99 HALLAM ROAD SOUTH, HALLAM

EASTERN DWARF GALAXIAS THREATENED SPECIES MANAGEMENT PLAN

Asphalt Roads Pty Ltd c/ Breese Pitt Dixon Pty Ltd



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1. INTRODUCTION

1.1. Project description

Breese Pitt Dixon Pty Ltd, on behalf of Asphalt Roads Pty Ltd (the proponent), engaged Brett Lane & Associates Pty Ltd (BL&A) and Aquatica Environmental to produce this Threatened Species Management Plan (TSMP) for the Eastern Dwarf Galaxias (*Galaxiella* pusilla) on, and in the vicinity of, 99 Hallam South Road, Hallam (the development site).

The development site is being prepared for an 18-lot industrial development.

1.2. Previous studies and sources of information

BL&A conducted a flora and fauna assessment of the development site in 2014 that identified that Eastern Dwarf Galaxias had been previously recorded in a drain that abuts the southern boundary of the development site in the Ogrady Road roadside reserve. The BL&A report outlined a number of recommendations for mitigating the potential impacts of the proposed development on Eastern Dwarf Galaxias. These are included in Section 4 of this TSMP.

A number of other key documents and sources of information were interrogated as part of developing this TSMP including, but not limited to, the following:

- Flora and Fauna Impact Assessment 99 Hallam South Road, Hallam: BL&A 2014;
- Surface/Storm Water Management Strategy, 99 Hallam South Road, Hallam: Alluvium 2015 (Appendix 2);
- 99 Hallam South Road, Hallam Groundwater Assessment: CDM Smith 2017 (Appendix 3);
- 99 Hallam South Road, Hallam Infiltration Concept Plan 8982-SK01: Breese Pitt Dixon 2016 (Appendix 4);
- Geotechnical Investigation and Infiltration Testing, 99 Hallam South Road, Hallam: Cardno 2017 (Appendix 5); and
- Advice on Recharge to Groundwater 99 Hallam South Road, Hallam: Cardno 2017 (Appendix 6).

1.3. TSMP objectives

The key objective of this TSMP is to:

 Ensure that development of the site does not impact upon existing Eastern Dwarf Galaxias habitat in a drain immediately south of the southern boundary of the development site.

The means by which this objective will be met are outlined in Section 4 and management prescriptions provided in Section 5.

1.4. About this TSMP

This TSMP was prepared to guide the impact mitigation, protection and management of the listed threatened Eastern Dwarf Galaxias and its habitat in a drain that abuts the southern boundary of the development site.



This TSMP provides a brief overview of the development site; identifies the potential impacts presented by development of the site; and outlines the management plan including mitigation measures and management actions.

Among other content, this TSMP provides details of the following:

- Details of the development site;
- Outline of mitigation measure and management actions; and
- Timeframes for implementing the TSMP mitigation measures and management actions.

Section 2 provides a description and background on Eastern Dwarf Galaxias, their habitat requirements, threats and current status.

Section 3 provides a description of the development site and describes the Eastern Dwarf Galaxias habitat that has the potential to be impacted by the development.

Section 4 outlines a number of mitigation measures to be implemented for development of the site.

Section 5 outlines the required management actions to achieve these mitigation measures and protect existing offsite Eastern Dwarf Galaxias habitat.

This TSMP was prepared by Aaron Jenkin (Principal Ecologist at Aquatica Environmental) and Mal Wright (Senior Ecologist at BL&A).



2. EASTERN DWARF GALAXIAS – SPECIES DESCRIPTION AND STATUS

2.1. Description

The Eastern Dwarf Galaxias (*Galaxiella pusilla*) is a tiny, slender, freshwater fish growing to a maximum length up to 47 millimetres for females and 37 millimetres for males (Coleman *et. al.* 2015). Similar other members of the *Galaxiidae* family, it has all soft-rayed fins, a body lacking scales, and a single dorsal fin positioned well back on the body. Body colour is olive-amber on the dorsal surface and sides, with a silvery-white belly, while the fins are transparent (DoE 2015).

Eastern Dwarf Galaxias are a mid-water species that spend their entire life cycle in freshwater environments. Their diet consists primarily of small aquatic macroinvertebrates.

Spawning occurs in late autumn to spring (May through to October) when females lay from 65 to 250 eggs on the underside of aquatic or submerged vegetation or on hard surfaces (e.g. Saddlier *et. al.* 2010). They are primarily an annual species, with adults dying after the spawning season (Humphries 1983; Coleman *et. al.* 2015).

The Dwarf Galaxias complex (previously *G. pusilla*) has recently been revised into two separate species and now includes Eastern Dwarf Galaxias (remaining as *G. pusilla*), which occurs east of Melbourne, and the newly described Little Galaxias (*G. toourtkoourt*), which occurs west of Melbourne (Coleman *et. al.* 2015). Based on this revision, it is Eastern Dwarf Galaxias that occurs in the region and is the subject of this Plan.



Plate 1: Eastern Dwarf Galaxias (Galaxiella pusilla)

2.2. Habitat

Eastern Dwarf Galaxias occur amongst marginal vegetation in still or gently flowing water of roadside ditches, swamps, and backwaters of creeks (e.g. Allen *et al.* 2002). Habitats are mostly shallow (typically 0.5–1.5 m), with still to low water velocities, partial shading



(usually 10-60%), and dense vegetation cover comprising mostly emergent aquatic species (Coleman *et. al.* 2015). The waters inhabited by this species are often temporary, drying up partially or completely during summer, and are replenished by rainfall or floodwaters from watercourses during the wetter months (Backhouse and Vanner 1978).

The National Recovery Plan for Eastern Dwarf Galaxias (Saddlier *et. al.* 2010) notes that Eastern Dwarf Galaxias have different habitat requirements depending on life stage and season including:

- Transient habitat: ephemeral habitat that retains water for less than one month following inundation and is mostly used by Eastern Dwarf Galaxias for dispersal.
- Spawning habitat: ephemeral habitat with abundant aquatic or submerged vegetation that retain water for 1-3 months following inundation and during the April to October breeding season.
- Short-term refuge habitat: ephemeral water bodies that retain water for more than three months but do not have the attributes to support a permanent population due to drying in lower rainfall years.

Long-term refuge habitat: permanent water bodies that provide permanent refuge for Eastern Dwarf Galaxias populations and where source stock can disperse and repopulate transient, spawning and short-term refuge habitats (i.e. those listed above).

2.3. Distribution

Distribution of Eastern Dwarf Galaxias is disjunct and patchy, due to the nature of its lowland, shallow, swampy habitat (DoE 2015). In consideration of the revised species (see Section 2.1) Eastern Dwarf Galaxias occurs in coastal south-eastern mainland Australia, from the Mitchell River Basin to Dandenong Creek, on Flinders Island in Bass Strait and north-eastern and north-western Tasmania (Coleman *et. al.* 2015). There is also a translocated population in the La Trobe University wildlife reserve, Bundoora, in the Yarra River catchment (Westbury 1995).

The current known range of Eastern Dwarf Galaxias is not believed to overlap with that of Little Galaxias.

2.4. Key threats

Key threats to Eastern Dwarf Galaxias include (DoE 2015 and Saddlier et al. 2010):

- Degradation and loss of habitat caused by wetland drainage, wetland inundation, fouling by livestock, ploughing, concreting of waterways, chemical pollution and European Carp (*Cyprinus carpio*) associated degradation.
- Alteration to flow regime and reduced connectivity caused by dam and levee construction, surface and groundwater abstraction, drawdown associated with forestry/revegetation.
- Wetland drying caused by climate change, reducing suitable habitat and connectivity.
- Increased competition and predation by legally and illegally introduced aquatic species such as the Eastern Gambusia (Gambusia holbrooki), Brown Trout (Salmo trutta), Rainbow Trout (Onycorhynchus mykiss) and Redfin Perch (Perca fluviatilis).
- Pollution of waterways including, herbicides, pesticides, excess nutrients and other urban and industrial pollutants.



 Illegal collection leading to localised depletions, possibly intensifying with increased community awareness.

2.5. Status

2.5.1. Legislative status

Eastern Dwarf Galaxias is listed as 'Vulnerable' under the EPBC Act and DELWP Advisory List of Threatened Vertebrate Fauna (DEPI 2013) and is FFG Act listed. The species is also designated as 'Vulnerable' on the International Union for Conservation of Nature (IUCN) Red List of Threatened Animals (Wager 1996) and on the Australian Society for Fish Biology threatened species list (ASFB 2010).

2.5.2. Regional status

Eastern Dwarf Galaxias were likely once more widespread through the region. However, wetland modification and land uses such as wetland draining, farming and urban development have lead to a decline in much of their key habitat area (DoE 2015). Figure 1 shows the locations where Eastern Dwarf Galaxias have been previously recorded in proximity to the development, including within the Ogrady Road table drains.

Major threats to the Eastern Dwarf Galaxias in the region include:

- Wetland drainage;
- Alteration to the flow regime of waterways (i.e. changes to the natural flooding and drying cycles);
- Degradation and loss of habitat due to land development and lack of regeneration; and
- Introduced feral fish competitors and predators (DoE 2015).



Figure 1: Eastern Dwarf Galaxias records in the vicinity of the development site Note: blue diamonds represent records; red dot represents the site (Source: VBA 2014)



3. SITE DESCRIPTION

3.1. Proposed development

The proposed development site is an approximately 2.75 hectare parcel of land located at 99 Hallam South Road, Hallam. The development site is bound by Hallam South Road to the east, Ogrady Road to the south, and existing industrial developments to the north and west.

Running along the southern boundary of the site, in the northern Ogrady Road reserve is a vegetated drain that has records of Eastern Dwarf Galaxias (Plate 2).

The proposed development of the site will involve the creation of 18 industrial lots ranging in size between 675 m² and 1,510 m². Access to the site will be via an internal road running off Hallam South Road – no access of any kind will be provided from Ogrady Road

The lots proposed for the southern boundary of the development site have been scaled in area order to allow for a 6-metre building setback to the southern property boundary to minimise shading and allow the retention of existing native vegetation – namely Swamp Scrub (EVC 53) – located along the southern boundary of the site and associated with the adjacent drain in the northern Ogrady's Road reserve.

This building setback on the southern boundary will incorporate an infiltration trench that will receive stormwater from the development to ensure sufficient recharge of groundwater on which the drain in the northern Ogrady's Road reserve relies.

The retention of native vegetation and provision of groundwater recharge, as described in Section 4, will contribute towards impact mitigation to prevent significant adverse impacts to the drain in the roadside reserve and thereby protect Eastern Dwarf Galaxias habitat.

A more detailed description of the development site is provided in the flora and fauna assessment (BL&A 2014).





Plate 2 Eastern Dwarf Galaxias habitat in the north Ogrady Road drain

3.2. Existing Eastern Dwarf Galaxias records and habitat

Figure 2 shows the distribution of Eastern Dwarf Galaxias records in the vicinity of the development site. There are numerous historical and recent records of the species in the region, and the species has been documented as occurring in the drain along Ogrady



Road (i.e. abutting the southern perimeter of development site) as recently as 2009 (Bloink 2009).

The condition of Eastern Dwarf Galaxias habitat immediately adjacent to the development site was undertaken as part of the flora and fauna assessment (BL&A 2014). The habitat was assessed against habitat descriptions and photograph records provided in recent investigations of that habitat (Bloink 2009 and McGuckin 2005). Based on these parameters the current condition of the habitat was found to be consistent with these previous observations.

Given the existence of recent records, a targeted survey for the species was not undertaken as part of the flora and fauna assessment of the development site (BL&A 2014) and the species is assumed to be present.



4. POTENTIAL IMPACTS AND MITIGATION MEASURES

The flora and fauna assessment (BL&A 2014) identified the overall environmental impacts of the proposed development of the site – i.e. impacts within the development site and offsite impacts. This previous assessment did not identify potential impacts to Eastern Dwarf Galaxias within the development site. This TSMP is therefore concerned with the potential *offsite* impacts of the development of the site on Eastern Dwarf Galaxias and their aquatic habitat in the vicinity of the site – namely the drain in the northern Ogrady's Road reserve and habitat wetlands to be created by Melbourne Water to the south of Ogrady's Road (Appendix 2).

The key potential impacts presented to existing Eastern Dwarf Galaxias habitat in the vicinity of the development site include:

- Changes to hydrology;
- Direct loss of habitat;
- Indirect loss of habitat through shading;
- Weeds; and
- Introduction of pollutants.

These potential impacts and design measures to be put in place to mitigate these potential impacts are described in the following sections.

4.1. Changes to hydrology

Although the drain abutting the development site to the west retains water for prolonged periods and there are damp/wet areas on the western side of the development site, overall, the site's natural hydrological regime has been highly modified. However, as identified in Sections 3.1 and 3.2 the drain on the southern boundary of the development site provides suitable hydrology for Eastern Dwarf Galaxias and development of the site has the potential to impact on the hydrological regime of this existing Eastern Dwarf Galaxias habitat.

The 2015 Alluvium surface/stormwater management strategy identifies that surface water on the site currently flows in a generally south-westerly direction into the drain, which then flows west to the point of outfall approximately 670 metres downstream (Appendix 2).

However, the 2017 CDM Smith groundwater assessment also identifies that the drain is largely dependent on groundwater inflows, which are in-turn largely dependent on recharge from the development site – in particular, an annual volume of groundwater recharge equivalent to 20mm/yr across the 2.70-hectare site – or 540 m³/yr (Appendix 3).

It will be important that development of the site does not detrimentally change the hydrology to the drain and therefore impact on the potential for the drain and its downstream receiving waterways to support Eastern Dwarf Galaxias.

The following hydrological mitigation measures will be incorporated into the proposed development based on the outcomes of the surface/stormwater and groundwater assessments, as well as geotechnical assessments undertaken to inform engineering solutions:



 Stormwater run-off within the development will be collected via a drainage system to the southeast of the site and treated by way of a sediment/waste trap as described in the Cardno 2017 advice on recharge to groundwater (Appendix 6, p.4);

(*Note:* the temporary sediment basin in the southeast of the site, recommended in the Alluvium 2015 assessment, has been replaced by the permanent sediment/waste trap and infiltration trench design element.)

- Treated stormwater will be diverted to a scoria-filled infiltration trench along the southeast and southern sections of the development as shown in the Breese Pitt Dixon 2016 infiltration concept (Appendix 4);
- The volume of the infiltration trench was determined in the Cardno 2017 advice to be 1,305 m³ with a 456 m³ capacity for water storage, based on a 35% void space (Appendix 6, p.3);
- The median saturated permeability of the soil, as measured by Cardno in 2017 (Appendix 5) was found to be 364 mm/yr (Appendix 6, p.3); and
- Based on the surface area of the walls and base of the infiltration trench of 1,640 m² (Appendix 6, p.3) Cardno determined that the volume of infiltration (and therefore groundwater recharge) from the trench would be approximately 600 m³/yr (597 m³/yr) – in excess of the required 540 m³/yr.

Mitigation summary: Development of the site will result in changes to surface water flows and groundwater recharge. The treatment and collection of stormwater to be diverted to an infiltration trench under developed conditions will ensure there is sufficient groundwater recharge to the Ogrady's Road northern drain and, therefore, no detrimental changes to the hydrology of existing Eastern Dwarf Galaxias habitat.

4.2. Direct loss of habitat

The proposed development of the site will retain the drain along the northern Ogrady Road reserve and the existing treed vegetation on the boundary between the development site and the drain, providing protection to Eastern Dwarf Galaxias habitat in the drain.

Summary: Development of the site will retain fringing vegetation along the drain and will result in no direct loss of existing aquatic habitat.

4.3. Indirect loss of habitat through shading

Shading of aquatic and riparian vegetation has the potential to impact upon vegetation condition, growth and/or cover, thereby potentially resulting in the indirect loss of Eastern Dwarf Galaxias habitat.

A shading assessment has been undertaken by the proponent, who advises that the height and 6-metre setback of warehouse-style buildings will prevent excessive shading of the drain and fringing native vegetation.

Mitigation summary: A 6-metre building setback will prevent excessive shading of the drain and fringing native vegetation.

4.4. Weeds

A number of common weed species are present on and in the vicinity of the development site including Blackberry, Thistle and range of other herbaceous species. The key risk



posed by weeds to Eastern Dwarf Galaxias habitat is encroachment and loss of critical habitat areas resulting in lost habitat capacity (e.g. Alligator weed).

Industry standard construction and waterway protection mitigation measures will be implemented during the construction phase of the project, to be outlined in a Construction Environment Management Plan. These will include measures outlined in Section 5.1.2.

Mitigation summary: Suitable weed monitoring and control measures will be implemented during construction and at least twice annually post construction.

4.5. Pollutants

With construction and the industrialisation of the development site, there is an increased threat that pollutants and litter may enter the drain and neighbouring waterways via surface and stormwater flows.

The development of the site will include a number of measures that will mitigate the threat of increased pollutants and litter including:

- Installation of a sediment/waste trap and infiltration trench to treat any stormwater leaving the site before it enters the drain;
- Litter clean-up will be implemented as part of an ongoing site management program and occur at least twice annually; and
- Provision will be made for the appropriate treatment of industrial waste and vehicle/machinery wash-down during construction and the operation of the industrial estate.

Mitigation summary: A sediment/waste trap and infiltration trench will be incorporated into the design of the development site, and litter clean-up will be implemented to mitigate against pollutants entering Eastern Dwarf Galaxias habitat.







- Property boundary
- Building set-back
- Ogrady Road Drain



Swamp Scrub (EVC 53) to be retained



0 15	30	60 Metres	i		
Figure 2:	Proposed	developm	nent and infiltration to	rench	
Project: 99	Hallam Sou	th Road, Ha	llam		
Client: TPC	Group c/- E	Breece Pitt I	Dixon Pty Ltd		
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5. MANAGEMENT PLAN

The following sections outline the key management actions to be implemented to achieve the mitigation measures outlined in Section 4 for the protection of existing Eastern Dwarf Galaxias habitat in the drain immediately south of the site.

5.1. Management actions

The following management actions will be undertaken during the design, construction and post-construction phases to implement the mitigation measures described in the previous section.

5.1.1. Design phase

Water Sensitive Urban Design (WSUD) principals will be applied to the design of the development and include the design recommendation outlined in Section 4 of this TSMP. The design phase will also include the development of a project-specific Construction Environment Management Plan (CEMP) that also incorporates the mitigation measures outlined in the following two sections.

5.1.2. Construction phase

Industry standard environment and waterway protection mitigation measures will be implemented during the construction phase of the project, to be outlined in the projectspecific CEMP. These measures will include:

Exclusion fencing and No-Go signage: Retained native vegetation and the Ogrady Road north drain will be identified on construction drawings as 'No-Go Zones'. Temporary exclusion fencing will be erected on the boundary of this protected area to protect the drain and retained fringing vegetation (i.e. key Eastern Dwarf Galaxias habitat). The temporary fence shall be a minimum of star pickets with three-strand wire and high visibility mesh attached to the top wire (with minimum gap of 500mm along the bottom) and erected prior to construction commences. The required alignment and extent of the fencing is to be undertaken in consultation by a suitably qualified ecologist and inspected before the start of construction.

Signage is to be attached to fencing clearly identifying the site as a significant ecological area and a 'No-Go' zone, and no entry permitted unless approval given by the site manager/project ecologist.

- **Stormwater management:** The permanent stormwater treatment and infiltration devices (Section 4.1) will be installed and maintained to ensure stormwater quality and quantity is equivalent to pre-development levels.
- Sediment and erosion controls: Control measures will be installed to prevent sediment from construction areas entering the drain.
- Wash-down facilities: An appropriate wash-down facility will be provided during construction to ensure potential pollutants from vehicles and machinery are appropriately managed.
- **Stockpiling**: Stockpiling of soils, fuels, chemicals and equipment will be kept a suitable distance away from the drain and adequately bunded where required to mitigate the risk of spills or leaks impacting Eastern Dwarf Galaxias habitat areas.



 Weed control: The construction area will be continually monitored for weed outbreaks during the construction phase and appropriate weed-management measures implemented if outbreaks occur.

5.1.3. Post-construction phase

Post construction mitigation measures are aimed primarily at ensuring the effective protection of aquatic habitat and fringing vegetation and will include:

- Litter clean-up: Many of the drains and channels in the area collect large volumes of litter, mostly from traffic and wind-blown litter. If this litter collects in the set-back area between the drain and the development it has the potential to enter the waterway and potentially introduce pollutants and toxicants that may harm the resident Eastern Dwarf Galaxias. Litter clean-up will be implemented as part of a site management program and occur at least twice annually.
- Weed control: Follow-up weed monitoring will be implemented as part of a site management program at least twice annually within the set-back area and appropriate weed-management measures implemented if weed outbreaks are observed.
- Wash-down and waste-control facilities: The industrial complex will provide appropriate vehicle wash-down and waste-control facilities to ensure potential pollutants from industrial processes or vehicles are appropriately managed.

5.2. Monitoring, reporting and corrective actions

5.2.1. Water quality monitoring

The proponent commits to monitoring water quality in the drain adjacent to the site and reporting as described below, both pre-construction and for two (2) years post-construction to ensure the key protection objective of the TSMP have been met. These monitoring activities are in addition to regular litter and weed monitoring in the set-back area to be undertaken as part of an ongoing site management program.

The aim of the water quality monitoring is to check that water quality parameters in the drain adjacent to the site are within the tolerances of Eastern Dwarf Galaxias. The water quality parameters to be measured will include temperature, turbidity, pH, dissolved oxygen and electrical conductivity. Monitoring will take place as follows:

- Two (2) pre-construction water quality monitoring events will be implemented one after a period of higher rainfall, and one after a period of lower rainfall; and
- Water quality monitoring events will be implemented biannually for two (2) years postconstruction – a total of four (4) events.

An average of the pre-construction water quality measurements will be used as baseline data for comparison with post-construction monitoring results. Each post-construction monitoring result will be combined with previous and pre-construction water quality measurements to determine a 'rolling average' of water quality measurements.

5.2.2. Reporting

A brief summary report will be published on the proponent's website twice annually postconstruction and will include the outcomes of the water quality monitoring events and any adaptive management recommendations if it is determined that activities associated with the development may have led to a reduction in water quality (see next section).



5.2.3. Corrective actions

It is considered that significant changes in the measure of *turbidity* during water quality monitoring provides the strongest indication that a corrective action is required. The following corrective action trigger and sequence of events following such a trigger will be implemented for two years post-construction:

- If water quality monitoring detects an increase in turbidity levels of greater than 50% when compared to the current 'rolling average', the following will occur:
 - An investigation will be undertaken to determine the likely source of increased sediment levels and turbidity in the drain; then
 - If it is determined that activities associated with the development are likely to have led to the increase in turbidity, adaptive management measures will be implemented in consultation with Melbourne Water. The Commonwealth will be informed of any proposed adaptive management measures and these will be published in the next biannual report on the proponent's website; or
 - If it is determined that the increase in turbidity has been caused by factors beyond the control of the proponent, Melbourne Water will be advised of the outcome of the investigation.



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Appendix 1: Management actions table

The following table identify specific management actions and targets pertaining to the management of Eastern Dwarf Galaxias habit at the development site **Table 1: Management actions**

Phase	Management Action	Management Action Description	Report section	Timing /Frequency	Target to be achieved	Responsible person	Completed (Yes/No)	Month and Year Completed
Pre-construction/ design	Pre-construction water quality monitoring	Assess the quality of surface water in the drain for temperature, turbidity, pH, dissolved oxygen and electrical conductivity	5.2.1	Twice prior to commencing construction – once following high rainfall, once during dry period	Monitoring results to be documented and retained for reporting purposes. Results will also inform management approaches and techniques.	Suitably qualified technician		
	Prepare CEMP	Prepare Construction Environment Management Plan	5.1.1	Condition of approvals	Detail all construction environment management measures to be implemented	Proponent/construction contractor		
	Install No-Go zones	Erect No-Go fencing on the boundary of Swamp Scrub to be retained	5.1.2	Prior to trench and building construction	Eastern Dwarf Galaxias habitat and retained Swamp Scrub protected	Construction contractor – ecologist to supervise		
	Install sediment control measures	Install sediment control measures along No-Go fencing	5.1.2	Prior to trench and building construction	Eastern Dwarf Galaxias habitat and retained Swamp Scrub protected from sediment run-off	Construction contractor – ecologist to supervise		
Construction	Installation of infiltration trench	Create infiltration trench	5.1.2	Prior to building construction	Allow trench construction access from future building footprint and protection of Swamp Scrub to be retained	Construction contractor		
	Monitor CEMP commitments	Monitor: No-Go fencing wash-down facilities stockpile locations and bunding sediment control measures weed outbreaks	5.1.2	Ongoing during construction	All CEMP commitments adhered to	Construction contractor		
Post-construction for	Post-construction water quality monitoring	Assess the quality of surface water in the drain for temperature, turbidity, pH, dissolved oxygen and electrical conductivity	5.2.1	Twice annually for two years post-construction – once following high rainfall, once during dry period	Monitoring results to be documented and retained for reporting purposes. Results will also inform management approaches and techniques.	Suitably qualified technician		
2 years	Weed and litter monitoring	Monitor the setback area between buildings and retained habitat for weed outbreaks and litter	5.1.3	Twice annually for two years post-construction	Weed outbreaks controlled & litter removed in set-back area	Land management contractor		
	Reporting	Summary report outlining the findings of the water quality monitoring	5.2.2 & 5.2.3	Within 2 months following each water quality monitoring event	Report published on proponent's website	Proponent/suitably qualified technician		



Appendix 2: Surface/stormwater management strategy (Alluvium 2015)



Appendix 3: Groundwater Assessment (CDM Smith 2017)



Appendix 4: Infiltration Concept (Breese Pitt Dixon 2016)



Appendix 5: Geotechnical Investigation and Infiltration Testing (Cardno 2017)



Appendix 6: Advice on Recharge to Groundwater (Cardno 2017)

