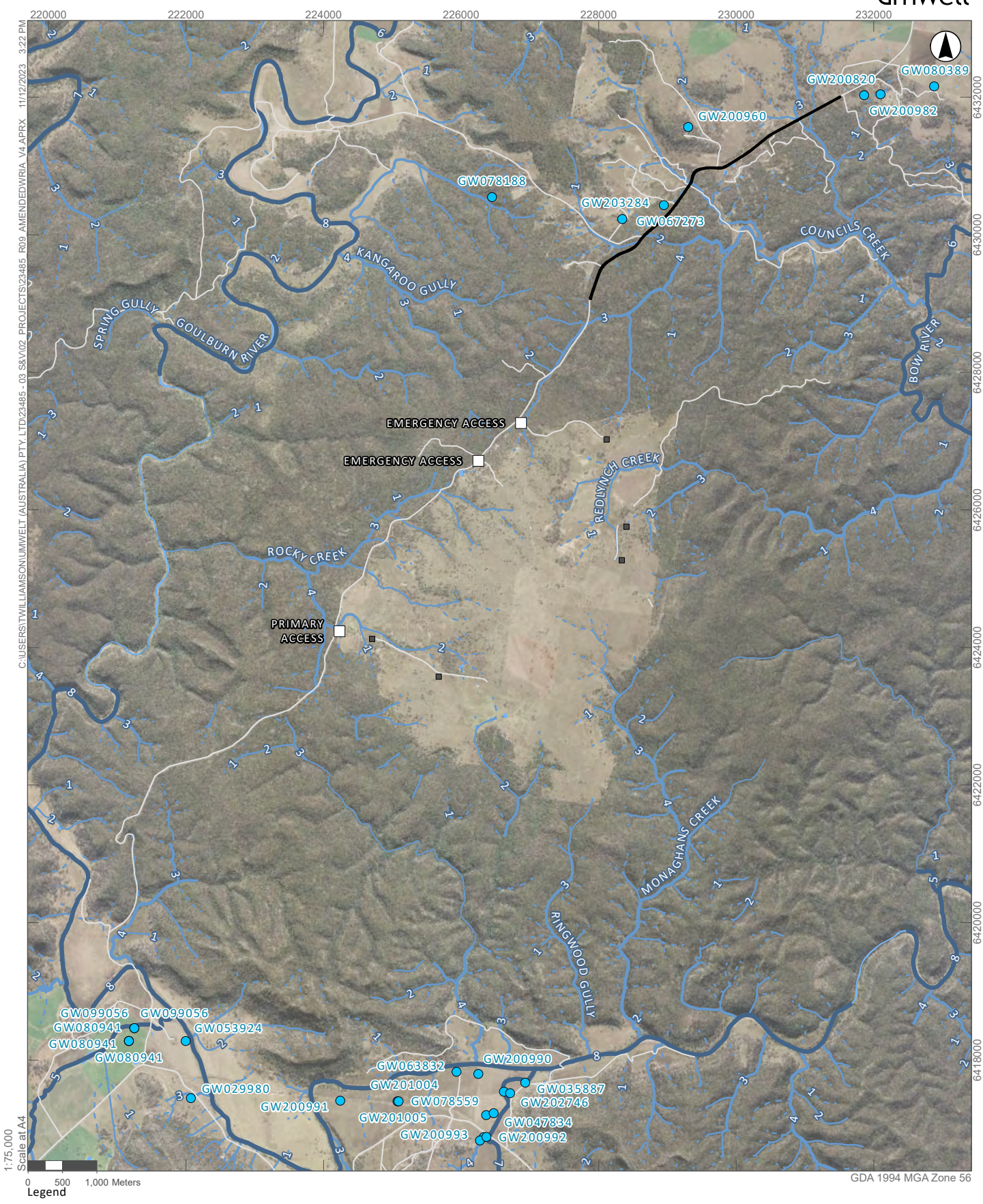


FIGURE 3.1

Hydrological Context

Image Source: ESRI Basemap (2021) **Data source:** NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019); Lightsource BP (2022)

FIGURE 3.1A
Hydrological Context in Road Upgrade Areas

Image Source: ESRI Basemap (2022) **Data source:** NSW LPI (2022), NSW DSFI (2022); NPWS Estate (2022)

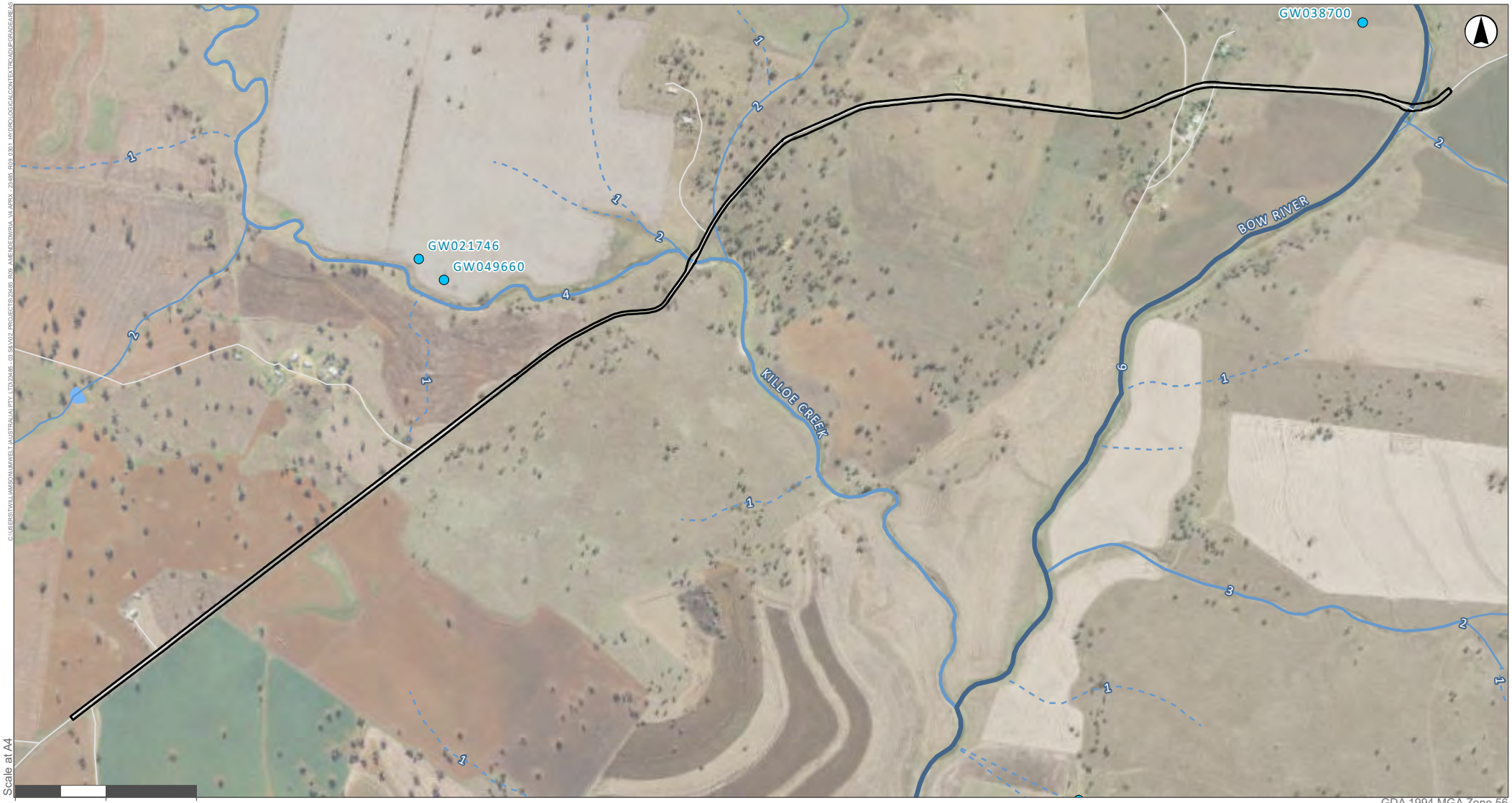


FIGURE 3.1B
Hydrological Context in Road Upgrade Areas

Image Source: ESRI Basemap (2022) **Data source:** NSW LPI (2022), NSW DSFI (2022); NPWS Estate (2022)

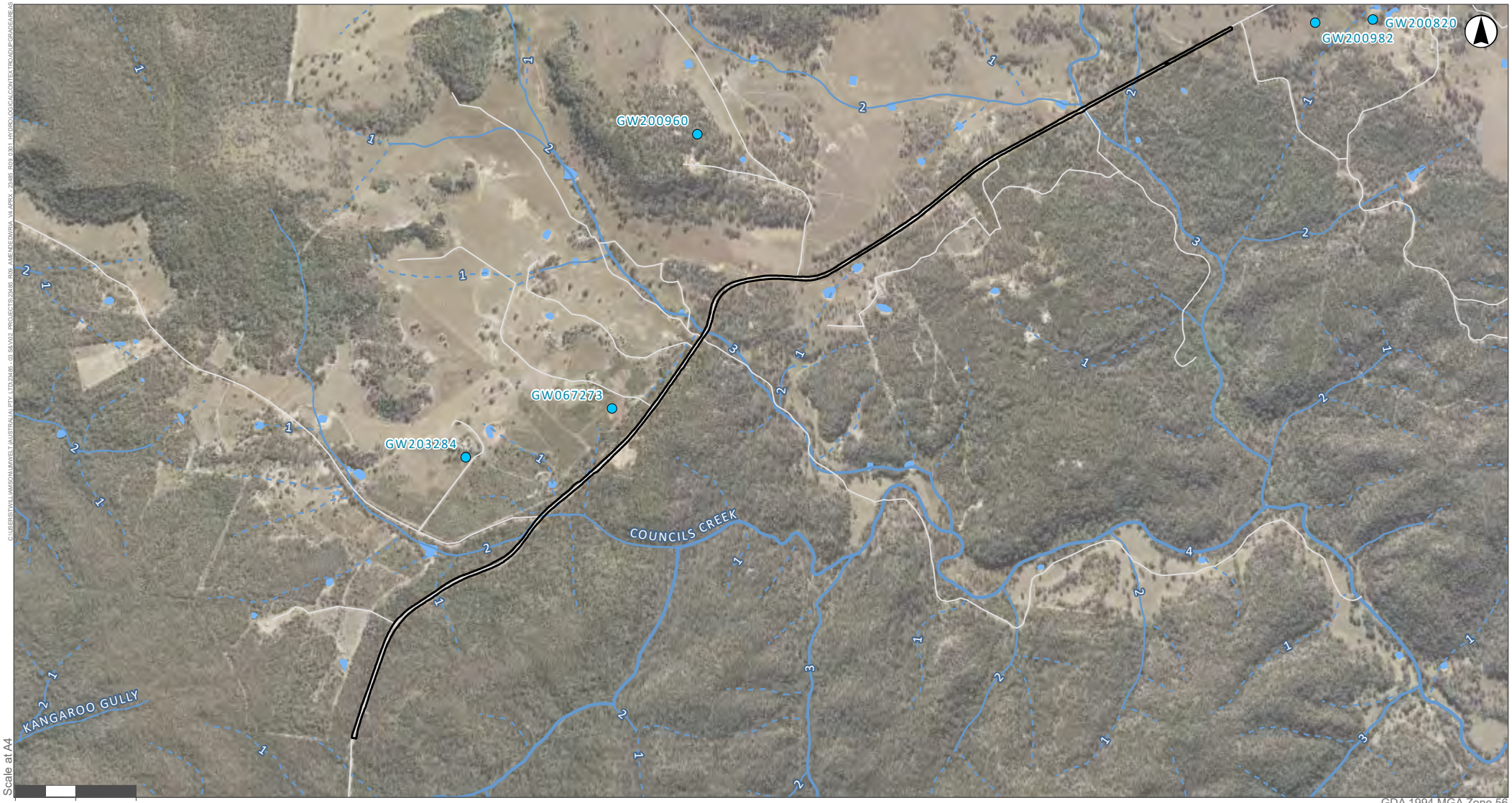


FIGURE 3.1C
Hydrological Context in Road Upgrade Areas

Image Source: ESRI Basemap (2022) **Data source:** NSW LPI (2022), NSW DSFI (2022); NPWS Estate (2022)

3.2 Rainfall and Evaporation

The closest active Bureau of Meteorology (BoM) daily rainfall gauge to the Project Area is Barrigan St, Wollar (Gauge 062032), approximately 16 km to the southwest. The gauge is considered representative of the local region rainfall patterns.

Records from the Barrigan St, Wollar gauge cover a continuous period of over 121 years from 1901 to 2022. The recorded annual average rainfall over this period is 590 mm, with 1950 providing for the highest annual total of 1,205 mm.

The average monthly rainfall data from the Barrigan St, Wollar gauge is presented in **Figure 3.2**. The mean and median rainfalls are highest during spring/summer, with the highest monthly mean reaching 61.5 mm in January, and are lowest in May at 26.5 mm. The highest daily rainfall values indicate storm events are most likely to occur during February with peak daily totals exceeding 180 mm.

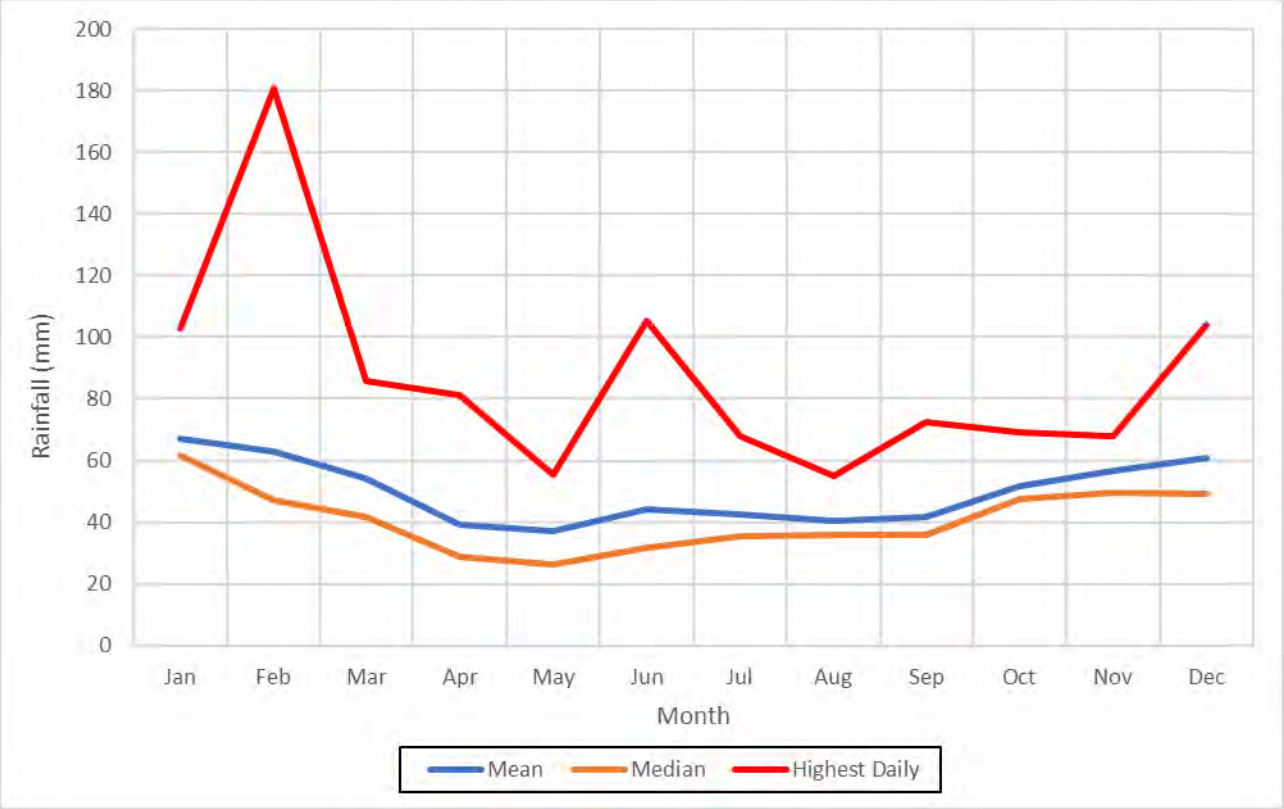


Figure 3.2 Monthly Rainfall at Barrigan St, Wollar Gauge (Gauge ID 062032)

The average annual evaporation across the Project Area is estimated to be between 1,200 and 1,600 mm/year (BoM, 2006), as shown in **Figure 3.3**.

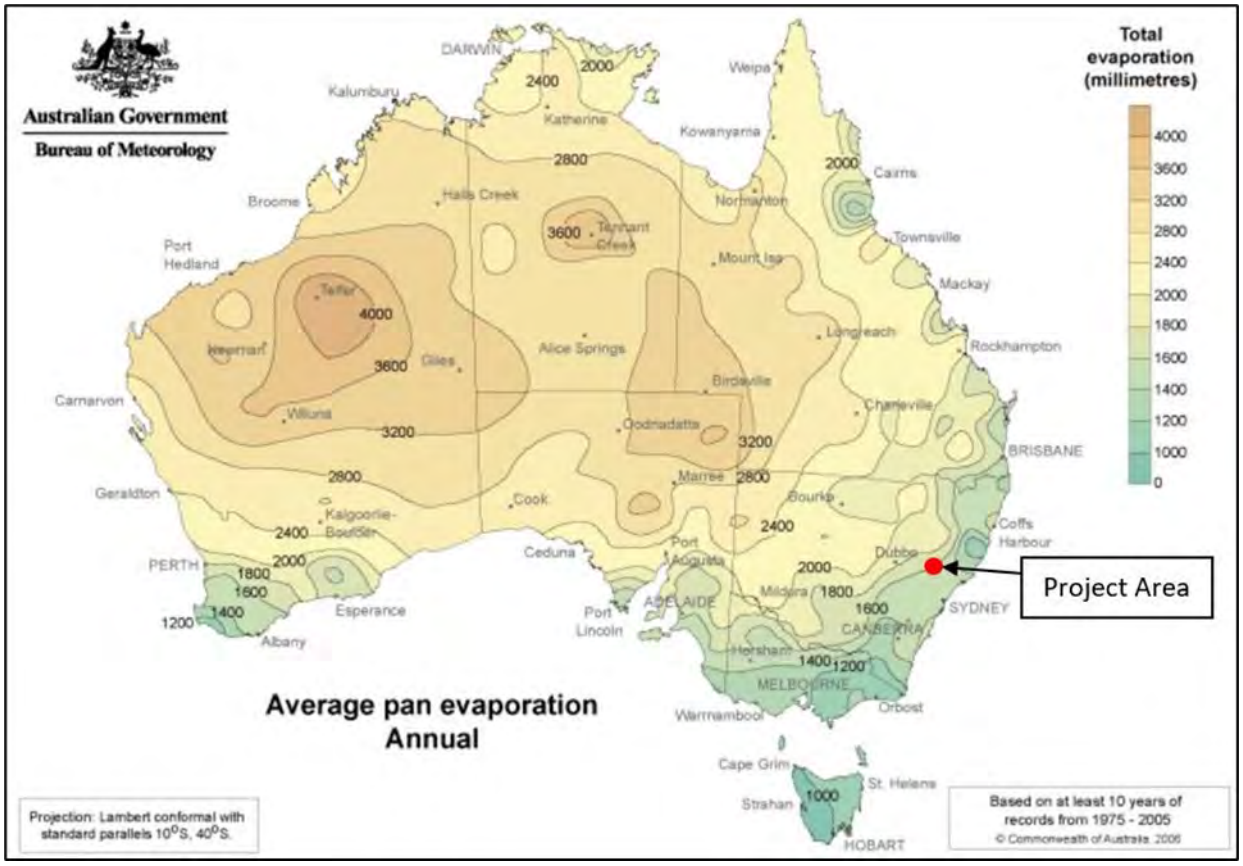


Figure 3.3 Average Annual Evaporation

3.3 Geology and Soils

The Project Area geology is generally comprised of Carboniferous granites and Cainozoic units with smaller sections of the Project Area comprised of Dungeree Volcanics and Tucklan Formation (Meakin et al, 2000). Common minerals are quartz and biotite.

There are no known occurrences of acid sulfate soils (ASS) within the Project Area (OEH, 2010),and it is highly unlikely they would exist at the site or be impacted by the Project due to the elevation of the Project Area (ASS is usually found at elevations less than 1 metre above sea level).

A review of NSW DPE soil profile and soil map information website, 'eSPADE', indicated the majority of the Project Area is located within the 'Bald Hill' soil landscape described as covering low hillocks and basalt or dolerite caps and flows to the south of Merriwa. The main soils are Euchrozem – Chocolate Soil intergrades with shallow stony loams on crests (DPE, 2022). The soil landscapes across the Project Area are shown in **Figure 3.4**. Refer to the Soil, Land and Agriculture Assessment report (Umwelt, 2023) for more information on the soils, issues identified and recommended management measures.

3.4 Groundwater

Groundwater at the Project Area is managed under the Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources (DPE, 2022).

Groundwater to the southwest and northwest of the Project Area, surrounding the Goulburn River is mapped in the *Upper Hunter Local Environmental Plan 2013* as 'Groundwater Vulnerability'. There is no identified groundwater vulnerability within the Project Area.

There are no WaterNSW registered groundwater bores within the Project Area. The closest groundwater bore (GW203284) is approximately 3 km northwest of the Project Area and is described as being drilled to 82 m in depth and for stock and domestic water supply purposes. The last recorded groundwater depth was 41 m below ground on 7 June 2014 (WaterNSW, 2021a). Bores approximately 4 km south of the Project Area (GW063832, GW200990, GW035887) located along the Goulburn River are either for monitoring or water supply purposes.

3.5 Water Extraction and Users

The *Water Management Act 2000* is the key piece of legislation for water resource management in NSW. Under the Act, Water Sharing Plans (WSPs) have been developed to protect the environmental health of water sources, whilst securing sustainable access to water for all users. The WSPs specify maximum water abstractions and allocations and provide licenced and unlicensed water users with a clear picture of when and how water will be available.

All water extraction in NSW, apart from some exemptions for basic landholder rights extractions and pollution control, must be authorised by a water access licence (WAL).

The Project Area is subject to the WSP for the *Hunter Unregulated and Alluvial Water Sources 2022* and the Project Area is located within the Upper Goulburn River Water Source.

Licensed surface water use in the Upper Goulburn River Water Source is primarily for agricultural (irrigation) use. The number of WALs and total share entitlement in the water source as well as the number and type of shares for the 2023/2024 year are presented in **Table 3.1**.

Table 3.1 Surface Water Access Licences

Number of WALs 2023/2024	Number of Shares			Total
	Aquifer	Domestic and Stock	Unregulated River	
20	102	8	1,780	1,890

3.6 Groundwater Dependent Ecosystems (GDEs)

The Goulburn River supports a number of identified moderate and low priority groundwater dependent ecosystems (GDEs) within the area surrounding the Project Area (DPIE, 2019), as shown on **Figure 3.5**.

Moderate potential aquatic GDEs were identified along significant reach lengths of the Goulburn River, west and south of the Project Area. Low potential terrestrial GDEs were identified within the Project Area, with some isolated small areas of medium and high potential terrestrial GDEs located well downstream of the Project Area along the natural surface water drainage paths (BoM, 2017).

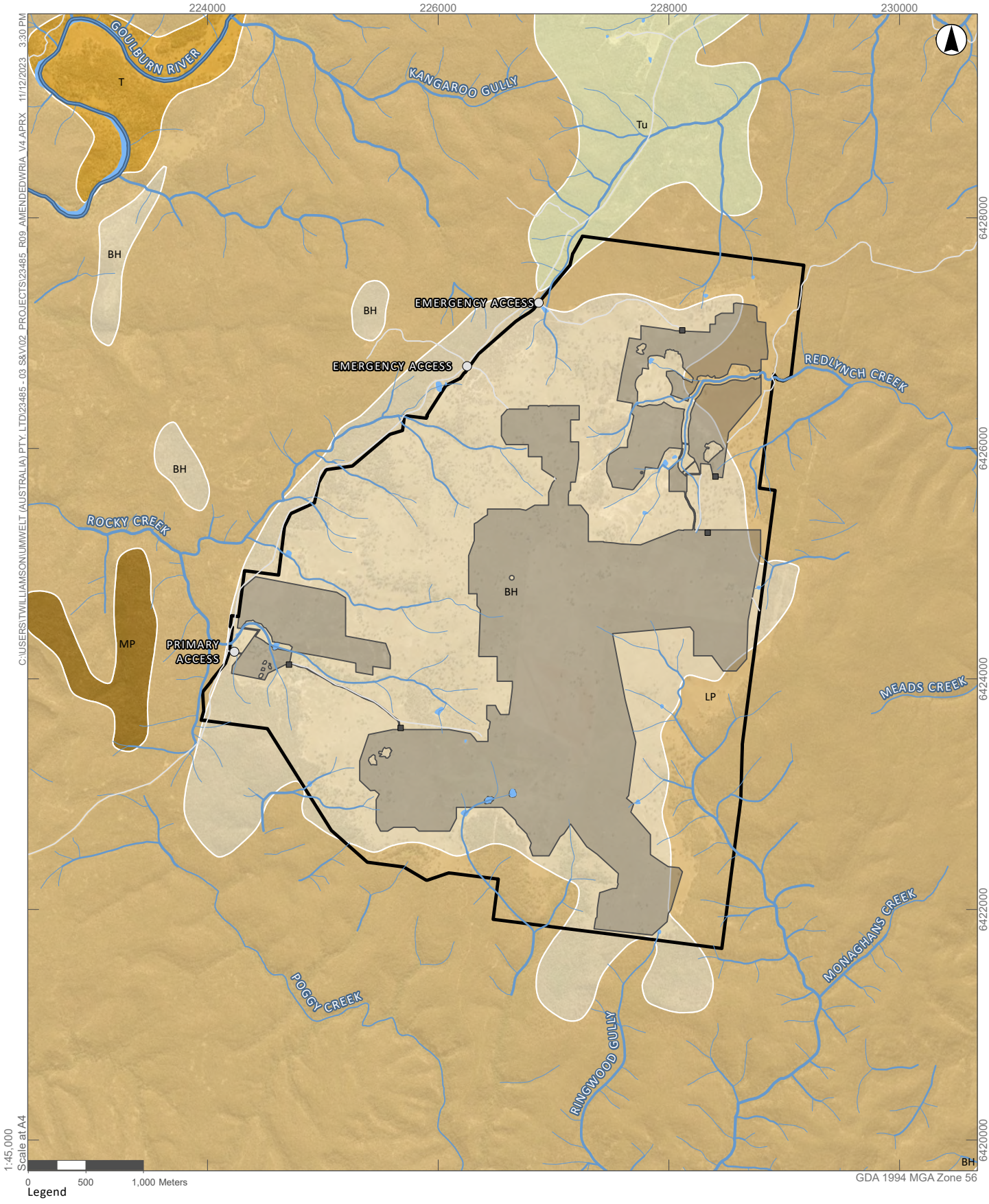
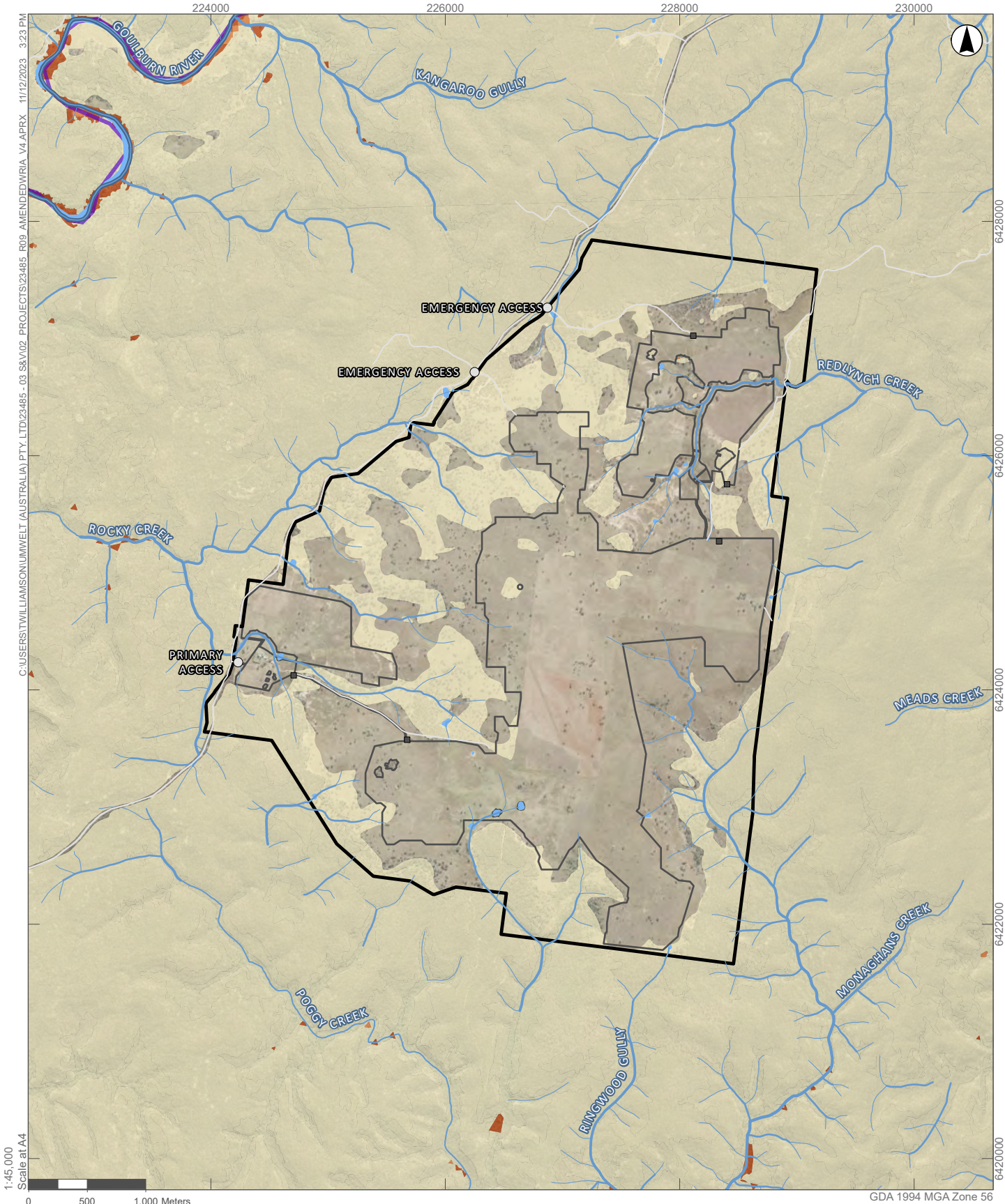


FIGURE 3.4

Soil Landscape Mapping

Image Source: ESRI Basemap (2021) **Data source:** NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019); Lightsource BP (2022)



Legend

- Gate
- Access Points
- Roads and Tracks
- Watercourse
- Waterbodies
- Study Area
- Development Footprint - Amended Project

Aquatic GDEs

- Moderate potential GDE - from national assessment

Terrestrial GDEs

- Low potential GDE - from regional studies
- Moderate potential GDE - from regional studies
- High potential GDE - from regional studies

FIGURE 3.5

Groundwater Dependent Ecosystems

Image Source: ESRI Basemap (2021) **Data source:** NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019); Lightsource BP (2022)

3.7 Surface Water Quality, Environmental Values and Water Quality Objectives

The NSW Water Quality Objectives (WQOs) have been developed to guide plans and actions to achieve healthy waterways. The WQOs are based on measurable environmental values (EVs) for protecting aquatic ecosystems, recreation, visual amenity, drinking water and agricultural water. The WQOs for the Hunter River catchment have been developed to achieve suitable water quality for the protection of:

- aquatic ecosystems
- visual amenity
- primary and secondary contact recreation
- livestock water supply
- irrigation water supply
- homestead water supply
- drinking water
- aquatic foods.

The River Flow Objectives for the Hunter River catchment have been developed to:

- protect pools in dry times
- protect natural low flows
- protect important rises in water levels
- maintain wetland and floodplain inundation
- maintain natural flow variability
- manage groundwater for ecosystems
- minimise effects of weirs and other structures.

Based on the likely construction activities and operations for the Project and the environmental values listed above, the water quality objectives presented in **Table 3.2** are considered relevant to the Project.

There is no relevant available water quality information for the existing environment. Often in modified environments, there is the potential for the current water quality to not meet the existing guidelines and trigger values for protecting environmental values. Irrespective of the current condition of waterways, the Project should not further degrade water quality. As such, the key objective of the Project is to minimise the potential impacts on downstream receiving waters, so that the Project changes the existing water regime by the smallest amount practicable.

Table 3.2 Project Relevant Water Quality Objectives

Parameter	Units	Value/Range
pH	-	6.5 to 8.0
Salinity (Electrical Conductivity)	µS/cm	30 to 350
Turbidity	NTU	2 to 25
Total Phosphorus	µg/L	20
Total Nitrogen	µg/L	250
Visual clarity and colour	-	Natural visual clarity should not be reduced by more than 20%. Natural hue of the water should not be changed by more than 10 points on the Munsell Scale. The natural reflectance of the water should not be changed by more than 50%.
Surface films and debris	-	Oils and petrochemicals should not be noticeable as a visible film on the water, nor should they be detectable by odour. Waters should be free from floating debris and litter.

4.0 Water Demand, Supply and Discharge

4.1 Proposed Water Supply and Use

The Project would require a water supply during the construction, operational and decommissioning phases.

During construction, non-potable water would primarily be used for plant establishment, dust suppression and site ablutions. The associated water demand for the 27-month construction period is estimated to peak at 11.26 ML/month.

During operations, non-potable water would be required for occasional maintenance activities such as washing of the PV solar panels, amenities and potable water would be required by operational staff as well as for stock. Washing of the panels would not require any detergent or cleaning agents. It is expected that this water demand would be minimal.

Potable water demands for both the construction and operational phases of the Project will be primarily sourced from rainfall stored in on-site water tanks at the O&M facility and augmented by water trucks if required. Potable water storages will be routinely tested to ensure water quality meets the requirements of the Australian Drinking Water Guidelines (ADWG) (National Health and Medical Research Council, 2011) and an appropriate maintenance regime will be implemented to ensure ADWG water quality standards are maintained.

Non-potable water demands to meet construction water demands will be sourced by purchasing and transporting water or treated wastewater to site by tanker from commercial suppliers in the nearby region. Other sources of non-potable water may include:

- Harvested runoff from farm dams under agreement with host or local landholders. These existing dams are unlikely to be licensed as the dams are likely to capture water under a harvestable right. The total capacity of all dams on a property allowed under the harvestable right is called the Maximum Harvestable Right Dam Capacity which has been calculated for the Project Area as 130 megalitres (based on a Project Area of 2,000 ha) (WaterNSW, 2022b). No change in licensing is expected to be required, however this should be confirmed prior to construction.
- Harvested runoff from disturbed areas captured in excavations or sediment basins/traps constructed to prevent sediment transport off-site.
- Groundwater from licensed bores in the region under agreement with host or local landholders.

Water sources would be determined in consultation with suppliers and landholders and will be subject to availability. Where further licenses are needed to access water from these sources or licence amendments are required, these will be secured by Lightsource bp prior to the water being used.

All other water sourced from either surface water or groundwater sources to meet Project construction demands will be licenced and managed, as required, in accordance with the requirements of the *Water Management Act 2000*, the Water Management (General) Regulation 2018 and relevant WSPs (i.e. the *Hunter Unregulated and Alluvial Water Sources 2022*.

4.2 Discharge

No change to the natural surface waterway outlets from the Project Area is being proposed and no water discharge is proposed as part of the Project.

5.0 Flood Assessment Methodology

5.1 Modelling Approach

The hydrological assessment was undertaken in accordance with ARR2019 and with consideration of the relevant provisions of the NSW Floodplain Development Manual (2005). The mapping within ARR2019 is consistent with the NSW Floodplain Development Manual (2005) but provides additional detail and updated recommendations on hazard category thresholds.

There are no specific floodplain risk management plans prepared by Upper Hunter Shire Council that cover the Project Area. The most recent floodplain risk management plan prepared within Upper Hunter Shire LGA is the Aberdeen Floodplain Risk Management Study and Draft Plan (2015). This document uses the NSW Government's Floodplain Development Manual (2005) to characterise and map flood hazard.

There are no Rural Floodplain Management Plans covering the Project Area, but the analysis and reporting is consistent with the expectations of a Rural Floodplain Management Plan.

A flood investigation was undertaken for 10%, 1%, 0.5% and 0.2% AEP events and the PMF. AEP is a measure of the likelihood a flood level or flow will be equalled or exceeded in any given year. The PMF is the largest flood that could be conceivably expected to occur at a particular location, usually estimated from Probable Maximum Precipitation (PMP).

Hydraulic modelling of the Project Area was completed using a two-dimensional (2D) TUFLOW flood model. TUFLOW software is one of the most widely used hydraulic modelling software packages in Australia. The software is considered an appropriate modelling tool for modelling riverine and local overland flooding. TUFLOW allows the simulation of runoff generated from local rainfall on a grid that is representative of the site topography, known as "direct rainfall" modelling. A finer resolution 2D TUFLOW model covering the Project Area catchment was used to determine the critical storm durations and temporal patterns. The TUFLOW model was run for the critical storms and temporal patterns determined using this resolution model.

The model provides estimates of flood levels, depth, velocities, and flood hazard for each of the modelled design events. The hydraulic model was run for both existing and climate change conditions. Climate change modelling was undertaken using the 0.5% and 0.2% AEP year flood events as proxies for assessing sensitivity to an increase in rainfall intensity of flood-producing rainfall events due to climate change.

5.1.1 Design Rainfall Inputs

5.1.1.1 Event Duration

Design rainfall was derived for burst durations between 30 minutes and 24 hours, based on the expectation that the critical storm duration for the Project Area catchment would be relatively short.

5.1.1.2 Intensity-Frequency Duration (IFD)

Rainfall burst depths for the modelled AEP events were estimated for the centroid of the catchment using the 2016 ARR IFD analysis available from the BoM as shown in **Table 5.1**. A consistent design rainfall was adopted (i.e., no spatial variation) given the size of the local catchment.

The PMP was estimated using the Generalised Short Duration Method (GSDM) (BoM, 2003).

Table 5.1 Design Rainfall Depths (mm) for Various Event Durations and AEPs

AEP (1: Y)	30 min	1.5 hr	2.0 hr	3.0 hr	6.0 hr	9.0 hr	12.0 hr	18.0 hr	24.0 hr
2	18.0	25.3	27.4	30.7	37.6	42.7	46.8	53.2	58.1
5	23.8	33.3	36.0	40.3	49.6	56.7	62.5	71.9	79.3
10	27.9	38.8	42.0	46.9	57.9	66.4	73.5	85.3	94.7
20	32.1	44.5	48.0	53.6	66.2	76.1	84.7	98.9	111.0
50	37.9	51.9	55.9	62.4	77.7	90.1	101.0	119.0	134.0
100	42.6	57.6	62.0	69.3	86.8	101.0	114.0	136.0	154.0
200	49.2	66.6	71.6	79.9	99.8	117.0	131.0	157.0	178.0
500	58.6	79.4	85.3	95.0	118.0	138.0	156.0	186.0	212.0

5.1.2 Model Domain and Topography

The Project Area catchment was delineated using LiDAR data and is shown in **Figure 5.1**. The total modelled area is approximately 33 km^2, covering all of the Project Area catchment, and extending downstream of the Project Area boundary along the relevant watercourse alignments.

The model topography was developed from the LiDAR data available for the site. The Project Area is covered by 2 m resolution LiDAR data flown in 2017 (GA, 2017). A 4 m model grid resolution was adopted covering the Project Area. The modelled topography is shown in **Figure 5.1**.

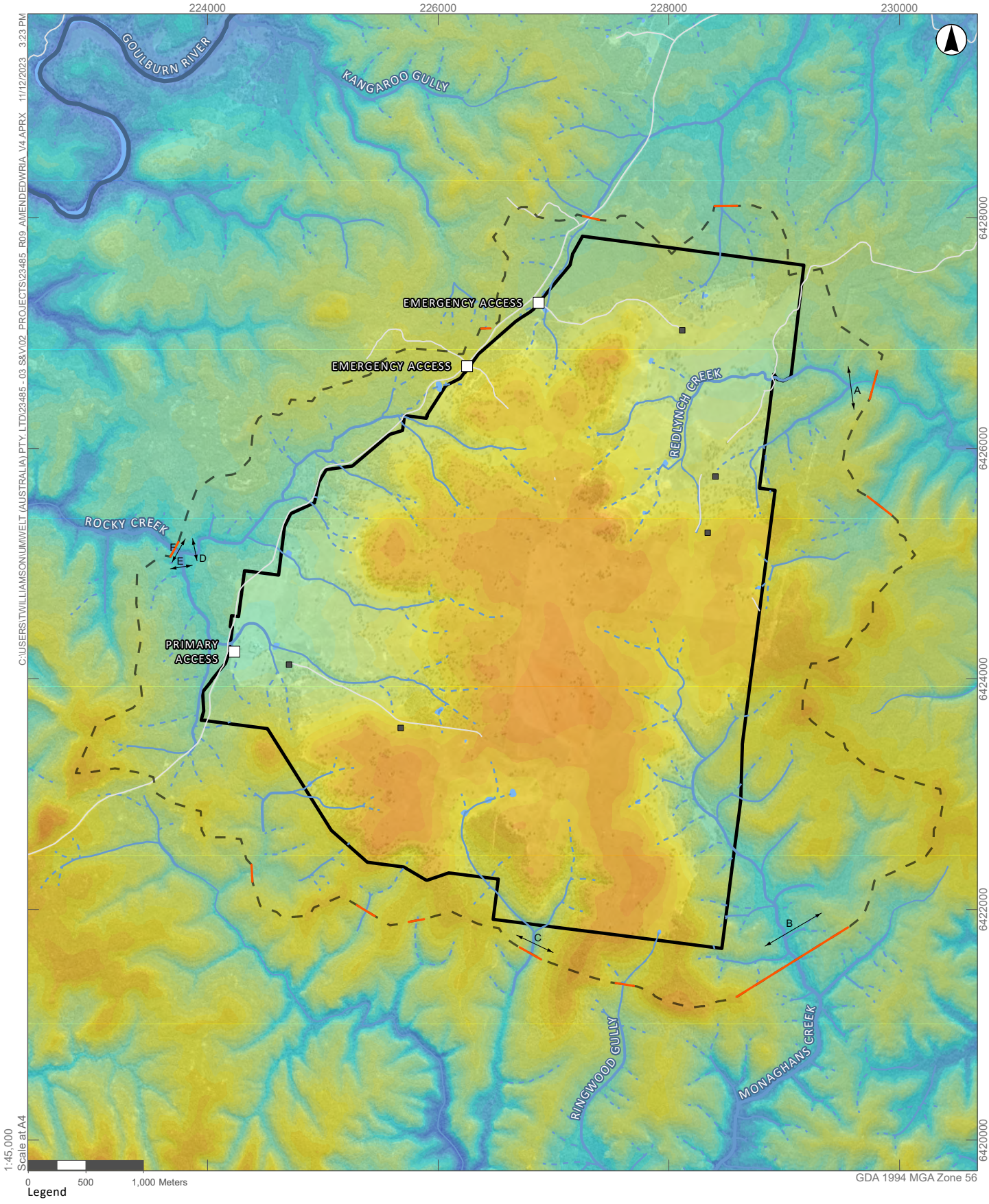


FIGURE 5.1

Model Domain and Topography

Image Source: ESRI Basemap (2021) **Data source:** NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019); Lightsource BP (2022)

5.1.3 Hydraulic Roughness and Losses

The hydraulic model used Manning's 'n' to represent the hydraulic roughness to determine the restriction caused by the range of land uses within the model area. Aerial photography was used to assign a specific Manning's 'n' roughness coefficient based on the recommendations in ARR2019, as shown in **Table 5.2**. Most of the Project Area is minimally to moderately vegetated based on aerial photography. Initial and continuing losses were also applied as per land use and the adopted values are shown in **Table 5.3**. The values used are typical and have been used in similar studies.

Losses were initially extracted from the ARR online Data Hub. The suggested losses were a 47.0 mm initial loss (IL) and a 3.8 mm/hr continuing loss (CL). As the site is in NSW, the CL was multiplied by a factor of 0.4, reducing it to a CL value of 1.52 mm/hr.

Table 5.2 Manning's Roughness used in the Developed Hydraulic Model

Manning's 'n'	Land Use
0.15	Residential – Rural (lower density)
0.3	Industrial/Commercial or large buildings on site
0.03	Minimal vegetation
0.06	Moderate vegetation
0.09	Heavy vegetation
0.06	Open water (with reedy vegetation)
0.02	Open water (with submerged vegetation)
0.02	Car park/pavement/wide driveways/roads

Table 5.3 Losses Used in the Developed Hydraulic Model

Event	Initial Loss (mm)	Continuing Loss (mm/h)
10% AEP	8.1	1.5
1% AEP	7.8	1.5
0.5% AEP	7.8	1.5
0.2% AEP	7.8	1.5
PMF	0	1

5.2 Model Scenarios

A range of storm duration and temporal patterns (as discussed in **Section 5.1.1**) were simulated (using ARR2019 inputs) to identify the rainfall profiles providing for the critical flood conditions (design peak water levels) across the Project Area. A coarse grid (10 m resolution) TUFLOW model was used to determine the critical storm duration for the 1% AEP and PMF events.

The critical storm duration and temporal pattern results providing the design peak water levels across the Project Area are presented in **Table 5.4**. The 1% AEP critical storms and temporal patterns were also adopted for the 10%, 0.5% and 0.2% AEP. These scenarios were modelled in the finer 4 m grid hydraulic model.

Table 5.4 Critical Storm and Temporal Patterns

Event	Critical Duration (hours)	Temporal Pattern[1]
10% AEP	0.5 hours	8
1% AEP	0.5 hours	5
0.5% AEP	0.5 hours	5
0.2% AEP	0.5 hours	5
PMF	0.25 hours	GSDM

*Note: [1] Refer to **Section 5.1.1.2**.*

5.3 Model Verification

There are no river flow gauges in the vicinity of the Project Area and therefore, in the absence of calibrated data, the modelled TUFLOW design flows were verified by comparison with those produced by the ARR Regional Flood Frequency Estimation (RFFE) method (**Table 5.5**). The RFFE Method is a replacement for the Probabilistic Rational Method described in the previous version of ARR. The RFFE flows were compared to the TUFLOW flows at a selection of sub-catchments, and all TUFLOW flows were within the RFFE Lower and Upper Confidence Limits. Given the general agreement between the TUFLOW and RFFE flows, the adopted model parameters values were considered fit for purpose. Additionally, the roughness values and losses adopted for this assessment (refer **Section 5.1.3**) are within ranges typically applied in studies of this nature.

Table 5.5 ARR Regional Flood Frequency Estimation Model Results

Location (Refer to Figure 5.1)	AEP (%)	TUFLOW Discharge (m^3/s)	RFFE Discharge (m^3/s)	RFFE Lower Confidence Limit (5%) (m^3/s)	RFFE Upper Confidence Limit (95%) (m^3/s)
A	10% AEP	35.5	19	8.2	43.7
	1% AEP	73.0	57.1	24	137
B	10% AEP	52	23.3	10.1	53.6
	1% AEP	98.2	70.3	29.6	168
C	10% AEP	23.6	16.2	7.1	37.3
	1% AEP	43.2	49	20.6	117
D	10% AEP	49.3	21.5	9.3	49.4
	1% AEP	99.6	64.8	27.2	155
E	10% AEP	30.9	18.3	8.0	42.2
	1% AEP	72.2	55.3	23.3	132
F	10% AEP	79.8	36.1	15.7	83.1
	1% AEP	168.4	109	45.8	260

6.0 Flood Modelling Results and Discussions

6.1 Overview and Flood Hazard Classifications

The flood model results provide the distribution of peak flood level, depth, velocity and hazard across the Project Area for each modelled design magnitude flood event. Note that areas where the modelled flood depths are less than 50 mm have been filtered from the results.

A comparison of the 1% AEP and PMF flood inundation extents is shown on **Figure 6.1** and a suite of detailed flood mapping of the simulated depth, velocity and flood hazard distributions for all modelled events is provided in **Appendix C**. Discussion of the flood conditions for each design event is provided in the following sections as outlined below:

- 10% AEP event (refer **Section 6.1.1**).
- 1% AEP event (refer **Section 6.1.2**) – representative of the principal flood planning event.
- 0.5% and 0.2% AEP events (refer **Section 6.1.3**) – representative of indicative climate change impacts.
- PMF event (refer **Section 6.1.4**).

The Project Area is typically located over the upper catchments of the minor watercourses that flow through the site. This provides for the 1% AEP flood inundation to be largely confined to narrow corridors along the watercourse alignments. The PMF inundation extents provide a significantly greater land area coverage of the Project Area, however much of this is shallow overland sheet flow with low flood hazard (Hazard Category H1). The PMF event represents the largest flood conceivable that could occur at a location.

The flood hazard of the site was assessed in accordance with ARR 2019, which defines six hazard categories as presented in **Table 6.1**. The combined flood hazard curves are presented in **Figure 6.2**. The flood hazard mapping is provided in **Appendix C**.

Table 6.1 Hazard Classification (ARR, 2019)

Hazard Vulnerability Classification	Classification Limit (D and V in combination)	Limiting Still Water Depth (D)	Limiting Velocity (V)	Description
H1	D*V ≤ 0.3	0.3	2.0	Generally safe for vehicles, people and buildings.
H2	D*V ≤ 0.6	0.5	2.0	Unsafe for small vehicles.
H3	D*V ≤ 0.6	1.2	2.0	Unsafe for vehicles, children, and the elderly.
H4	D*V ≤ 1.0	2.0	2.0	Unsafe for vehicles and people.
H5	D*V ≤ 4.0	4.0	4.0	Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6	D*V ≥ 4.0	-	-	Unsafe for vehicles and people. All building types considered vulnerable to failure.

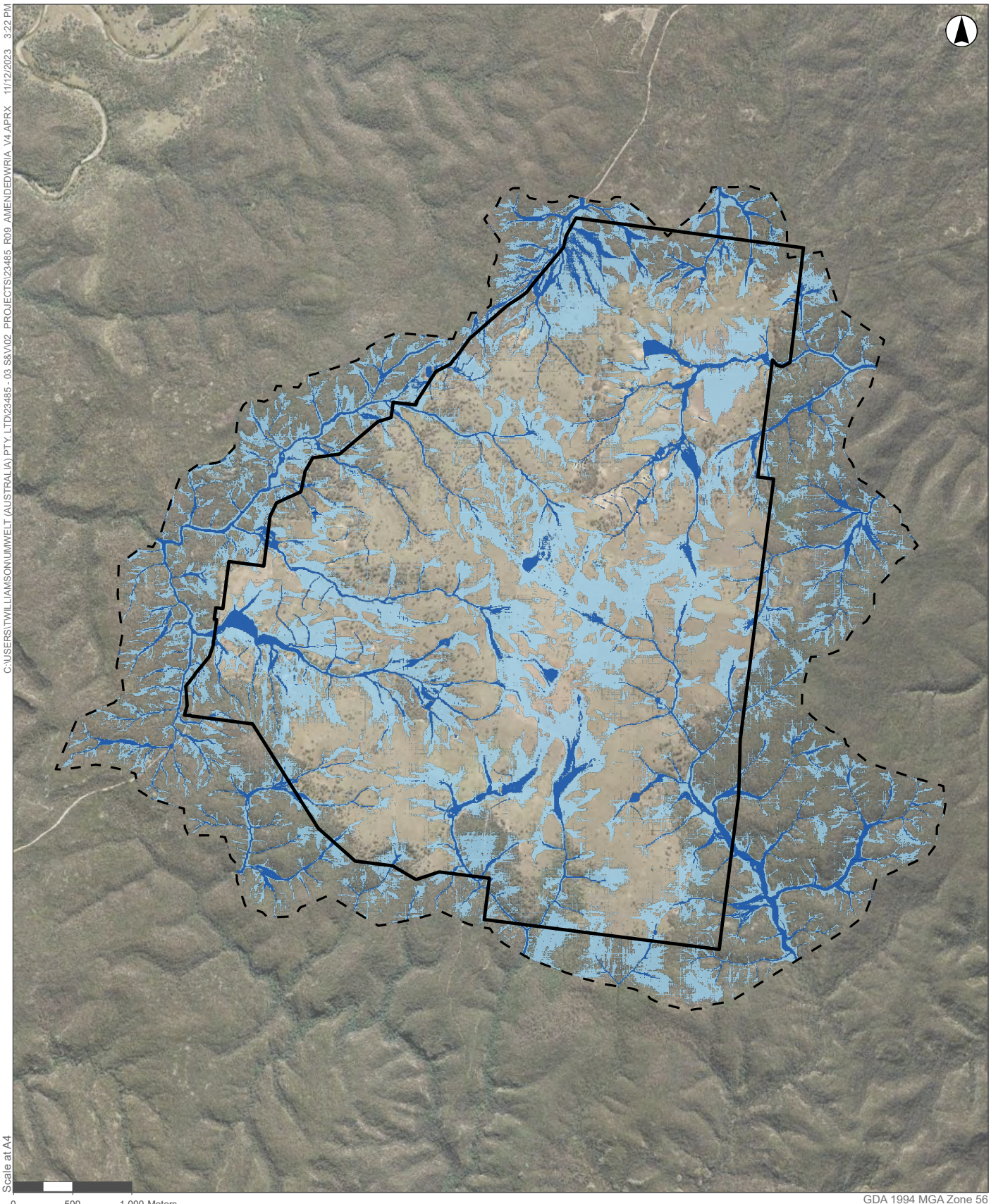


FIGURE 6.1

Flood Extents

Image Source: ESRI Basemap (2021) **Data source:** NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019); Lightsource BP (2022)

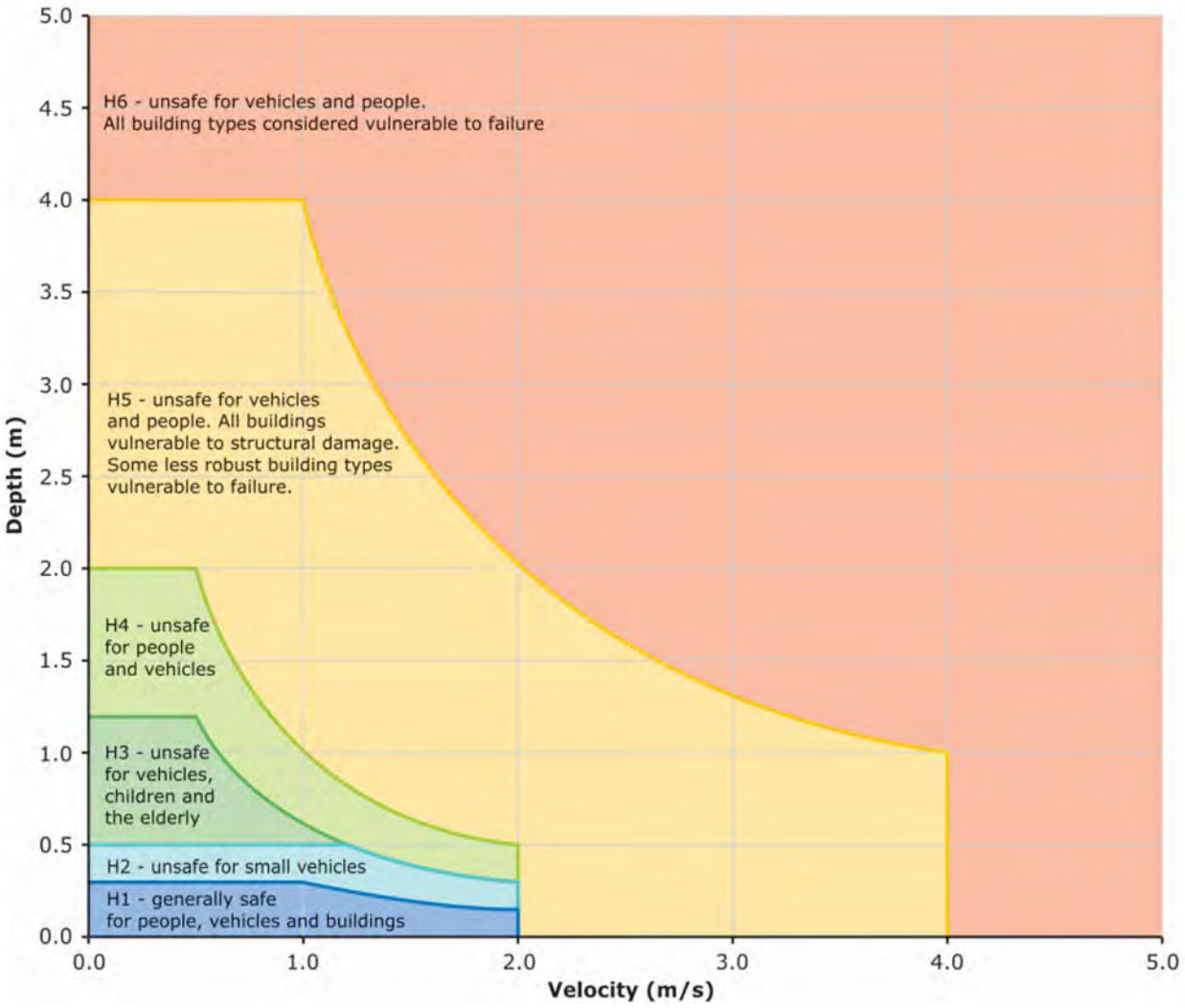


Figure 6.2 Combined Flood Hazard Curves (Smith et al. 2014)

6.1.1 10% AEP Results

Modelled 10% AEP depths, velocities and flood hazards are presented in **Appendix C**. Results show there is generally no widespread flooding within the Project Area, with active flowpaths typically confined within the watercourses and local depressions.

General overland flood flow depths outside of the main waterway alignments are typically shallow at less than 0.3 m. The minor watercourses within the Project Area have flood depths generally less than 1 m with some higher depths observed at farm dam locations. Higher flood depths exceeding 1 m are observed along the main channel alignment.

High velocities up to approximately 4.5 m/s are predicted within the northeast and western channels. Review of aerial imagery shows evidence of erosion and sedimentation (due to higher flow velocities and steeper areas).

The flood hazard within the site for this flood event is mostly characterised as H1: 'Generally safe for vehicles, people and buildings', with isolated areas of higher flood hazard (H5 and higher) predicted in the northeastern and southern areas of the site, however these areas are well confined to the waterways and defined drainage lines (which will be avoided due to slope limitations on the PV trackers).

6.1.2 1% AEP Results

Modelled 1% AEP depths, velocities and flood hazard are in **Appendix C**. The general flood inundation patterns and extents are similar to the 10% AEP event, albeit with increasing depths and velocities associated with the higher flows.

Flood depths remain generally less than 0.3 m along overland flow paths and local depressions, with depths of flow along the minor watercourses within the Project Area typically up to 1 m with some localised higher depths along the reaches. A similar flood depth range is observed for farm dams. The mainstream flooding of the creek adjacent to the Project Area is still relatively confined.

High velocities up to approximately 4.5 m/s are predicted within the northeast and western channels. Review of aerial imagery shows evidence of erosion and sedimentation (due to higher flow velocities and steeper areas).

The flood hazard within the site for this flood event is mostly characterised as H1: 'Generally safe for vehicles, people and buildings', and only reaches above this in the waterways and defined drainage lines. Within some of the watercourse alignments, flood hazard classes H5 and H6 are attained and accordingly would represent areas where infrastructure should be avoided.

6.1.3 Climate Change Modelling

The 0.5% and 0.2% AEP year flood events were used as proxies for assessing sensitivity to an increase in rainfall intensity of flood-producing rainfall events due to climate change. The 0.5% and 0.2% AEP design rainfalls for the Project Area represent general increases of 10% and 25% in rainfall respectively above the 1% AEP design rainfall. Accordingly, these are within the 10–30% range typically adopted for climate change allowance on design rainfall.

Modelled 0.5% and 0.2% AEP depths, velocities and flood hazards are presented in **Appendix C**.

The flood inundation patterns and extents are again generally similar to the 1% AEP design results (as discussed in **Section 6.1.3**). The modelling shows no activation of additional flow paths or extended inundation areas that materially impact on the development.

Flood depth remains generally less than 0.3 m for overland flow areas with flood depths up to 2 m along the well-defined mapping extents of the larger watercourses.

The 0.5% and 0.2% AEP climate change flood depths are only marginally larger than that of 1% AEP existing conditions. Higher AEP events show similar results indicating the inundation impact of climate change is not anticipated to be a significant issue for the Project. The results suggest the Project Area is able to drain effectively without a significant increase in floodplain area which could hold water at high depths for extended periods of time.

6.1.4 PMF Results

Modelled PMF depths, velocities and flood hazards are presented in **Appendix C**. There is an overall increase in mapped flood extent, although a significant proportion of this area is in overland flow areas with flow depth less than 0.3 m.

Flood extents along the defined watercourses and overland flow paths have generally increased with broader areas of overland sheet flow (up to 0.5 m depth) as a result of extreme rainfall intensity, but still typically confined to the general alignments albeit with increasing flood depth. The watercourses within the Project Area have flood depths up to 4 m in the lower reaches with a similar flood depth range observed within the Project Area's dams.

Corresponding to the increase in the flood depth distribution across the Project Area, flow velocities are increased for the PMF event. Within defined watercourses, velocities reach between 5.0 and 6.0 m/s. Review of aerial imagery shows evidence of erosion and sedimentation (due to higher flow velocities and steeper areas).

The flood hazard within the site is mostly characterised as H1: 'Generally safe for vehicles, people and buildings' and only reaches above this in the waterways and defined drainage lines. Within some of the watercourse alignments, flood hazard classes H5 and H6 are attained and accordingly would represent areas where infrastructure should be avoided as shown in Figure C-15 in **Appendix C**.

7.0 Assessment of Potential Impacts

Based on the outcomes of the flood modelling (**Section 6.0**) and the risk assessment (**Appendix B**), the Project has the potential to impact on water resources in the following manner:

- impacts to surface water quality on receiving and downstream waterways
- impacts to stream stability, riparian health and fish passage
- impacts to flooding, including flow rates, velocities and depths
- impact on water supply
- impacts to groundwater, including impacts to downstream users and GDEs.

A risk assessment was undertaken for the Project to identify and assess the potential water resources related risks associated with the Project. The risk assessment is provided in **Appendix B** and has adopted the Risk Assessment Framework set out in Australian Standard/New Zealand Standard (AS/NZS) ISO 31000:2018 Risk Management – Principles and Guidelines (2018).

7.1 Surface Water Quality

Water quality impacts are most likely to be experienced during construction and decommissioning with limited operational impact.

7.1.1 Construction and Decommissioning

During construction and decommissioning of the Project, soils would be subject to disturbance, involving minor vegetation removal, excavation works and stockpiling of materials, which can potentially lead to sediments and/or pollutants mobilising in runoff and entering local waterways. Furthermore, this could result in the deterioration of EVs and WQOs (as outlined in **Section 3.7**), damage to private property for involved landholders as well as increased turbidity and decrease in water quality to downstream waterways. Sediments and pollutants present in runoff may enter the downstream waterways or environments, such as the adjacent Goulburn River National Park, and have the potential to flow into Goulburn River and the tributaries which discharge to the Hunter River. The key factor influencing the extent of sediment runoff and stormwater pollution is likely to be weather events. The occurrence of a major storm event at a critical phase of the construction period could potentially result in higher levels of turbid runoff. With the implementation of erosion and sediment control measures (outlined in **Section 8.0**) potential construction-related erosion and sedimentation impacts would be appropriately managed and are expected to be minor. Particular emphasis will be given to erosion and sediment control measures surrounding construction works occurring at the interface of the Goulburn River National Park (particularly during establishment of the perimeter road and assets within 20 m of the boundary). In addition, the potential exists for spills (such as hydraulic oil and fuels from equipment or vehicles as well as concrete spills, building materials and chemicals) to be washed into waterways. With the implementation of the control measures outlined in **Section 8.0**, potential construction-related soil contamination would be appropriately managed and is expected to be minor.

During the construction phase, there may be a requirement to construct waterway crossings within the Project Area to allow for access tracks to be constructed. Detailed design would be undertaken in line with relevant guidelines prior to any works commencing and with consideration of the findings and recommendations of the Project Aquatic Assessment (Coast Ecology, 2023).

Road upgrades are proposed to the north of the Project Area at the Golden Highway/Ringwood Road intersection and on Wollara Road and Ringwood Road, including upgrades to culverts at the existing road crossings of Bow River and Killoe Creek. Strategic designs have been prepared and detailed design would be undertaken in line with relevant guidelines prior to any works commencing. With the implementation of erosion and sediment control measures (outlined in **Section 8.0**), and the design of appropriate erosion and scour protection, potential construction-related erosion and sedimentation impacts would be appropriately managed and are expected to be minor.

With the implementation of measures outlined in **Section 8.0**, the potential water quality impacts would be adequately managed during the Project's construction and decommissioning phases.

7.1.2 Operation

Potential water quality impacts during the operational phase would be minimal, as the day-to-day activities during this phase would be limited to routine maintenance and monitoring. There is the potential for:

- stormwater runoff from impervious surfaces, such as the base of PV panels, resulting in localised erosion
- accidental spills or discharge through use and storage of chemicals such as fuel
- use of herbicides for vegetation control (it is noted that herbicides are currently used on the site for agricultural applications).

With the implementation of operational management measures outlined in **Section 8.0**, water quality impacts during the operational phase are expected to be negligible.

7.2 Impacts on Stream Stability, Riparian Health and Fish Passage

There are a number of non-perennial and perennial streams traversing the Development Footprint refer to **Figure 3.1**). While the Amended Project design has aimed to avoid works close to or within waterways, several waterway crossings will be required for site access, internal access roads and the electrical cabling layout. Amended Project waterway crossings, including those where there is a potential for direct impacts on the adjacent national park or it's interface will be designed to minimise impacts on stream stability and fish passage and will be designed with reference to:

- Guidelines for Controlled Activities on Waterfront Land (the CAA Guidelines) (Department of Planning, Industry and Environment (DPIE) Water, 2018).
- Why Do Fish Cross the Road? Fish Passage Requirements for Waterway Crossings (NSW Department of Primary Industries (DPI) Fisheries, 2003).
- Fisheries NSW Policy and guidelines for fish habitat conservation and management, (NSW DPI, 2013).

For works on waterfront land (within 40 m of top of bank of any watercourse with a defined bed and bank, i.e. the lower reaches of Redlynch Creek andRocky Creek and road upgrade works at Bow River and Killoe Creek as described in **Figure 3.1**) the following measures will be incorporated into the design of the works and controls included in the Soil and Water Management Plan:

- a site specific erosion and sediment control plan will be prepared for all works on waterfront land
- where practicable, infrastructure will be maintained outside of the vegetated riparian zone
- utilisation of stream crossings for co-location of services to avoid the need to trench through stream beds wherever practicable
- rehabilitate disturbed areas and provide scour protection to bed and banks as required to mitigate any areas with increased potential for erosion due to changes in flow regimes associated with Project infrastructure
- where practicable, undertake works on waterfront land from April to mid-October when fish passage is unlikely to occur.

During detailed design, consultation will be undertaken with DPI Fisheries to determine if any of the proposed waterway crossings require consideration of fish passage. For any crossings that do require consideration of fish passage, the relevant DPI Fisheries guidelines will be considered during the detailed design process.

The Aquatic Assessment provides further detail and management measures to ensure that access roads and waterway crossing are design to prevent blocking of fish passage.

7.3 Flooding

The 10%, 1%, 0.5% and 0.2% AEP and PMF were assessed using flood depth, velocity, and hazard levels. Modelling has shown the Project Area to be of low flood risk (**Section 6.0**) with minimal risk to changes in internal or external waterway flows (discussed in **Appendix B**). Access points to the Project Area were also predicted to be of low flood risk. Design of waterway crossings for access points and crossings within the Project Area will be undertaken at the detailed design phase.

The results of the flood impact assessment have shown that the Project Area is located outside areas of major flood hazard. Peak stormwater discharges from the Project Area for impervious areas may increase slightly through the creation of compacted gravel roads and some small operational buildings. However, potential impacts to drainage features and downstream watercourses are considered likely to be minimal due to the relative size of the Project Area in relation to the size of the receiving catchments, and the distributed nature of minor impacts. The Proponent has assessed the risk of flood depths and flood velocities and removed infrastructure such as PV trackers and inverters from areas at risk. Low-risk infrastructure such as access roads and cable trenches remain within these areas to maintain connectivity.

Minimal changes to the land topography, impervious fraction and therefore runoff and groundwater infiltration are expected due to the nature and extent of proposed infrastructure. If the recommendations outlined in **Section 8.0** are met and a relevant set of construction and operation Management Plans (to be approved prior to construction/operation commencement) are developed, the Project is unlikely to have any residual impacts on surface or groundwater.

If there is an intent to fill or level areas of flood inundation for the construction of PV arrays and/or ancillary infrastructure, individual or collective assessments would be required. These assessments would form part of a Soil and Water Management Plan to be developed as part of the Construction Environmental Management Plan (CEMP) to be developed prior to the commencement of construction.

Farm dams covering the Project Area do not appear to hold significant volumes of water as per the 1% AEP flood depths (discussed further in **Section 6.0**). Two small farm dams are located within the Development Footprint and filling them (if required) would likely have negligible adverse impacts to flood behaviour within receiving watercourses, but may increase general day to day flows within receiving waterways due to a decrease in catchment storage. This would need to be considered further in the Soil and Water Management Plan to define the degree of potential impact.

Access tracks and cable reticulation are the only works proposed within the watercourses and no other artificial structures are planned to be installed in the creeks within the Project Area. Where waterway crossings (i.e., culvert crossings or causeways) are required, these would be designed and constructed in compliance with the DPE – Water Guidelines.

Security fencing around the perimeter of the development footprint has the potential to trap and accumulate flood debris and impede flows. This may result in minor increases in water level upstream of the blockage and potential redistribution of flow at the boundary. Given the local topography and minor nature of the identified watercourses in the Project Area, any redistribution of flow though fence blockage would be localised and the risk of any potential blockages is low and any inundation outside of the mapped flood extents would be minor. Fence maintenance and clearing of debris after each flood event will further minimise any potential impacts.

The proposed road upgrades will be designed to accommodate B- double trucks, noting only 19 m semi-trailers are proposed to be used during construction, and the safe passing of vehicles in both directions with 3.5 m lanes. Detailed design would be undertaken in line with relevant guidelines prior to any works commencing. If the upgrades are designed to minimise impacts/afflux to acceptable levels and the design of appropriate erosion and scour protection is undertaken, it is expected that any impacts as a result of the upgrades works will be negligible.

7.4 Impact on Water Supply

7.4.1 Construction and Decommissioning

The Project would require a water supply during the construction and decommissioning phases, as discussed in **Section 4.0**.

The associated water demand is estimated as 11.26 ML/month for the 27-month construction period.

Water supply for the Project is proposed to be trucked in through a commercial supplier. Existing farm dams not part of the Development Footprint may also be utilised. Water sources would be confirmed during detailed design phase and in consultation with suppliers and landholders and be subject to availability. A water sourcing strategy would be developed so that water used during the construction phase does not cause issues to adjacent landowners or other stakeholders.

The use of any farm dams during construction and decommissioning would be agreed with the landholder. The estimated Maximum Harvestable Right Dam Capacity and licensed water use would not be exceeded. Water requirements beyond existing water rights would be sourced from commercial suppliers and delivered to site by water tanker.

Based on the above, it is anticipated that the Project's proposed water use during construction and decommissioning would not have a negative impact on water supply to the Project Area and the region.

7.4.2 Operation

During operations, a minimal water demand would be required for ongoing maintenance activities such as washing of the PV solar panels, amenities, and potable purposes by operational staff as well as for stock. Potable water demands for both the construction and operational phases of the Project will be primarily sourced from rainfall stored in on-site water tanks at the O&M facility and augmented by water trucks if required.

Based on the above, it is anticipated that the Project's proposed water use during operation would not have a negative impact on water supply to the Project Area and the region.

7.5 Groundwater Impacts

7.5.1 Construction and Decommissioning

Impacts to groundwater resources, including GDEs, are not expected given the groundwater table is unlikely to be intercepted during Project construction and the relatively deep depth to groundwater at the Project Area based on available information (refer **Section 3.4**, **Section 3.5** and **Section 3.6**). This means that any hydrocarbon/chemical spills are unlikely to infiltrate to the groundwater table.

Should the final Project design identify that construction activities will result in the interception of the groundwater table, an assessment of impacts will be undertaken, and appropriate management measures be developed to mitigate any potential impacts.

7.5.2 Operation

There will be no impacts to groundwater resources including GDEs and bore users during operation given that the groundwater table will not be intercepted.

7.6 Cumulative Impacts

Cumulative impacts are considered to be negligible as the Project is located in the upper reaches of the catchment (mainly 1st and 2nd order streams) and other projects do not occur in these areas.

Potential water quality impacts and erosion and sedimentation will be controlled with the implementation of measures outlined in **Section 8.0**.

8.0 Management and Mitigation Measures

Table 8.1 presents the proposed measures to be implemented as part of the Project to manage and minimise impacts on water resources. Refer to **Appendix B** for risk assessment.

Table 8.1 Management and Mitigation Measures relating to Water Resources

ID	Management and Mitigation Measures	Timing	Relevant Impacts
WR1	Solar panels will be designed to provide a minimum of 300 mm freeboard for the lowest edge above the maximum 1% AEP flood level.	Detailed design	Flooding, Refer to **Section 7.3**.
WR2	The solar panel piles will be designed to withstand the 1% AEP flood velocities expected in the Project Area.	Detailed design	Flooding, Refer to **Section 7.3**.
WR3	No sensitive infrastructure (e.g., substation, BESS, etc.) will be placed within 20 m of any Strahler 3 or above order streams.	Detailed design	Flooding, Refer to **Section 7.3**.
WR4	All waterway crossings will be designed and constructed in compliance with the Department of Primary Industries, Office of Water, Guidelines for riparian corridors on waterfront land and Guidelines for watercourse crossings on waterfront land.	Detailed design	Fish Passage, Refer to **Section 7.2** and Flooding, Refer to **Section 7.3**.
WR5	Further investigations will be carried out where required during detailed design to confirm the flood immunity objectives and design criteria for the Project are met.	Detailed design	Flooding, Refer to **Section 7.3**.
WR6	A Construction Soil and Water Management Plan (CSWMP) will be prepared to outline measures to manage soil and water impacts associated with the construction and decommissioning works. The CSWMP will provide: • Measures to minimise/manage erosion and sediment transport both within the construction footprint and offsite including requirements for the preparation of erosion and sediment control plans (ESCP) for all progressive stages of construction. Management controls will be included to guide construction works occurring at the interface of Goulburn River National Park (during establishment of the perimeter road and assets within 20 m of the boundary). This will include vegetation removal methods, controls around excavation works, limitations on stockpiling of materials and heavy vehicle movements on the interface of the park. Works which may lead to increased mobility of sediments and contaminants on the interface of the national park, and waterways where surface water flow is directed on to the national park will be strictly controlled. • Measures to manage waste including the classification and handling of spoil. • Procedures to manage unexpected, contaminated finds. • Measures to manage stockpiles including locations, separation of waste types, sediment controls and stabilisation. • Measures to manage accidental spills including the requirement to maintain materials such as spill kits.	Prior to construction	Surface Water Quality and Groundwater, Refer to **Section 7.1** and **Section 7.5**.

ID	Management and Mitigation Measures	Timing	Relevant Impacts
	• Controls for receiving waterways which may include designation of 'no go' zones for construction plant and equipment. • Creation of catch/diversion drains and sediment fences at the downstream boundary of construction activities where practicable to support containment of sediment-laden runoff. • Erosion and sediment control measures will be implemented and maintained at all work sites in accordance with the principles and requirements in Managing Urban Stormwater – Soils and Construction, Volume 1 (Landcom 2004) and Volume 2D (NSW Department of Environment, Climate Change and Water 2008b), commonly referred to as the "Blue Book".		
WR7	Debris will be cleared from fencing following flood events.	Operation	Flooding, Refer to **Section 7.3**.
WR8	An Operational Environmental Management Plan (OEMP) will be developed for the Project to address potentially adverse impacts on the receiving environment surface water quality during the operational phase. This will include the development and appropriate maintenance of suitable ground cover around solar panels, and grassed table drains near access tracks to minimise the potential for erosion and export of sediment. Additional measures for the treatment of stormwater quality are not considered necessary.	Operation	Surface Water Quality and Groundwater, Refer to **Section 7.1** and **Section 7.5**.
WR9	Water sources would be confirmed during detailed design phase and in consultation with suppliers and landholders and be subject to availability. A water sourcing strategy will be developed so that water used during the construction phase does not cause issues to adjacent landowners or other stakeholders.	Detailed Design	Water Supply, Refer to **Section 7.4**.
WR10	Post-construction, disturbed areas will be stabilised by the establishment and maintenance of a vegetated groundcover consisting of low-growing grasses. A weed control program will be implemented for the Project Area to manage noxious weeds and reduce weed invasion. In order to reduce the potential impact of pesticide use, glyphosate-based products, or similar non-residual and non-persistent herbicides, will be used to manage vegetation and grazing on the Project Area. This groundcover is expected to both significantly reduce the incidence of impact erosion as well as provide for the additional filtering of suspended solids and biological uptake of nutrients. Consequently, the likelihood that stormwater generated from the Project Area will contain levels of suspended solids significantly greater than baseline existing conditions is low.	Operation	Surface Water Quality, Refer to **Section 7.1**.
WR11	Proposed road upgrades at Golden Highway/Ringwood Road intersection, Wollar Road and Ringwood Road including culvert upgrades as required.	Detailed Design / Construction.	Surface Water Quality and Flooding, Refer Section 7.1 and **Section 7.3**.

9.0 Conclusion

This WRIA has reviewed information and data to understand the potential impacts of the Project on water resources within the Project Area.

The potential impacts associated with the construction, operation and decommissioning phases can be appropriately managed through implementation of a range of conventional mitigation measures.
In summary:

- The potential for discharge of sediments and the resulting impact on the receiving environment surface water quality during ground disturbance activities (construction and decommissioning) can be adequately managed through appropriate construction management planning including best practice erosion and sediment control measures.
- Potentially adverse impacts on the receiving environment surface water quality during the operational phase will be addressed through development of an OEMP. This will include the development and appropriate maintenance of a suitable ground cover underneath and around solar panels, and grassed table drains near access tracks to minimise the potential for erosion and export of sediment. Additional measures for the treatment of stormwater quality are not considered necessary.
- The flood risk assessment conducted in this study assessed the flood behaviour for both the existing and climate change conditions. The 10%, 1%, 0.5% and 0.2% AEP and PMF were assessed using flood depth, velocity, and hazard levels. The Project Area was found to present a low risk of flooding for both the existing and climate change conditions.
- The results of the flood impact assessment have shown that the Project Area is located outside areas of major flood hazard. Peak stormwater discharges from the Project Area for impervious areas may increase slightly. However, potential impacts to drainage features and downstream watercourses are considered likely to be minimal due to the relative size of the Project Area in relation to the size of the receiving catchments, and the distributed nature of minor impacts.
- High velocities were predicted within the northeast and western channels. Review of aerial imagery shows evidence of erosion and sedimentation (due to higher flow velocities and steeper areas). It is recommended the erosion on site is further investigated (including site investigation) and remediation undertaken if deemed necessary prior to construction. These areas will be avoided.
- Minimum changes to the land topography, impervious fraction and therefore runoff and groundwater infiltration are expected due to the nature and extent of proposed infrastructure. If the recommendations outlined in **Section 8.0** are met and a relevant set of construction and operation management plans (to be approved prior to construction/operation commencement) are developed, the Project is likely to have nil to minor residual impacts on surface or ground water.
- The potential for adverse impacts on the receiving environment surface water quality from point sources such as chemical storage will be mitigated through design and will be operated to comply with relevant Australian Standards and local planning requirements.

No constraints were identified within the Project Area that would prevent the Project from meeting the requirements of the local and state planning requirements.

10.0 References

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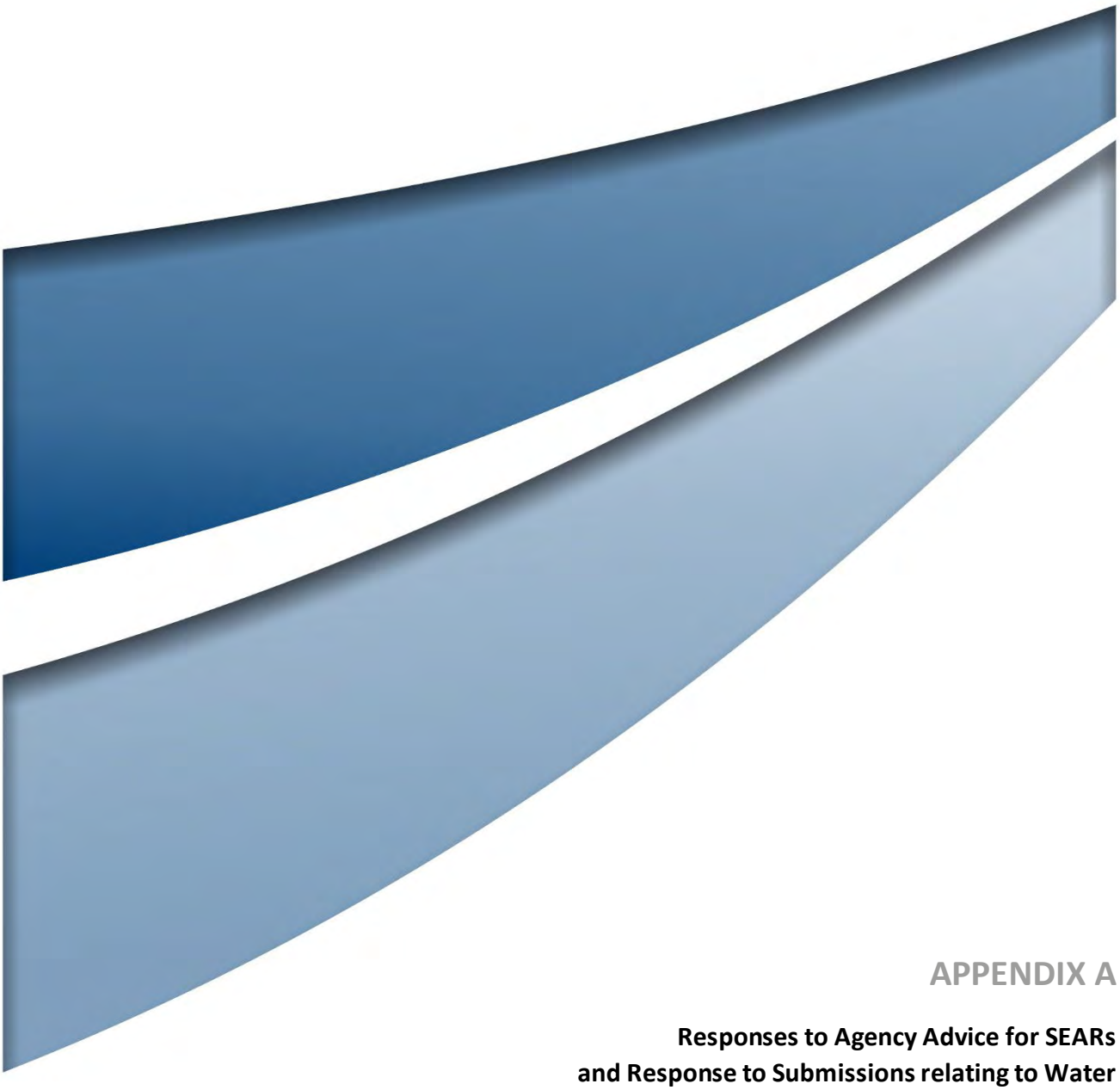


APPENDIX A

Responses to Agency Advice for SEARs
and Response to Submissions relating to Water

Agency Advice (SEARs) and Where it has Been Addressed in the WRIA		
Water and Soils		
5	The EIS must map the following features relevant to water and soils including:	
a.	Acid sulfate soils (Class 1, 2, 3 or 4 on the Acid Sulfate Soil Planning Map).	**Section 3.3**. The land is not identified as a risk area for acid sulphate soils, and it is highly unlikely they would exist at the site or be impacted by the Project.
b.	Rivers, streams, wetlands, estuaries (as described in s4.2 of the Biodiversity Assessment Method).	**Section 3.1**, **Section 5.0** and **Section 7.0**. Mapping of the rivers and wetlands has been undertaken using hydraulic modelling.
c.	Wetlands as described in s4.2 of the Biodiversity Assessment Method.	**Section 3.1**, **Section 5.0** and **Section 7.0**. Mapping of the rivers and wetlands has been undertaken using hydraulic modelling.
d.	Groundwater.	**Section 3.4** and **Section 7.0**.
e.	Groundwater dependent ecosystems.	**Section 3.6** and **Section 7.0**.
f.	Proposed intake and discharge locations.	**Section 4.1** and **Section 7.0**.
6	The EIS must describe background conditions for any water resource likely to be affected by the development, including:	
a.	Existing surface and groundwater.	**Section 2.0**, **Section 5.0** and **Section 7.0**.
b.	Hydrology, including volume, frequency and quality of discharges at proposed intake and discharge locations.	**Section 2.0** and **Section 7.0**.
c.	Water Quality Objectives (as endorsed by the NSW Government http://www.environment.nsw.gov.au/ieo/index.htm) including groundwater as appropriate that represent the community's uses and values for the receiving waters.	**Section 3.7** and **Section 7.0**.
d.	Indicators and trigger values/criteria for the environmental values identified at (c) in accordance with the ANZECC (2000) Guidelines for Fresh and Marine Water Quality and/or local objectives, criteria or targets endorsed by the NSW Government.	**Section 3.7** and **Section 7.0**.
7	The EIS must assess the impacts of the development on water quality, including:	
a.	The nature and degree of impact on receiving waters for both surface and groundwater, demonstrating how the development protects the Water Quality Objectives where they are currently being achieved, and contributes towards achievement of the Water Quality Objectives over time where they are currently not being achieved. This should include an assessment of the mitigating effects of proposed stormwater and wastewater management during and after construction.	**Section 5.0** and **Section 7.0**.
b.	Identification of proposed monitoring of water quality.	**Section 7.0**.

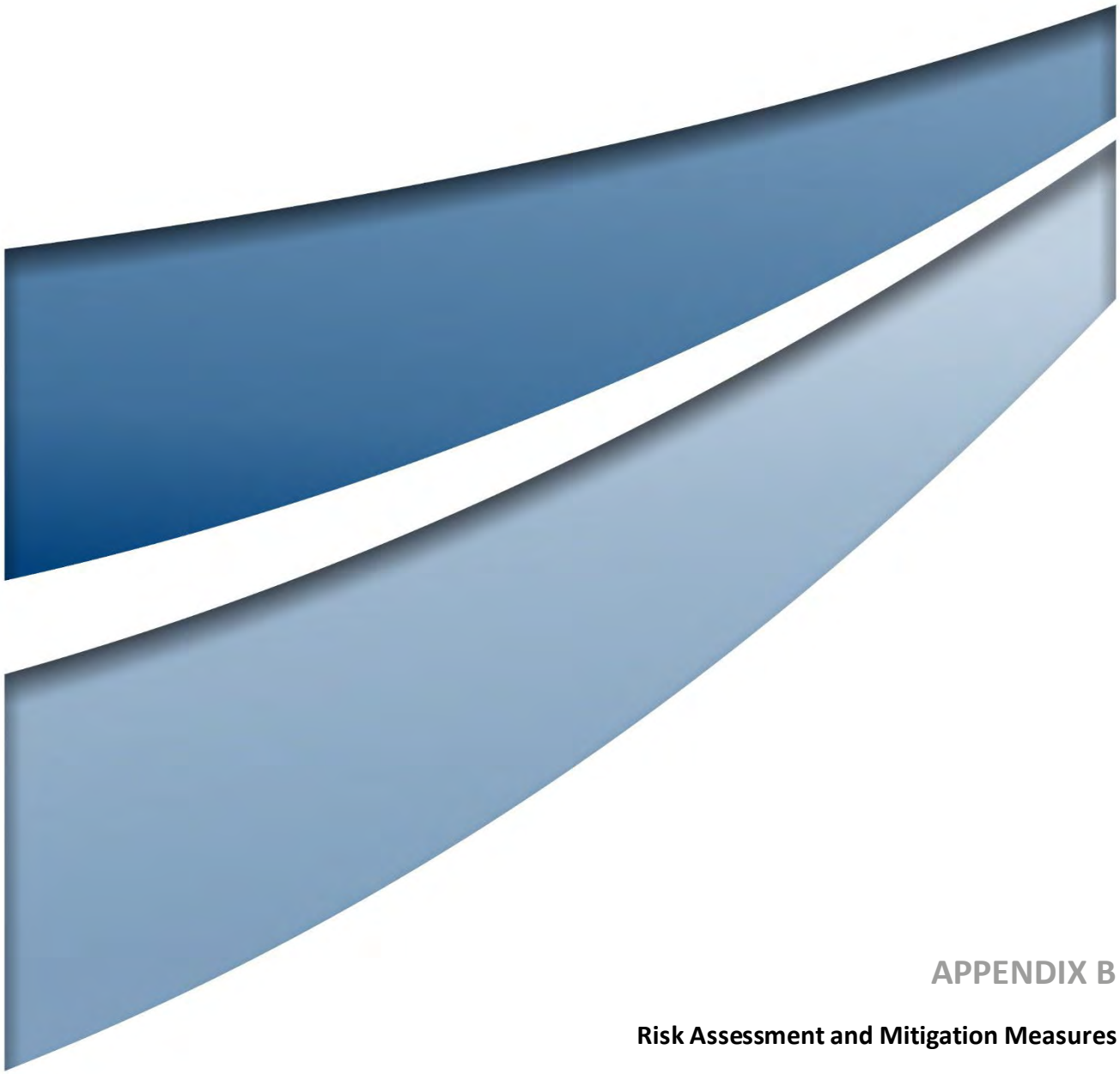
Agency Advice (SEARs) and Where it has Been Addressed in the WRIA		
8	The EIS must assess the impact of the development on hydrology, including:	
a.	Water balance including quantity, quality and source.	Proposed water supply is discussed in **Section 4.0**. Detailed water balance modelling was not undertaken as water demands are expected to be minimal during construction, operation and decommissioning. Assessment of flows from the Project Area using TUFLOW models, see **Section 5.0** and **Section 7.0**.
b.	Effects to downstream rivers, wetlands, estuaries, marine waters and floodplain areas.	Assessment flows from the Project Area using TUFLOW models, see **Section 5.0** and **Section 7.0**.
c.	Effects to downstream water-dependent fauna and flora including groundwater dependent ecosystems.	**Section 3.6**. Please refer to Biodiversity Development Assessment Report for impacts to fauna and flora.
d.	Impacts to natural processes and functions within rivers, wetlands, estuaries and floodplains that affect river system and landscape health such as nutrient flow, aquatic connectivity and access to habitat for spawning and refuge (e.g. river benches).	**Section 7.0**.
e.	Changes to environmental water availability, both regulated/licensed and unregulated/rules-based sources of such water.	**Section 4.0** and **Section 7.0**.
f.	Mitigating effects of proposed stormwater and wastewater management during and after construction on hydrological attributes such as volumes, flow rates, management methods and reuse options.	No major stormwater and wastewater infrastructure proposed for the Project Area. See **Section 7.0** for surface water impacts.
g.	Identification of proposed monitoring of hydrological attributes.	See **Section 7.0**.
Flooding		
9	The EIS must map the following features relevant to flooding as described in the Floodplain Development Manual 2005 (NSW Government 2005) including:	
a.	Flood prone land.	**Section 5.0** and **Section 7.0**.
b.	Flood planning area, the area below the flood planning level.	**Section 5.0** and **Section 7.0**.
c.	Hydraulic categorisation (floodways and flood storage areas).	**Section 5.0** and **Section 7.0**.
10	The EIS must describe flood assessment and modelling undertaken in determining the design flood levels for events, including a minimum of the 1 in 10 year, 1 in 100 year flood levels and the probable maximum flood, or an equivalent extreme event.	**Section 5.0** and **Section 7.0**.
11	The EIS must model the effect of the proposed development (including fill) on the flood behaviour under the following scenarios:	**Section 5.0** and **Section 7.0**.

Agency Advice (SEARs) and Where it has Been Addressed in the WRIA		
a.	Current flood behaviour for a range of design events as identified in 11 above. This includes the 1 in 200 and 1 in 500 year flood events as proxies for assessing sensitivity to an increase in rainfall intensity of flood producing rainfall events due to climate change.	**Section 5.0** and **Section 7.0**.
12	Modelling in the EIS must consider and document:	
a.	The impact on existing flood behaviour for a full range of flood events including up to the probable maximum flood.	**Section 5.0** and **Section 7.0**.
b.	Impacts of the development on flood behaviour resulting in detrimental changes in potential flood affection of other developments or land. This may include redirection of flow, flow velocities, flood levels, hazards and hydraulic categories.	**Section 5.0** and **Section 7.0**.
c.	Relevant provisions of the NSW Floodplain Development Manual 2005.	**Section 5.0** and **Section 7.0**.
13	The EIS must assess the impacts on the proposed development on flood behaviour, including:	
a.	Whether there will be detrimental increases in the potential flood affectation of other properties, assets and infrastructure.	**Section 5.0** and **Section 7.0**.
b.	Consistency with Council floodplain risk management plans.	**Section 5.0** and **Section 7.0**.
c.	Compatibility with the flood hazard of the land.	**Section 5.0** and **Section 7.0**.
d.	Compatibility with the hydraulic functions of flow conveyance in floodways and storage in flood storage areas of the land.	**Section 5.0** and **Section 7.0**.
e.	Whether there will be adverse effect to beneficial inundation of the floodplain environment, on, adjacent to or downstream of the site.	**Section 5.0** and **Section 7.0**.
f.	Whether there will be direct or indirect increase in erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses.	**Section 5.0** and **Section 7.0**.
g.	Any impacts the development may have upon existing community emergency management arrangements for flooding. These matters are to be discussed with the SES and Council.	**Section 5.0** and **Section 7.0**.
h.	Whether the proposal incorporates specific measures to manage risk to life from flood. These matters are to be discussed with the SES and Council.	**Section 5.0** and **Section 7.0**.
i.	Emergency management, evacuation and access, and contingency measures for the development considering the full range or flood risk (based upon the probable maximum flood or an equivalent extreme flood event). These matters are to be discussed with and have the support of Council and the SES.	**Section 5.0** and **Section 7.0**.
j.	Any impacts the development may have on the social and economic costs to the community as consequence of flooding.	**Section 5.0** and **Section 7.0**.

Response to Submissions on EIS as related to Water		
Item	**Submission**	**Response**
NSW RFS		
1	A 10,000 litre water supply (tank) fitted with a 65 mm storz fitting shall be located adjoining the internal property access road within the required APZ.	The Project EIS has committed to an appropriate dedicated water supply for bushfire protection being provided in accordance with the requirements of the NSW Rural Fire Service. This measure has been amended to include the additional detail suggested by RFS above. This updated measure has been included in Appendix B of the Amendment Report.
National Parks and Wildlife		
2	15. b. ensure waterway crossings designs, or standards applied where direct impacts on the national park or its interface are identified are provided as part of the EIS. Ensure selected designs minimise impacts on stream stability, riparian quality and any fish passage. Provide either the reference to the design standards utilised or engineer reports as necessary.	Impacts on stream stability, riparian health and fish passage are addressed in **Section 7.2**.
3	15. c. provide the draft mitigation measures to be applied under the Soil and Water Management Plan to avoid or minimise direct impacts to waterways, water quality and riparian areas, especially for Redlynch Creek, Rocky Creek, Monaghans Creek, Bow River and Killoe Creeks	Mitigation measures to avoid or minimise direct impacts to waterways, water quality and riparian areas will be incorporated within the project CSWMP as addressed in **Section 7.2** and **Table 8.1**.
4	15. e. ensure the preparation of the future Construction Environmental Management Plan (CEMP), and any relevant subplans such as the: i. Soil and Water Management Subplan – manages surface water resulting from the projects increased volume and velocity of runoff due to increase impervious surfaces, address the risk of mobilisation of contaminants generated during construction and operation of the protect/facility. ii. Erosion Sediment Control Subplan – to manage water quality impacts affecting the park interface and waterways during construction, upgrade of roads and the transmission line. Providing clear management controls to guide construction works occurring at the interface of national park (during establishment of the perimeter road and assets within 20 m of the boundary). This should include vegetation removal methods, controls around excavation works, limitations on stockpiling of materials and heavy vehicle movements on the interface of the park.	Refer to **Table 8.1**.

Response to Submissions on EIS as related to Water		
	NPWS advises on limiting or strictly controlling works which lead to increased mobility of sediments and contaminants on the interface, and waterways where surface water flow is directed on to the national park.	
5	15. f. ensure the preparation of the future Operational Environmental Management Plan (OEMP) and any relevant subplans such as the: ii. Soil and Water Management Plan, to address surface water management during the long-term operation of the facility to ensure protection and rehabilitation of waterways adjoining park to improve filtration of flows from the project area. Reducing risk of adverse water quality impacts and threats to aquatic threatened biodiversity values. Ensure this is supported by a water quality monitoring program to demonstrate sustained or improved water quality outcomes.	Refer to **Table 8.1**.
6	8. Offsite impacts of herbicide use require assessment Section 7.1.2 'Operation' of the Water Resources Impact Assessment (Appendix 16 of the EIS) describes the potential use of herbicides for vegetation control. BCD notes that the site of the solar farm has many ephemeral watercourses on it, all of which flow into the adjacent Goulburn River National Park. Further information is required from the proponent to describe any direct, indirect and prescribed impacts that the use of herbicide may have on the adjacent National Park Estate. <u>Recommendation 8</u> The proponent should ensure that any direct, indirect or prescribed impacts to vegetation on the Goulburn River National Park from herbicide used on the project area are assessed in accordance with the BAM.	Refer to the Solar Farm Biodiversity Development Assessment Report which is contained in Part B of the Amendment Report.
DPI Fisheries		
7	Waterway crossings should be designed and constructed in accordance with the national guidelines entitled 'Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings' (Fairfull and Witheridge , 2003). This document can be access via the website at this link: https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0004/633505/Whydo-fish-need-to-cross-the-road_booklet.pdf.	This comment from DPI Fisheries is noted and has been incorporated into the development of the Project. **Table 8.1** in this assessment directly addresses this requirement. The Project design has aimed to avoid works close to or within waterways. The EIS identifies that several waterway crossings will be required for site access, internal access roads and the electrical cabling layout.

Response to Submissions on EIS as related to Water		
		Waterway crossings will be designed to minimise impacts on stream stability and fish passage and will be designed with reference to: • Guidelines for Controlled Activities on Waterfront Land (DPE, 2018). • Why Do Fish Cross the Road? Fish Passage Requirements for Waterway Crossings (DPI, 2003). • Fisheries NSW Policy and guidelines for fish habitat conservation and management, (NSW DPI, 2013).
8	Environmental safeguards (silt curtains, booms etc) are to be used during the works to ensure that there is no escape of turbid plumes into the adjacent aquatic environment;	This assessment addresses the requirement from DPI Fisheries to safeguard adjacent aquatic environments and notes the development of a Construction Soil and Water Management Plan (CSWMP) prior to construction. The CSWMP will be prepared to outline measures to manage soil and water impacts associated with the construction and decommissioning works as detailed in **Section 8.0**.
DPE Water		
9	The proponent should confirm that works are setback from the mapped watercourses in accordance with the Guidelines for Controlled Activities on Waterfront Land – Riparian Corridors (DPE, 2022).	The RtS and Amendment Report including amended Aquatic Assessment addresses this submission.
10	Works within waterfront land must consider the Guidelines for Controlled Activities on Waterfront Land – Vegetation management Plans (DPE, 2022).	The RtS and Amendment Report including amended Aquatic Assessment addresses this submission.
11	The proponent prepares a Soil and Water Management Plan and an Erosion and Sediment Control Plan in accordance with industry standards including the guideline, Managing Urban Stormwater: Soils and Construction (Landcom, 2004).	Appendix 5 of the Project EIS confirms that a CSWMP will be prepared to outline measures to manage soil and water impacts associated with the construction works. This will also include an ESCP. In order to address this submission, LSbp confirms that these management plans will be developed in consultation with DPE Water and in accordance with industry standards including the guideline, Managing Urban Stormwater: Soils and Construction (Landcom, 2004). These measures have also been included in **Table 8.1**.



APPENDIX B

Risk Assessment and Mitigation Measures

Risk Assessment and Mitigation Measures

The Risk Assessment Framework set out in *Australian Standard/New Zealand Standard (AS/NZS) ISO 31000:2018 Risk Management – Principles and Guidelines (2018)* was adopted for this assessment. Criteria used to rank the likelihood and consequences of potential impacts and how they are combined to determine the level of impact are set out in **Table B1** through to **Table B3** below. Specifically, the degree of sensitivity for Environmental Values (EV) (High, Moderate or Low) is outlined in **Table B1**, while the magnitude of impacts (High, Moderate or Low) is described in **Table B2**. Finally, the sensitivity and impact magnitude are combined to give five categories for the significance of impacts in **Table B3** (Major, High, Moderate, Low or Negligible). The five categories for the significance of an impact are explained below:

- **Major** significance of impact – arises when an impact will potentially cause irreversible or widespread harm to an EV that is irreplaceable because of its uniqueness or rarity. Avoidance through appropriate design responses is the only effective mitigation.
- **High** significance of impact – occurs when the proposed activities are likely to exacerbate threatening processes affecting the intrinsic characteristics and structural elements of the EV. While replacement of unavoidable losses is possible, avoidance through appropriate design responses is preferred to preserve its intactness or conservation status.
- **Moderate** significance of impact – although reasonably resilient to change, the EV would be further degraded due to the scale of the impact or its susceptibility to further change. The abundance of the EV ensures it is adequately represented in the region, and that replacement, if required, is achievable.
- **Low** significance of impact – occurs where an EV is of local importance and temporary and transient changes will not adversely affect its viability provided standard environmental management controls are implemented.
- **Negligible** significance of impact – impact on the EV will not result in any noticeable change in its intrinsic value and hence the proposed activities will have negligible effect on its viability. This typically occurs where the activities occur in industrial or highly disturbed areas.

Mitigation measures were applied to the potential (unmitigated) impacts to identify the residual (mitigated) impacts as shown in **Table B4**.

Table B1 Description of Sensitivity Criteria

Sensitivity	Description
High	The EV is listed on a recognised or statutory state, national or international register as being of conservation significance. The EV is intact and retains its intrinsic value. The EV is unique to the environment in which it occurs. It is isolated to the affected system/area which is poorly represented in the region, territory, country, or the world. It has not been exposed to threatening processes, or they have not had a noticeable impact on the integrity of the EV. Project activities would have an adverse effect on the value.
Moderate	The EV is recorded as being important at a regional level and may have been nominated for listing on recognised or statutory registers. The EV is in a moderate to good condition despite it being exposed to threatening processes. It retains many of its intrinsic characteristics and structural elements. It is relatively well represented in the systems/areas in which it occurs, but its abundance and distribution are limited by threatening processes. Threatening processes have reduced its resilience to change. Consequently, changes resulting from project activities may lead to degradation of the prescribed value. Replacement of unavoidable losses is possible due to its abundance and distribution.
Low	The EV is not listed on any recognised or statutory register. It might be recognised locally by relevant suitably qualified experts or organisations e.g., historical societies. It is in a poor to moderate condition as a result of threatening processes which have degraded its intrinsic value. It is not unique or rare and numerous representative examples exist throughout the system/area. It is abundant and widely distributed throughout the host systems/areas. There is no detectable response to change, or change does not result in further degradation of the EV. The abundance and wide distribution of the EV ensures replacement of unavoidable losses is achievable.

Table B2 Description of Magnitude Criteria

Magnitude	Description
High	An impact that is widespread, long lasting and results in substantial and possibly irreversible change to the EV. Avoidance through appropriate design responses or the implementation of Project Area-specific environmental management controls are required to address the impact.
Moderate	An impact that extends beyond the area of disturbance to the surrounding area but is contained within the region where the Project is being developed. The impacts are short term and result in changes that can be ameliorated with specific environmental management controls.
Low	A localised impact that is temporary or short term and either unlikely to be detectable or could be effectively mitigated through standard environmental management controls.

Table B3 Significance Assessment Matrix

Magnitude of Impact	Sensitivity of Environmental Value		
	High	Moderate	Low
High	Major	High	Moderate
Moderate	High	Moderate	Low
Low	Moderate	Low	Negligible

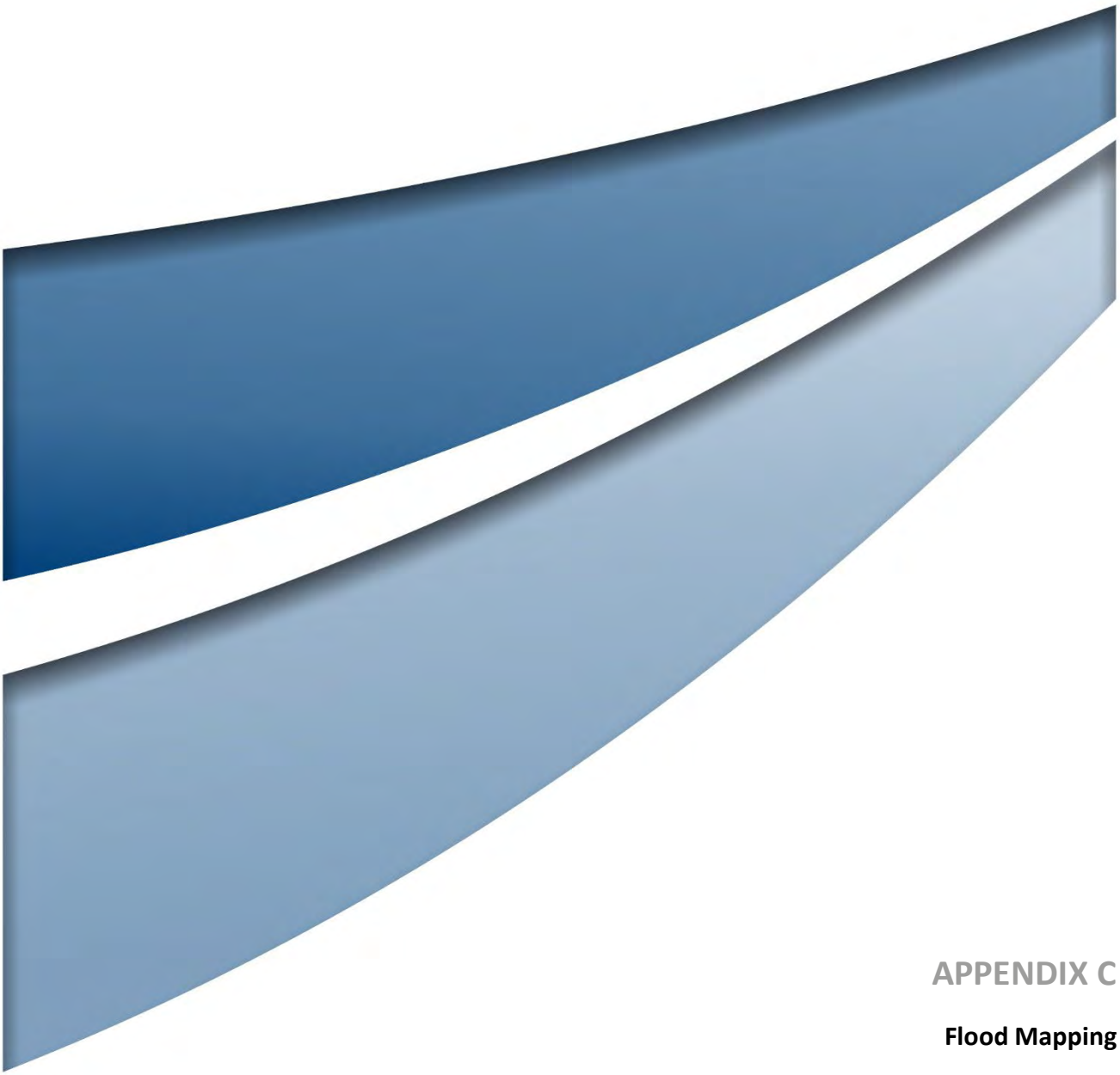
Table B4 Risk Assessment and Mitigation Measures

Potential Impacts to Surface Water	Relevant Environmental Value/s	Pre-Mitigated Impact			Mitigation Measure	Residual (Mitigated) Impact	
		Sensitivity	Magnitude	Significance		Magnitude	Significance
Discharge of sediments (both air and water-borne) from exposed ground during construction and decommissioning phases resulting in impacts on receiving environment surface water quality.	• Aquatic ecosystems • Irrigation • Farm supply • Stock watering • Visual Recreation • Cultural & Spiritual Values.	**Moderate**	**Moderate**	**Moderate**	A Construction Soil and Water Management Plan (CSWMP) will be prepared to outline measures to manage soil and water impacts associated with the construction works and decommissioning. The CSWMP will provide: • Measures to minimise/manage erosion and sediment transport both within the construction footprint and offsite including requirements for the preparation of erosion and sediment control plans (ESCP) for all progressive stages of construction. • Measures to manage waste including the classification and handling of spoil. • Procedures to manage unexpected, contaminated finds. • Measures to manage stockpiles including locations, separation of waste types, sediment controls and stabilisation. • Measures to manage accidental spills including the requirement to maintain materials such as spill kits. • Controls for receiving waterways which may include designation of 'no go' zones for construction plant and equipment. • Creation of catch/diversion drains and sediment fences at the downstream boundary of construction activities where practicable to support containment of sediment-laden runoff. • Erosion and sediment control measures will be implemented and maintained at all work sites in accordance with the principles and requirements in Managing Urban Stormwater - Soils and Construction, Volume 1 (Landcom 2004) and Volume 2D (NSW Department of Environment, Climate Change and Water 2008b), commonly referred to as the "Blue Book".	Low	Low
Soil disturbance	• Aquatic ecosystems • Primary Recreation • Secondary Recreation • Visual Recreation • Cultural & Spiritual Values.	**Low**	**Moderate**	**Low**	• The area of vegetation to be cleared will be kept to a minimum and determined during detailed design of the Project. • Placement of infrastructure in vegetated areas will be avoided where possible. Where clearance of vegetation is required, clearance activities would be undertaken in accordance with the Project Area-specific CSWMP prior to the commencement of construction.	Low	Negligible
Discharge of stormwater from the Project Area during operational phase resulting in impacts on receiving environment surface water quality.	• Aquatic ecosystems • Irrigation • Farm supply • Stock watering • Visual Recreation • Cultural & Spiritual Values.	**Low**	**Moderate**	**Low**	• Infrastructure such as inverters and battery storage will be located with a minimum 300 mm freeboard above the maximum 1% AEP flood level. It is common for this type of infrastructure to be housed within containers or small sheds with relatively small footprints. Given the shallow depths across the site, raising these small fill pads is highly unlikely to result in any adverse impacts offsite. • Operation phase mitigation measures will be guided by an operational management plan developed for the Project, which will detail methods for minimising sediment loss from the Project Area in accordance with best practice guidelines. • Stormwater runoff from the Project Area during the operational phase will be discharged diffusely across the Project Area via vegetated surfaces wherever practical.	Low	Negligible

Potential Impacts to Surface Water	Relevant Environmental Value/s	Pre-Mitigated Impact			Mitigation Measure	Residual (Mitigated) Impact	
		Sensitivity	Magnitude	Significance		Magnitude	Significance
					• Post-construction, disturbed areas will be stabilised by the establishment and maintenance of a vegetated groundcover consisting of low-growing grasses. A weed control program will be implemented for the Project Area to manage noxious weeds and reduce weed invasion. In order to reduce the potential impact of pesticide use, glyphosate-based products, or similar non-residual and non-persistent herbicides, will be used to manage vegetation and grazing on the Project Area. This groundcover is expected to both significantly reduce the incidence of impact erosion as well as provide for the additional filtering of suspended solids and biological uptake of nutrients. Consequently, the likelihood that stormwater generated from the Project Area will contain levels of suspended solids significantly greater than baseline existing conditions is low. • Stormwater discharging from the Project Area post-development is anticipated to be of a quality that will not impact the surface water receiving environment. Specific treatment and/or detention of stormwater for the removal of sediments and gross pollutants prior to the release to the environment are not considered necessary.		

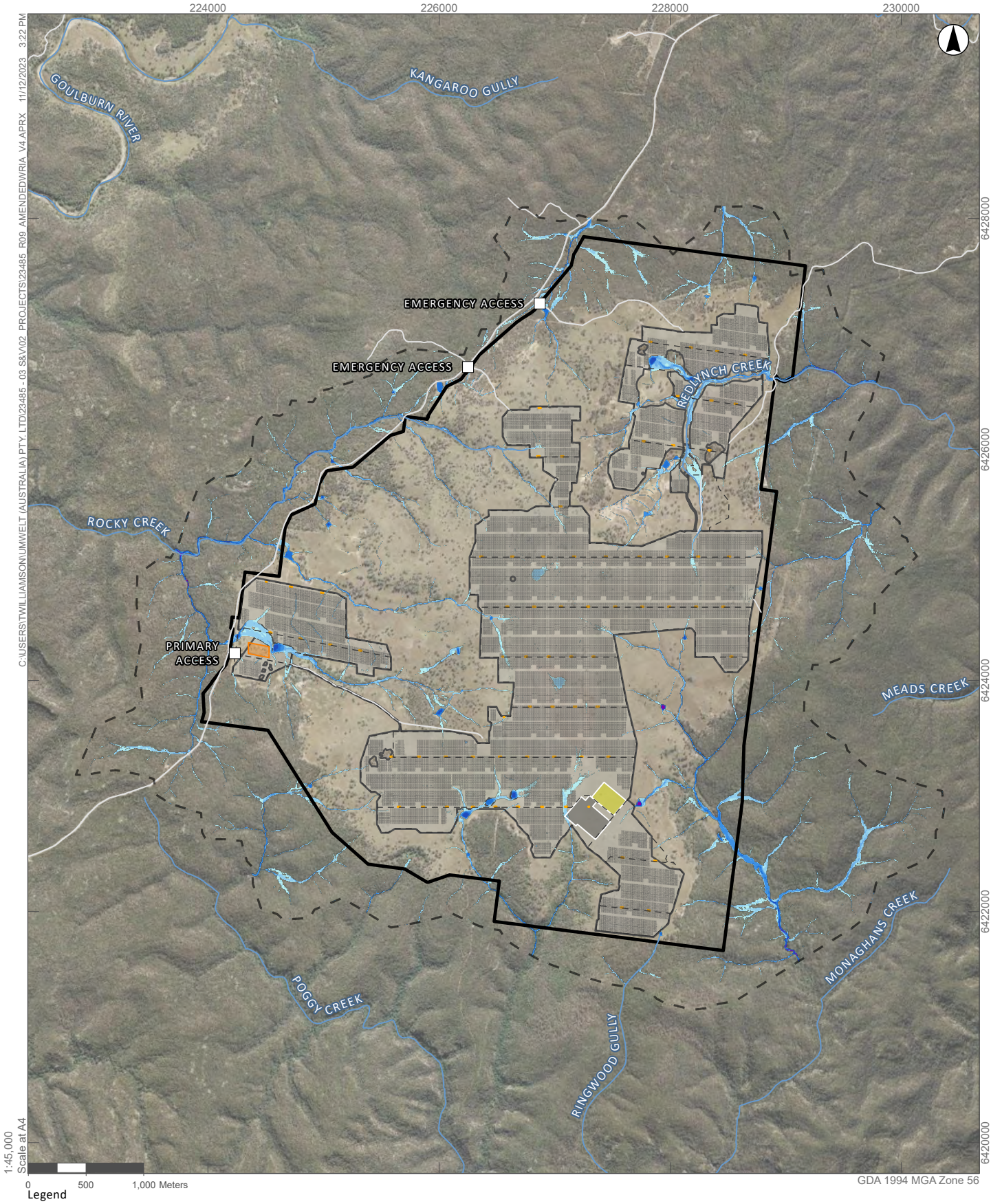
Discharge of stormwater from the Project Area during <u>operational</u> phase resulting in adverse impacts on receiving environment surface water geomorphology (e.g., stream bank erosion and scouring) or hydroecology	• Aquatic ecosystems
	• Irrigation
	• Farm supply
	• Stock watering
	• Visual Recreation
	• Industrial use
	• Cultural & Spiritual Values.
		Low	**Moderate**	**Low**	• Project Area drainage works will aim to minimise potential impacts on the existing overland flow paths and stormwater will be discharged diffusely across the Project Area via vegetated surfaces wherever practical. Project Area drainage works will aim to minimise potential impacts on the existing overland flow paths.
					• Debris will be cleared from fencing following flood events.
					• Erosion controls (e.g., rip rap, i.e. rock protection) will be installed where considered necessary in accordance with BPESC Guidelines (IECA, 2008).
					• Although peak flows of stormwater runoff from the Project are expected to increase slightly post-development at locations where surfaces are made impervious or less pervious, these increases are not expected to impact the downstream environment for the following reasons:
					  ○ A very small proportion of the catchment will be subject to development and this runoff is expected to form a very small percentage of peak flow in each receiving watercourse.
					  ○ The areas to be developed are spread across the Project Area, and any increases in runoff will be dissipated across the Project Area.
					  ○ Mitigation measures such as grassy buffer strips and vegetated table drains will attenuate peak flows.
					• Additional specific mitigation measures to control stormwater discharge from the Project Area are not considered necessary given the small volume discharged in the context of each receiving catchment. The proposed mitigation measures are considered sufficient to reduce any impacts to stream water quality and geomorphology.
					• The proposed road upgrades will be designed to minimise afflux and appropriate scour protection will be designed to minimise erosion and scour.
						Low	Negligible

Potential Impacts to Surface Water	Relevant Environmental Value/s	Pre-Mitigated Impact			Mitigation Measure	Residual (Mitigated) Impact	
		Sensitivity	Magnitude	Significance		Magnitude	Significance
Spills/leaks from chemical (e.g., fuel and oil) storage areas into surface water bodies during <u>construction</u> and <u>decommissioning</u> phases resulting in adverse impacts on receiving environment surface water quality.	• Aquatic ecosystems • Irrigation • Farm supply • Stock watering • Primary Recreation • Secondary Recreation • Visual Recreation • Cultural & Spiritual Values.	**Low**	**Moderate**	**Low**	• Chemicals such as hydrocarbon materials will be stored in accordance with relevant Australian Standards to ensure that any spillages are contained.	Low	Negligible
Untreated discharges from on-Project Area wastewater during <u>operational</u> phase into surface water environment.	• Aquatic ecosystems • Irrigation • Farm supply • Stock watering • Primary Recreation • Secondary Recreation • Visual Recreation • Cultural & Spiritual Values.	**Low**	**Moderate**	**Low**	• Effluent will be removed from the Project Area and disposed in a suitable facility by a licensed operator.	Low	Negligible
Discharge of stormwater from the Project Area following the <u>decommissioning</u> phase resulting in impacts on receiving environment surface water quality and/or quantity	• Aquatic ecosystems • Irrigation • Farm supply • Stock watering • Visual Recreation • Cultural & Spiritual Values.	**Low**	**Moderate**	**Low**	• After the Project reaches the end of its operational life, the project would either be upgraded (pending any additional approval requirements) or decommissioned. Decommissioning would involve removing all project infrastructure and returning the development footprint to its pre-existing land use, as far as practicable. Mitigation measures are therefore not considered necessary post decommissioning.	Low	Negligible
Changes to the quantity of downstream water flows (e.g., from diversion of surface water bodies during construction) as a result of <u>construction</u> of the project.	• Aquatic ecosystems • Irrigation • Farm supply • Stock watering • Primary Recreation • Secondary Recreation • Visual Recreation • Industrial use • Cultural & Spiritual Values.	**Moderate**	**Moderate**	**Moderate**	• Project Area drainage works will aim to minimise potential impacts on the existing overland flow paths. Waterway crossings will be built in accordance with the code for self-assessable development for waterway barrier works. • Detailed design of project will be undertaken to minimise the need for waterway diversions as far as practical and to ensure minimal changes to downstream flows through the use of water attenuation devices (tanks/dams etc.) where increases to Area discharges are anticipated due to increases in impervious areas. • The proposed road upgrades will be designed to minimise afflux. • A construction management plan will be developed for the Project which will incorporate an Erosion and Sediment Control Plan and detail methods for minimising sediment-laden runoff in accordance with the International Erosion Control Association's (IECA) Best Practice Erosion and Sediment (BPESC) guidelines (IECA, 2008). • Debris will be cleared from fencing following flood events.	Low	Low



APPENDIX C

Flood Mapping



Legend

- Access Points
- Proposed Access Tracks
- Roads and Tracks
- Watercourse
- Model Extent
- Project Area
- Development Footprint - Amended Project

Proposed Infrastructure

- Battery Energy Storage System
- Battery Substation
- Inverters
- Compound Area
- Solar Panel Footprint

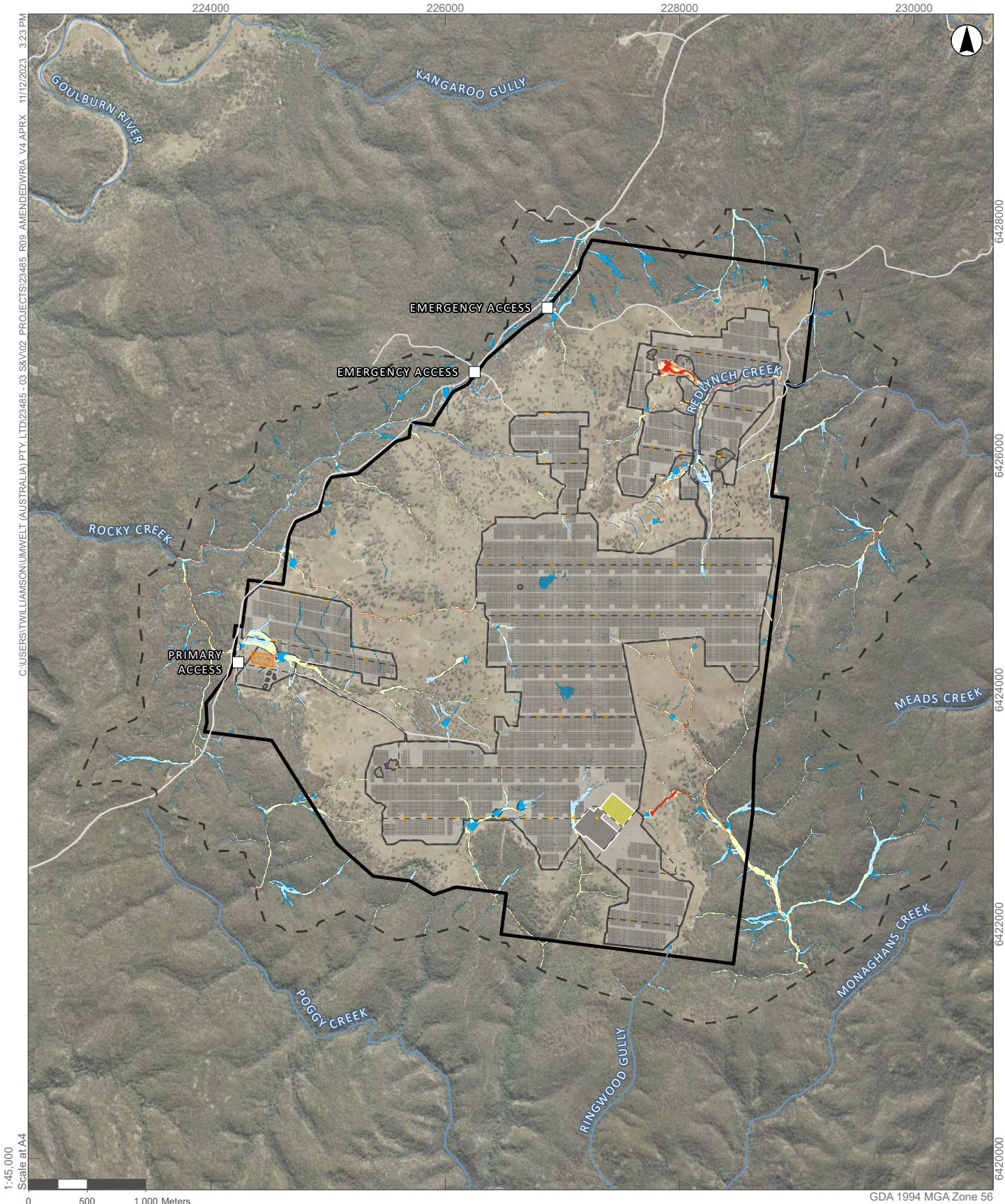
Water Depth (m)

- 0 - 0.1
- 0.1 - 0.3
- 0.3 - 0.5
- 0.5 - 1
- 1 - 2
- 2 - 3
- 3 - 4
- >4

APPENDIX C.1

10% AEP Flood Depth for Existing Conditions

Image Source: ESRI Basemap (2021) **Data source:** NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019); Lightsource BP (2022)



Legend

- Access Points
- Proposed Access Tracks
- Roads and Tracks
- Watercourse
- Model Extent
- Project Area
- Development Footprint - Amended Project

Proposed Infrastructure

- Battery Energy Storage System
- Battery Substation
- Inverters
- Compound Area
- Solar Panel Footprint

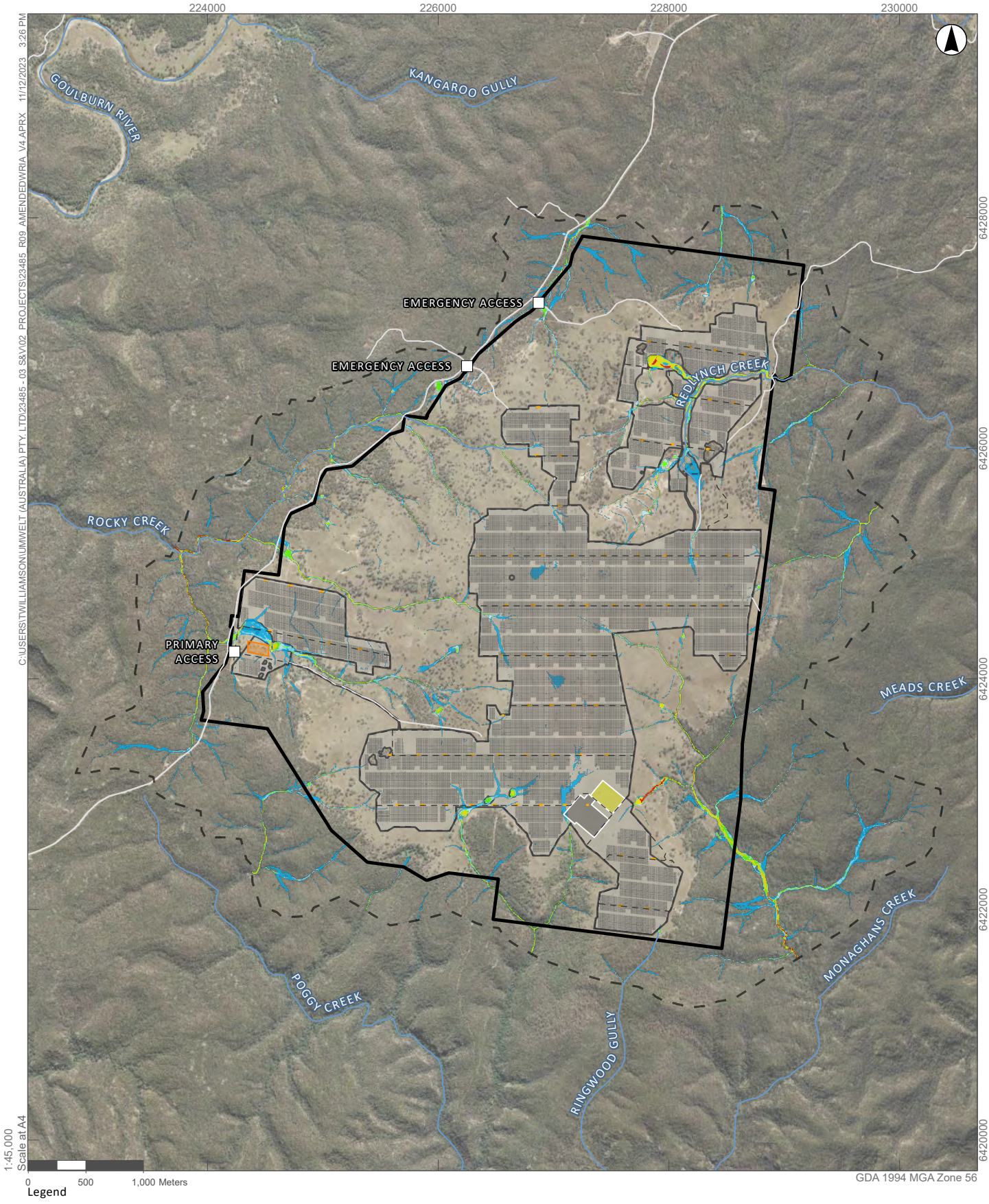
Water Velocity (m/s)

- < 0.5
- 0.5 - 1
- 1 - 2
- 2 - 3
- > 3.0

APPENDIX C.2

10 % AEP Flood Velocity for Existing Conditions

Image Source: ESRI Basemap (2021) **Data source:** NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019); Lightsource BP (2022)



Legend

- Access Points
- Proposed Access Tracks
- Roads and Tracks
- Watercourse
- Model Extent
- Project Area
- Development Footprint - Amended Project
- Compound Area

Proposed Infrastructure

- Battery Energy Storage System
- Battery Substation
- Inverters
- Solar Panel Footprint

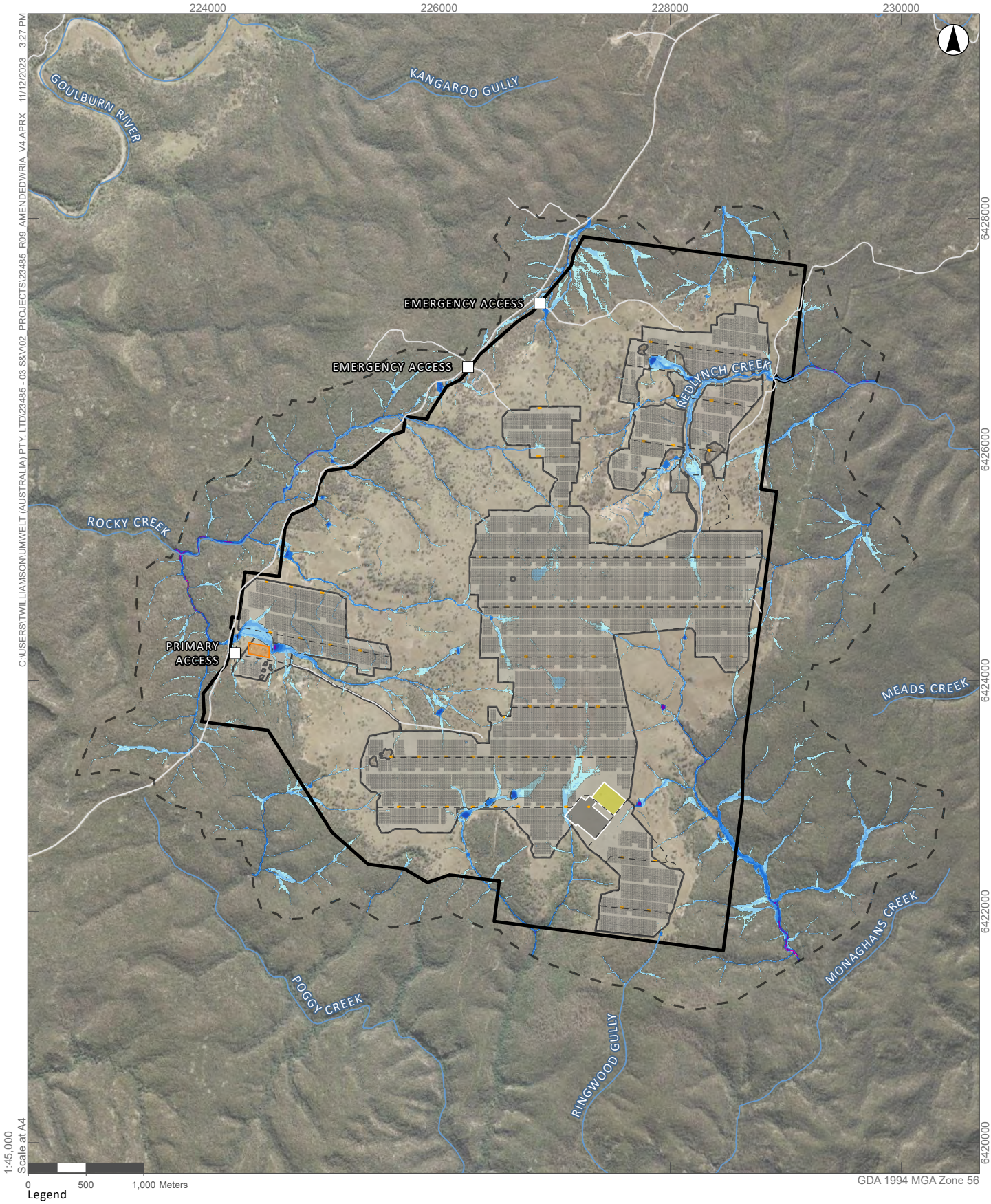
Hazard Category

- H1
- H2
- H3
- H4
- H5
- H6

APPENDIX C.3

10% AEP Flood Hazard for Existing Conditions

Image Source: ESRI Basemap (2021) **Data source:** NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019); Lightsource BP (2022)



Legend

- Access Points
- Proposed Access Tracks
- Roads and Tracks
- Watercourse
- Model Extent
- Project Area
- Development Footprint - Amended Project
- Compound Area

Proposed Infrastructure

- Battery Energy Storage System
- Battery Substation
- Inverters
- Solar Panel Footprint

Water Depth (m)

- < 0.1
- 0.1 - 0.3
- 0.3 - 0.5
- 0.5 - 1
- 1 - 2
- 2 - 3
- 3 - 4
- > 4.0

APPENDIX C.4

1% AEP Flood Depth for Existing Conditions

Image Source: ESRI Basemap (2021) **Data source:** NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019); Lightsource BP (2022)