Merimbula Sewage Treatment Plant Upgrade and Ocean Outfall
Environmental Impact Statement
Bega Valley Shire Council
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Merimbula Sewage Treatment Plant Upgrade and Ocean Outfall

Appendix H

Part B: Groundwater Dependent Ecosystem Assessment

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1. Background

1.1 Project summary

The Merimbula Sewage Treatment Plant (STP) is located between Merimbula and Pambula on Arthur Kaine Drive, approximately 3.5 kilometres (km) south of the Merimbula town centre and 2.5 km north of Pambula village.

Bega Valley Shire Council (BVSC) is proposing an upgrade to the Merimbula Sewage Treatment Plant (STP) including a new ocean outfall in Merimbula Bay (the Project). The Project would be located between Merimbula and Pambula on Arthur Kaine Drive, within the Bega Valley Shire local government area (LGA). The Merimbula STP is bounded by the Pambula Merimbula Golf Club (PMGC) to the south, Merimbula Lake to the west, Merimbula Airport to the north and Arthur Kaine Drive to the east. The Merimbula STP is accessed via Arthur Kaine Drive, which links to Princes Highway to the west and providing direct access to Merimbula Airport in the north.

The Project would involve an upgrade of sewage treatment at the Merimbula STP and replacement of the existing beach face outfall and dunal exfiltration ponds with an ocean outfall in Merimbula Bay. Specifically, the Project would involve:

- upgrade of the STP to improve the quality of treated wastewater (including for beneficial re-use);
- decommissioning of the beach-face outfall, as well as an STP effluent pond;
- discontinuing the use of the dunal exfiltration ponds;
- installation of a secondary disposal mechanism - an ocean outfall pipeline about 3.5 km in length to convey treated wastewater to a submerged diffuser;
- installation of upgraded pumps; and
- continuation of the beneficial re-use irrigation scheme at the PMGC grounds and the Oaklands agricultural area, with treated wastewater of improved quality.

The Project area comprises the existing Merimbula STP site and ocean outfall alignment, as well as areas required for construction, including laydown areas within the adjacent PMGC grounds and on Merimbula Beach (with access via Pambula Beach). The first section of the outfall pipeline would be placed underground, travelling from the existing STP to a point below the mean high water mark in Merimbula Bay, beyond the surf zone. The pipeline would then continue above-ground, along the sea bed to the diffuser approximately 2.7 km offshore.

The Project is aimed at reducing the environmental and health impacts of current operations, by providing a higher level of treatment and a superior mode of discharge/ dispersion of the treated wastewater via an ocean outfall in Merimbula Bay. The upgraded STP would be operated with the additional treatment processes which would improve the quality of the treated wastewater.

A full description of the Project is provided in the EIS in **Chapter 2 Project description**.

1.2 Hydrogeology

A detailed account of geology and hydrogeology is given in the *Groundwater Impact Assessment* (AECOM, 2020) undertaken for the Project. Local geology is dominated by Quaternary sediment deposits that overlay older fluvial and lacustrine sediments deposited along a palaeo drainage network eroded by the ancestral Pambula River. The palaeovalley is thought to be at least 90 metres (m) deep and 300 m wide (AECOM, 2020).

The Quaternary alluvial, colluvual, and dunal deposits contain an unconfined aquifer beneath the Project area, which is recharged by rainfall. The aquifer is locally confined by an aquitard of silt and clay deposits. The water-bearing strata, interpreted from drilling logs and geophysical data, consist of:

- an upper sand unit comprising medium to coarse sand;
- an underlying unit comprising clay, interbedded with coarse sand starting about 5 m below the top of this unit;
- a lower unit comprising coarse sand with minor clayey interbeds; and
- inferred Pambula Palaeovalley deposits including middle and lower units

Groundwater level data indicates an upwards hydraulic gradient from deeper coarse sand layers that give a piezometric level that extends slightly above ground level in some places (AECOM, 2020).

Groundwater level contours indicate that there is a natural mound south of the Project area, and groundwater flows outwards from this. There is a north-south divide along the sand spit beneath Arthur Kaine Drive and Merimbula Airport, which either drains water west into Merimbula Lake, or east to Merimbula Beach. Water table fluctuations are driven by rainfall in the centre and south of the spit, and by tidal fluctuations and wave action near the coast (IGGC, 2013). Along the proposed ocean outfall pipeline alignment, water level falls from between 1 m AHD and 1.1 m AHD at inland bores, to 0.5 m AHD and 0.6 m AHD close to Merimbula Beach (AECOM, 2020). It fluctuates about 0.5 m inland, and 0.3 m close to beach.

Groundwater in the Project area is fresh near the water table and becomes brackish at about 10 m, then saline towards the coast (AECOM, 2020). Nutrients are present in low concentrations, but can fluctuate following bushfires or controlled burns (IGGC, 2013). Concentrations of pathogenic bacteria is low except for immediately down-gradient of the exfiltration ponds.

2. Desktop assessment of GDEs in the Project area

2.1.1 GDE assessment protocol

This assessment complies with the *Risk assessment guidelines for groundwater dependent ecosystems* (GDEs), (NSW Office of Water, 2012). These guidelines lay out the steps required of proponents in assessing risks to GDEs in NSW. The first steps of this process determine whether there are any GDEs in the potential area of impact, then their ecological value. For this assessment, this will be done using existing ecological and groundwater assessments, and the GDE Atlas (BOM, 2017).

The next steps are to determine the likelihood and consequences of impact to the GDEs. These use a risk matrix, as well as ecological knowledges, to identify whether impacts are likely, how major the impacts would be, and whether they would be permanent or temporary. The type of GDE, regional setting, and sensitivity of key organisms in the ecosystem are all important considerations in carrying out this assessment.

The impact on GDEs from construction and operation of the Project from changes to flow or quality, including any impacts from drawdown or barriers, is then assessed.

2.2 GDE Atlas search results

2.2.1 Aquatic GDEs

Two different aquatic GDEs were found immediately adjacent to the Merimbula STP site, but do not occur within the Project area boundaries (**Figure 1**):

- Merimbula Lake, an estuarine lake to the west of the STP and mapped as highly likely to depend on groundwater inflow, and
- Coastal wetland vegetation on the shore of Merimbula Lake west and south of the Merimbula aerodrome. This includes estuarine mangrove forest and saltmarsh communities.

Merimbula Lake has been mapped as a Coastal Wetland under *State Environmental Planning Policy (Coastal Management) 2018*, and although the Project is not located on any land mapped as 'coastal wetland', a portion of the underground section of the pipeline would travel under an area mapped as coastal wetland, and a portion of the Project area is within the Proximity Area (ELA, 2020) so impacts from potential changes to groundwater will be considered.

2.2.2 Terrestrial GDEs

The Project area intersects four mapped groundwater dependent vegetations communities:

- Far South Coast Grassy Woodlands (Low Potential GDE);
- Lowland Gully Scrub Forest (Low Potential GDE);
- Coastal Sand Forest (High Potential GDE); and
- Coastal Scrub and Beach Strand (High Potential GDE).

These communities are shown in **Figure 1**, along with the Project area. In most cases, the amount of each vegetation community intersecting the Project area is minor (and also correspond with the underground section of the proposed outfall pipeline).

Some of the areas mapped as GDE have been previously cleared and can be discounted from the assessment. These include:

- Far South Coast Grassy Woodland within the northern Project area and enclosed in the current STP area. Only a small amount to the vegetation community remains in the Project area;
- Coastal Scrub and Beach Strand, and Coastal Sand Forest between the existing STP and Merimbula Beach. This area has been cleared and now contains the existing dunal exfiltration ponds, use of which is proposed to be discontinued; and
- Eden Dry Shrub Forest, Far South Coast Grassy Woodland, Lowland Gully Shrub Forest and Coastal Scrub and Beach Strand that now contains the road linking the STP site to the exfiltration ponds.

The vegetation classes mapped in the GDE Atlas correspond to the following plant community types (PCT) in the Biodiversity Assessment Report (ELA, 2020) prepared for the Project:

- Far South Coast Grassy Woodlands is mapped as PCT 777- Coast Grey Box- Mountain Grey Gum-stringybark moist shrubby open forest in coastal gullies, southern South East Corner Bioregion; and
- Coastal Scrub and Beach Strand, and Coastal Sand Forest are mapped as PCT 659- Bangalay- Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion.

More details on these PCTs are included in ELA (2020). For the remainder of this report, the vegetation classes referred to come from the GDE Atlas mapping.

2.3 Other sources

In addition to Merimbula Lake, Coastal Wetlands mapping under *State Environmental Planning Policy (Coastal Management) 2018* shows another wetland in the back-dunes of Merimbula Beach and extending south from the Project area. This wetland is not mapped as being groundwater dependent on the GDE Atlas, but has potential to be given the shallow groundwater table in the area. The water table beneath this wetland is close to the surface because it is topographically low and close to the clay deposits with low hydraulic conductivity, and sand deposits with high hydraulic conductivity (AECOM 2020). Groundwater levels fluctuate by about 0.5 m in response to seasonal rainfall recharge (AECOM, 2020). Water from the exfiltration ponds may also contribute to a slight increase in downslope groundwater levels, although regular monitoring of groundwater levels determines when to switch disposal to the beach-face outfall (AECOM, 2020). This aims to ensure groundwater levels do not rise too far.

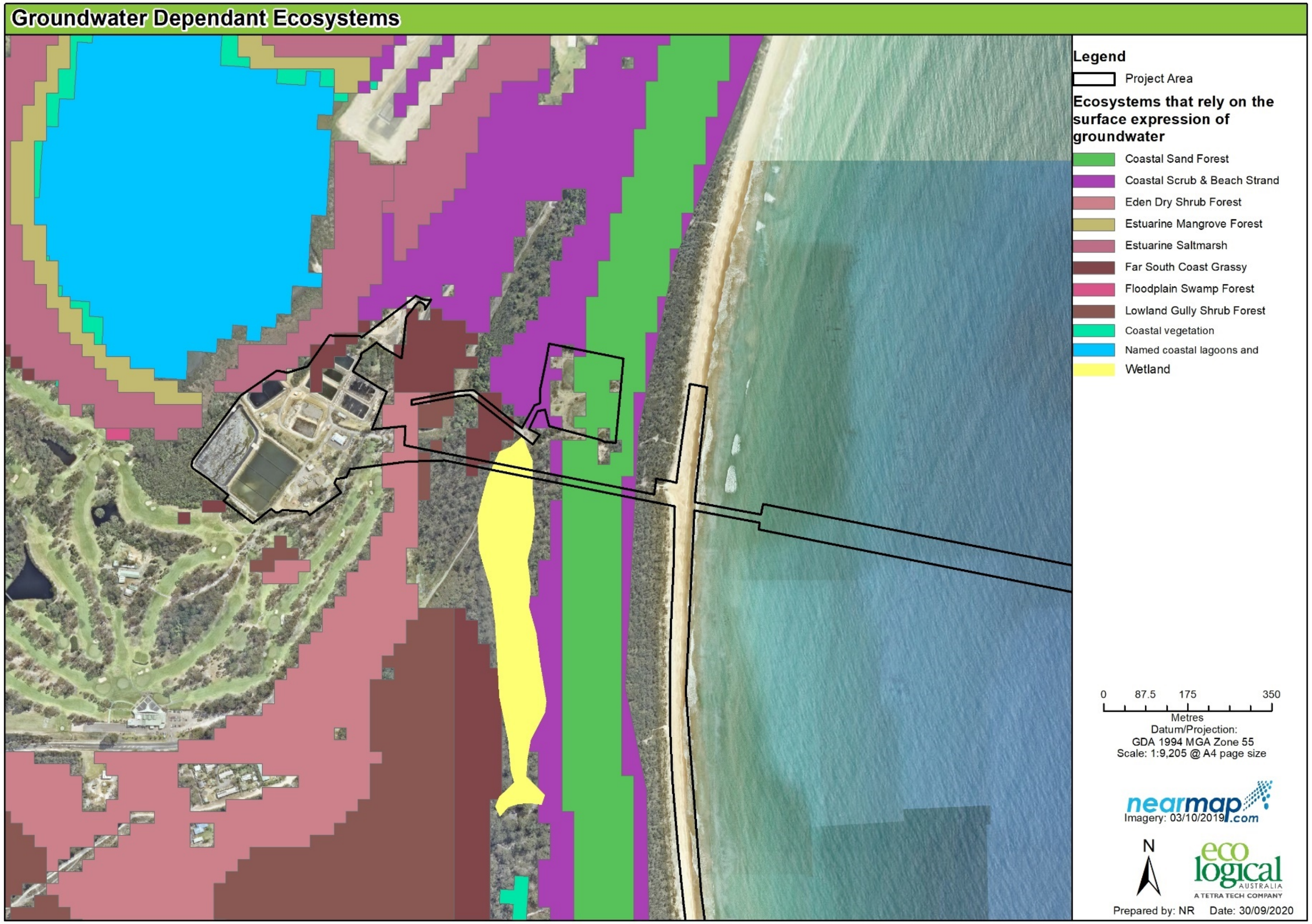

Figure 1. Mapped Groundwater Dependant Ecosystems within and surrounding the Project area (Source: BOM GDE Atlas)

3. Potential impacts

Potential impacts to GDEs include direct impacts, such as the clearing of groundwater dependent vegetation, or indirect impacts occurring as a result of changes to groundwater quality or level.

3.1.1 Construction phase

Directional drilling for the proposed ocean outfall pipeline is the main activity with potential to impact GDEs in the Project area, but the risks of these are minor. The proposed outfall pipeline would extend vertically from the end of STP ponds, then head east towards the coast for approximately 1,200 m before emerging at a point offshore beyond the surf zone to travel along the sea floor.

The pipeline would be installed by underground trenchless directional drilling, with the first 800 m travelling below vegetation communities, and the remaining length being below the beach or sea bed. Drilling clays would be used during the process to seal off the aquifer from the drilled hole and prevent leakage of drilling fluids. Consistency of drilling clays would be monitored at the surface by the drilling contractor during drilling to minimise the chance of aquifer contamination. The maximum depth of drilling would be greater than 18 m below ground level, and the external diameter of the pipeline would be up to 450 mm. Depth of drilling at Arthur Kaine Drive is expected to be 10 m below ground level, depth midway from the STP would be approximately 8 m, and depth beneath the sand dunes would be approximately 10 m to 20 m below ground level. Therefore, drilling is unlikely to intercept roots of groundwater dependent vegetation and any damage would be minimal.

Drilling for the ocean outfall pipeline would also pass beneath the northern end of the wetland occurring east of the STP site. At this location, the pipeline would be approximately 6 m below the bottom of wetland, and 5 m below the average water table. During drilling, integrity of the drill hole would be maintained by the use of drilling fluids, and the pipeline installed immediately so that the cavity is not left unsupported. This would minimise the risk of collapse around the bore cavity, and the subsequent loss of aquifer structure beneath the wetland. Drilling beneath the wetland is expected to pose a negligible threat to the wetland.

During construction, the laydown areas (outside of the STP site) would be within the PMGC grounds and on Merimbula Beach, so most of the existing vegetation can be retained. None of the other areas mapped as groundwater dependent vegetation would be removed.

3.1.2 Operational phase

Once operational, the Merimbula STP would use the same land as previously, except for the exfiltration ponds and the decommissioned beach-face outfall pipe.

Aquifer recharge area would remain the same, so there would be minimal change in groundwater levels, apart from around the exfiltration ponds. Analysis of water level data by IGGC (2013) indicates that pond-related contributions to groundwater fluctuations caused localised increases of 1.5 m to 2.5 m near the ponds, and 0.8 m to 1.0 m beneath the wetland area where it would be crossed by the pipeline. However, recharge from the exfiltration ponds is only short-lived and temporary, so the loss of this water is unlikely to have a significant impact on the wetland.

Once in place, the pipeline would constitute a minor barrier to groundwater flow. The rate of reduction in water moving northward across the pipeline has been predicted at 0.7% (AECOM, 2020). This level of change is well within the range of natural climate variability, so is unlikely to have a significant impact. The 0.7 % loss may cause a reduction in the amount of water reaching the northern extent of the overlying wetland, but this would be compensated for by the water entering the wetland south of the pipeline.

Pathogenic microbiological activity is currently elevated down-gradient of the exfiltration ponds. Discontinued use of the exfiltration ponds would improve groundwater quality around the ponds.

4. Risk assessment

The GDE Risk Matrix (**Figure 2**) determines an overall risk category to a GDE based on its ecological value, and the level of risk posed by an activity (OEH, 2012). The risk matrix identifies the level of management action required, and the timeframe for action.

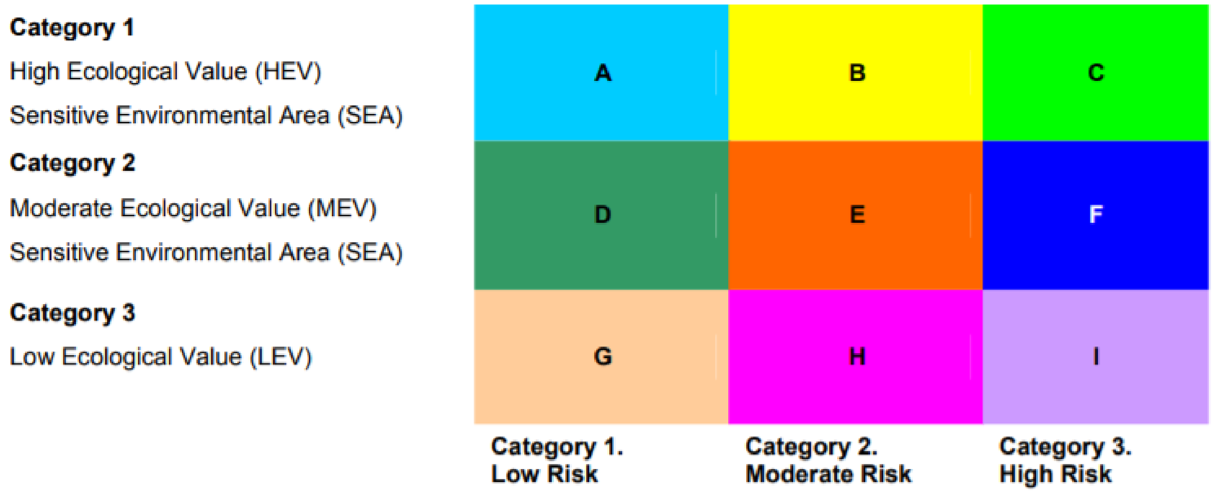

Figure 2. GDE Risk Matrix

4.1 Ecological value categories

OEH (2012) provide a list of criteria for categorising the ecological value of GDEs. The categories include:

- Category 1 (High Ecological Value)
  This includes:
  - communities where slight changes to groundwater attributes result in their loss;
  - GDEs in State or Commonwealth Reserves;
  - undisturbed GDEs or aquifers; and
    natural GDEs that are habitat for endemic, relictual, rare, or endangered species.
- Category 2 (Moderate Ecological Value)
  This includes:
  - communities where moderate changes to groundwater discharge or water table would cause changes in distribution, composition, and/or health;
  - natural GDEs that are habitat for vulnerable or threatened species, populations or communities;
  - any GDE that provides an ecological service to other ecosystems such as rivers, wetlands, or estuaries;
  - GDE communities that exhibit either a threshold or proportional response to changes in groundwater attributes;
  - GDEs or aquifers in moderate to good condition from its natural state but not covered by state or Commonwealth legislation; and
  - ecosystems where groundwater plays a minor role in ecosystem water balance.

- Category 3 (Low ecological value)
  - any aquifer or GDE that is highly modified; and
  - involves a high cost to rehabilitate, and there are other GDE types in moderate to good condition in the same aquifer.

The four groundwater dependent vegetation communities identified for the Project all fall into Category 2 GDEs. The groundwater dependent wetland is also a Category 2 GDE.

4.2 Risk Categories

The other component of the risk assessment process needed for the Risk Matrix is the risk category. These have been classified as

- Category 1 (Low Risk) – where there is minor to no discernible impact to the aquifer or GDE;
- Category 2 (Moderate Risk)- where there is a moderate risk to the aquifer or GDE, or there is a temporary change expected; and
- Category 3 (High Risk)- there will be a significant or major impact to the aquifer or associated GDE.

Impacts to GDEs and the aquifer are expected to be minor for this Project. The main impact would be during the installation of the outfall pipeline. However, this is only likely to have a minor risk associated with it, since it would be enclosed and not contribute to aquifer collapse. Once the pipeline is in place, it would cause only a small amount of mounding upslope of the pipe, but this would only be localised.

There is a risk that the pipeline would become breached as it ages, and that treated wastewater could leak into the aquifer, but the chance of this happening is minor, and the consequences of treated wastewater entering the aquifer would also be minor. If the leak occurred beneath the wetland, groundwater level could rise and there could be an increase to a point where it is expressed at the surface by ponding. Nutrient concentration in the ponded water may exceed natural levels, but as the wastewater is treated and concentration would be further diluted by groundwater or surface water, this is unlikely to cause a major problem. Any excess nutrients entering the wetland would be further absorbed by biological processes.

The extent of vegetation clearing would be minimal, so impacts to groundwater dependent vegetation would be negligible.

There is likely to be an improvement in groundwater quality below the exfiltration ponds once the use of these ponds is discontinued, but this would not have any negative impacts on GDEs.

Drilling for the pipeline would occur close to the groundwater divide between eastern and western draining groundwater, so would have negligible impact on water draining west to Merimbula Lake.

4.3 Risk matrix management actions

For Category 2 (moderate ecological value) GDEs, where there is a low risk of impact, the short- and mid-term management actions are to protect any hotspots and conduct baseline risk monitoring (refer **Figure 3**). As there are no GDE hotspots, and the risk is minor, no monitoring is required.

4.4 Mitigation measures

Proposed impacts to GDEs would be minor to negligible during installation and operation of the outfall pipeline, and no mitigation measures are required provided the outfall pipeline is inspected regularly and maintained.

Risk matrix box	Descriptor	Management action short term	Management action mid term	Management action long term **
A	High value / low risk	Protection measures for aquifer and GDEs.	Continue protection measures for aquifers and GDEs.	Adaptive management. Continue monitoring.
		Baseline risk monitoring.	Periodic monitoring and assessment.	
B	High value / moderate Risk	Protection measures for aquifer and GDEs.	Protection measures for aquifer and GDEs.	Adaptive management. Continue monitoring.
		Baseline risk monitoring. Mitigation action.	Monitoring and periodic assessment of mitigation.	
C	High value / high risk	Protection measures for aquifer and GDEs.	Protection measures for aquifer and GDEs.	Adaptive management. Continue monitoring.
		Baseline risk monitoring. Mitigation.	Monitoring and annual *assessment of mitigation.	
D	Moderate value / low risk	Protection of hotspots.	Protection of hotspots.	Adaptive management. Continue monitoring.
		Baseline risk monitoring.	Baseline Risk monitoring.	
E	Moderate Value/Moderate Risk	Protection of hotspots.	Protection of hotspots.	Adaptive management. Continue monitoring.
		Baseline Risk monitoring.	Monitoring and periodic assessment of mitigation.	
		Mitigation action.		
F	Moderate Value/High Risk	Protection of hotspots.	Protection of hotspots.	Adaptive management. Continue monitoring.
		Baseline Risk monitoring. Mitigation Action.	Monitoring and annual *assessment of mitigation.	
G	Low value/Low risk	Protect hotspots (if any).	Protect hotspots (if any).	Adaptive management. Continue monitoring.
		Baseline Risk monitoring.	Baseline Risk monitoring.	
H	Low Value/Moderate Risk	Protect hotspots (if any).	Protect hotspots (if any).	Adaptive management. Continue monitoring.
		Baseline Risk monitoring. Mitigation action.	Monitoring and periodic assessment of mitigation.	
I	Low Value/High Risk	Protect hotspots (if any).	Protect hotspots (if any).	Adaptive management. Continue monitoring.

* Annual assessment of mitigation or as deemed necessary based on GDE type.

** It is anticipated that that the monitoring actions and management will change in light of observed GDE responses. The triggers for management responses will vary depending on GDE type and WSP. Therefore, this is outside the scope of this document.

Figure 3. Risk matrix management actions

5. Conclusion

There are two vegetation communities with a high potential for groundwater dependence, and two aquatic ecosystems likely to be fed by groundwater in the Project area. These are:

- Coastal Sand Forest;
- Coastal Scrub and Beach Strand;
- Freshwater wetland east of the STP; and
- Merimbula Lake and coastal wetland vegetation.

The proposed outfall pipeline would pass beneath the first three of these, but the pipeline would be beneath the groundwater table and would have negligible impact on groundwater flow, quality, or level. There is unlikely to be any change to groundwater flow into Merimbula Lake.

All GDEs present are classified as Category 2 (Moderate Ecological Value) GDEs, and the risks associated with the STP development are Category 1 (Minor Risks). Therefore, no ongoing monitoring is needed.

6. References

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