5 MATTERS PROTECTED UNDER THE EPBC ACT

5.1 Changes to Matters Protected under the EPBC Act

MRWA committed to undertake additional spring surveys following publication of the PER in September 2015 to clarify the extent of critical habitat of the Threatened Grand Spider Orchid (*Caladenia huegelii*). A flora survey for a separate MRWA project recorded the Threatened Muchea Bell (*Darwinia foetida*) within the proposal footprint. This chapter updates the assessment of potential impacts on *Caladenia huegelii* to incorporate the findings of the survey and adds an assessment of potential impacts on *Darwinia foetida*.

5.2 Listed Threatened Flora Species and Communities

5.2.1 *Caladenia huegelii*

One individual of *Caladenia huegelii* was recorded from a location adjacent to Ellenbrook (Coffey, 2015b). The individual is located in remnant vegetation 20 m west of the housing estate and east of the proposal footprint. A noise wall will be constructed adjacent to the southbound carriageway of the proposed highway. The vegetation surrounding the individual has been identified as critical habitat for the species (DEC, 2009).

Critical habitat for the *Caladenia huegelii* was mapped in the flora study area which encompasses the proposal footprint (see PER Chapter 8, Flora and Vegetation, Figure 8.1B). A targeted field survey for potential critical habitat for *Caladenia huegelii* was undertaken on 18 September 2015 (see Section 3.1 and Appendix C). The area of potential critical habitat mapped in the study area west of Ellenbrook (near the recorded individual) by Coffey (2015c), was reduced by 42.8 ha to 141.4 ha. The extent of critical habitat in the study area, including critical habitat in Whiteman Park (not re-surveyed) is 185.1 ha. As a result of the revised mapping, the proposal's direct impact to *Caladenia huegelii* critical habitat has been reduced by 9.2 ha from 39.2 ha to 30.0 ha (see Figure 3.1).

Opportunistic survey for plants did not record any new locations of *Caladenia huegelii*.

5.2.1.1 Potential Impacts and Management Measures

The proposal will not result in any direct impact to known individuals of *Caladenia huegelii*. Indirect impacts potentially include habitat degradation from fragmentation, weeds, illegal rubbish dumping, dieback and potentially reduced visitation by pollinators (i.e., Thynnid wasps).

Direct impacts during construction will be managed by establishing and maintaining a 50 m vegetated buffer around the plant, where possible given the proximity of the plant to Ellenbrook boundary fences. Indirect impacts will be managed through development and implementation of a construction EMP, which will include measures to control the introduction and spread of weeds and dieback, and control access to reduce the potential for illegal rubbish dumping. A FVMMP will be developed and implemented to manage impacts on significant vegetation, including threatened flora, priority flora, TECs and PECs. This will include establishing baseline condition, undertaking monitoring and implementing remedial actions should changes to vegetation health and condition be detected.

The proposal will indirectly impact 1.9 ha of *Caladenia huegelii* critical habitat through the isolation of a potentially unviable fragment of critical habitat between Ellenbrook and the proposal (discussed later in response to consolidated issue 154 in Chapter 7, Response to Office of the Environmental Protection Authority Issues, Section 7.3.2). Other indirect impacts on *Caladenia huegelii* caused by the highway creating a barrier to the movement of wasps from critical habitat on the western side of the highway to the

patch of bushland east of the highway will be reduced by incorporating species used by Thynnid wasps as food sources in revegetation of the road reserve.

The significance of potential direct and indirect impacts on *Caladenia huegelii* has been assessed against the Department of the Environment's (DOTE) significant impact criteria (DOTE, 2013) and is detailed in Table 5.1.

Table 5.1 Significant impact criteria to *Caladenia huegelii*

Species	Significant impact criteria	Proposal relevance	Significant impact?
Caladenia huegelii	Lead to a long-term decrease in the size of a population.	The proposal will not directly impact any known individual.	No
	Reduce the area of occupancy of the species.	The proposal is unlikely to reduce the area of occupancy for *Caladenia huegelii*, as four separate surveys over four seasons have not recorded other individuals.	No
	Fragment an existing population into two or more populations.	The proposal will not fragment a population (one individual) into two.	No
	Adversely affect habitat critical to the survival of a species.	The proposal will remove 30 ha of native vegetation that is potential critical habitat and potentially indirectly impact a further 1.9 ha through habitat fragmentation. The individual will be protected within the vegetation to be retained east of the proposed highway.	Potential
	Disrupt the breeding cycle of a population.	A vegetated buffer will be maintained and managed around the known population to retain habitat for native pollinators.	No
	Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	The proposal is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that *Caladenia huegelii* is likely to decline. Potential critical habitat for *Caladenia huegelii* exists outside the proposal footprint within the study area (185.1 ha) and potentially beyond the study area. The loss of 31.9 ha of potential critical habitat will not cause species decline.	No
	Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat.	The proposal has the potential to introduce invasive weeds which could degrade critical habitat supporting the known population. The construction EMP will manage the introduction and/or spread of invasive weeds. The FVMMP will monitor and manage impacts on threatened flora including *Caladenia huegelii.*	No
	Introduce disease that may cause the species to decline.	The construction EMP for the proposal will include measures to manage the risk of introduction or spread of diseases, specifically *Phytophthora* dieback.	No
	Interfere with the recovery of the species.	The proposal will not interfere with the recovery of *Caladenia huegelii*.	No

5.2.1.2 Residual Impacts

A summary of the management measures and residual impacts on *Caladenia huegelii* is provided in Table 5.2. Based on the significant impact criteria (Table 5.1), the clearing of 30 ha of potential critical habitat and potential loss of a further 1.9 ha of critical habitat through fragmentation may have a significant impact on the *Caladenia huegelii*.

The management measures are consistent with MRWA policies and procedures and are aligned with current industry practice. The effectiveness of the management measures in mitigating the residual impact on the *Caladenia huegelii* will be dependent on the successful implementation of the construction EMP and the FVMMP.

The management measures will reduce indirect impacts of the proposal on *Caladenia huegelii*.

Table 5.2 Summary of residual impacts to *Caladenia huegelii* following implementation of mitigation measures

Species and EPBC Act conservation status	Existing environment	Management measures	Residual impacts
Grand Spider Orchid (*Caladenia huegelii*) Endangered	One individual was recorded 60 m from the proposal footprint. Previous records of this species are known to occur within 100 m of the proposal footprint (Coffey, 2015b). The extent of critical habitat in the flora study area has been revised to 185.1 ha.	• Establish, clearly demarcate and maintain a 50 m vegetated buffer around known locations of *Caladenia huegelii* (see MPM013 in Table 13.1). • Preparation and implementation of an EMP to limit risk of fire, the introduction and/or spread of weeds (i.e. WONS and declared pests) and/or dieback, littering and unauthorised access (see FVM03 in Table 13.1). • Preparation and implementation of a Flora and Vegetation Management and Monitoring Plan to manage impacts on environmentally significant flora and vegetation (see FVM04 in Table 13.1). • Preparation and implementation of a weed and dieback hygiene management plan (see FVM07 in Table 13.1). • Species used by Thynnid wasps as food sources will be incorporated in revegetation of the road reserve adjacent to *Caladenia huegelii* critical habitat in the vicinity of Ellenbrook (see FVM13 in Table 13.1).	Up to 31.9 ha of potential critical habitat will be impacted within the proposal footprint.

5.2.2 *Darwinia foetida*

Darwinia foetida is listed as Critically Endangered under the EPBC Act. *Darwinia foetida* was identified in a desktop assessment as occurring within the flora study area (see PER Chapter 8, Flora and Vegetation, Section 8.2, Existing Environment). Subsequent field surveys undertaken for the proposal did not locate *Darwinia foetida* within the proposal footprint. The assessment of *Darwinia foetida*'s presence in the proposal footprint was given in PER Table 8.1 as 'Likely'.

Phoenix Environmental Sciences carried out a flora and fauna assessment along parts of the GNH road reserve in Muchea and Chittering (Phoenix Environmental, 2015). The assessment was undertaken as part of a separate MRWA project to upgrade GNH between Muchea and Wubin. The assessment included the results of several field surveys during 2014 and 2015, some of which overlapped parts of the GNH road reserve within the development envelope of the proposal.

Two new populations of the Threatened flora Muchea Bell (*Darwinia foetida*) were recorded during the Phoenix Environmental surveys. One new population of seven individuals was located on the western side of GNH road reserve, adjacent to the northern end of the roadside rest area north of the Brand Highway intersection in Muchea (see Figure 3.1D). This population is nominally within the proposal footprint. A second new population of ten individuals was recorded from the GNH road reserve, about 4 km southeast of Muchea and outside the development envelope.

MWH was commissioned to undertake a further targeted search of the *Darwinia foetida* population nominally within the proposal footprint (MWH, 2016) (Appendix H, *Darwinia foetida* further information). MWH located the individuals recorded by Phoenix Environmental and revised the plant count to 16 mature individuals and 1 seedling. The population is located approximately 2 m from the edge of the sealed area of the roadside rest area. The extent of the population was identical to that mapped by Phoenix Environmental.

No critical habitat has been formally defined or described for *Darwinia foetida* (DOTE, 2016). MWH defined approximately 0.12 ha of roadside vegetation surrounding this population as critical habitat based on its area of occupancy, the hydrology of the area, coexisting species and the local habitat of this population. The critical habitat is bounded on the south by the roadside rest area, on the west by a fence, on the east by GNH and on the north by a drain under GNH (see Figure 3.1). The critical habitat is not considered to extend outside this area due to changes in vegetation and soils (MWH, 2016).

5.2.2.1 Potential Impacts and Management Measures

Direct impacts during construction will be avoided by establishing and maintaining a 10 m buffer in existing vegetation around *Darwinia foetida*, within the constraints of the site. Indirect impacts will be managed through development and implementation of a construction EMP, which will include measures to control the introduction and spread of weeds and dieback. A FVMMP will be developed and implemented to manage impacts on significant vegetation, including threatened flora, priority flora, TECs and PECs. This will include establishing baseline condition, undertaking monitoring and implementing remedial actions should changes to vegetation health and condition be detected.

While the proposal will not result in direct impacts to *Darwinia foetida*, the proximity of *Darwinia foetida* to the rest area and Great Northern Highway potentially expose it and its critical habitat to indirect impacts. These indirect impacts potentially include habitat degradation from dust, altered hydrology, weeds and dieback. Due to the proximity of Great Northern Highway, this location is already exposed to many of these threats as well as illegal rubbish dumping and an altered fire regime resulting from introduced grasses and weeds (MWH, 2016).

The significance of potential direct and indirect impacts on *Darwinia foetida* has been assessed by MWH (MWH, 2016) against DOTE's significant impact criteria (DOTE, 2013) and is detailed in Table 5.3.

Table 5.3 Significant impact criteria to *Darwinia foetida*

Species	Significant impact criteria	Proposal relevance	Significant impact?
Darwinia foetida	Lead to a long-term decrease in the size of a population.	The proposal will not directly impact any known individual. The individuals currently persist in a highly altered environment despite weed and hydrological threats.	No
	Reduce the area of occupancy of the species.	Although the area of occupancy of the species is small (about 0.06 ha), the proposal will not further reduce the area of occupancy of the species.	No
	Fragment an existing population into two or more populations.	The proposal will not fragment a population into two.	No
	Adversely affect habitat critical to the survival of a species.	The proposal will not directly impact the 0.12 ha of critical habitat mapped in this location.	No
	Disrupt the breeding cycle of a population.	While the breeding cycle of *Darwinia foetida* is not known, the majority of *Darwinia* species are pollinated by insects and possibly birds. The proposal will not have any impacts that are expected to disrupt the breeding cycle of the species.	No
	Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	The proposal may indirectly modify or decrease the availability of habitat within the drain due to localised altered hydrology. However, given the persistence of the species in low quality habitat with dense weed cover including **Eragrostis curvula* and **Watsonia meriana*, indirect impacts are unlikely to cause the species to decline.	No
	Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat.	The species persists in an area heavily infested with weed species including **Watsonia meriana*, **Eragrostis curvula*, **Avena barbata* and **Briza maxima*. The implementation of weed and dieback hygiene management plan will minimise the introduction of new weed species. The implementation of a Flora and Vegetation Management and Monitoring Plan will include monitoring of the buffer around *Darwinia foetida*. The proposal is not expected to significantly impact *Darwinia foetida* in relation to invasive species.	No
	Introduce disease that may cause the species to decline.	The construction EMP for the proposal will include measures to manage the risk of introduction or spread of diseases, specifically *Phytophthora* dieback.	No
	Interfere with the recovery of the species.	The proposal will not interfere with the recovery of *Darwinia foetida*.	No

Adapted from MWH (2016).

5.2.2.2 Residual Impacts

A summary of the management measures and residual impacts on *Darwinia foetida* is provided in Table 5.4. Based on the significant impact criteria (Table 5.2), the proposal will not directly impact any individuals or populations of *Darwinia foetida*. The proposal will result in the removal of the roadside rest area and upgrades to GNH, both of which may have indirect impacts on *Darwinia foetida* such as habitat degradation from dust, altered hydrology, weeds and dieback.

The management measures are consistent with MRWA policies and procedures and are aligned with current industry practice. The effectiveness of the management measures in mitigating the residual impact on the *Darwinia foetida* will be dependent on the successful implementation of the construction EMP and the FVMMP.

The management measures will reduce indirect impacts of the proposal on *Darwinia foetida*. Given the proposed management and the species' current persistence next to GNH in a highly modified and weedy environment, the proposal is not expected to have a significant impact.

Table 5.4 Summary of residual impacts to *Darwinia foetida* following implementation of mitigation measures

Species and EPBC Act conservation status	Existing environment	Management measures	Residual impacts
Muchea Bell (*Darwinia foetida*) Critically Endangered	Sixteen mature plants and one seedling have been recorded within the nominal proposal footprint. Previous records of this species are known to occur within 200 m of the proposal footprint (Coffey, 2015b). The extent of critical habitat at this location is 0.12 ha.	• Establish, clearly demarcate and maintain a 10 m buffer in existing vegetation around known locations of *Darwinia foetida* (see MPM02 in Table 13.1). • Delineation of the clearing boundary prior to clearing (see FVM02 in Table 13.1). • Preparation and implementation of an EMP to limit risk of fire, the introduction and/or spread of weeds (i.e. WONS and declared pests) and/or dieback, littering and unauthorised access (see FVM03 in Table 13.1). • Preparation and implementation of a Flora and Vegetation Management and Monitoring Plan to manage impacts on environmentally significant flora and vegetation (see FVM04 in Table 13.1). • Preparation and implementation of a weed and dieback hygiene management plan (see FVM07 in Table 13.1). • Educational and induction material will include information on significant flora and ecological communities to reduce the risk of accidental clearing. (see FVM08 in Table 13.1).	No direct impacts. No significant indirect impacts.

6 ENVIRONMENTAL OFFSETS

This chapter documents the proposal's offset strategy to address residual impacts on environmental values relevant to both the State, as assessed by the EPA, and for MNES, as determined by DOTE.

6.1 Definition of Offsets

Under the Commonwealth Environmental Offsets Policy (Government of Australia, 2012) the term 'environmental offsets' refers to measures that compensate for the residual adverse impacts of an action on the environment. Offsets provide environmental benefits to counterbalance the impacts that remain after avoidance and mitigation.

Under the WA Environmental Offsets Policy (Government of Western Australia, 2011) an environmental offset is an off-site action or actions that addresses significant residual environmental impacts of a development or activity.

Both State and Commonwealth policies specify that environmental offsets are not intended to make proposals with unacceptable impacts acceptable and are not a substitute for undertaking all reasonable avoidance and environmental mitigation measures.

Under both the State and Commonwealth offset policies, environmental offsets can be classified as direct or indirect. Definitions for direct and indirect offsets under these policies are discussed in Table 6.1.

Table 6.1 Definition of direct and indirect offsets

Offset category	Definition	
	State	Commonwealth
Direct	Actions designed to provide for on-ground improvement, rehabilitation and conservation of habitat outside the proposal footprint. Direct offsets vary, depending on the specific circumstances of environmental impacts, and include acquisition, restoration, revegetation and rehabilitation of natural areas.	Actions that provide a measurable conservation gain for an impacted protected matter. A conservation gain may be achieved by improving or creating new habitat, reducing threats, or averting the loss of a protected matter or its habitat that is under threat.
Indirect	Actions aimed at improving scientific or community understanding and awareness of environmental values that are affected by a development or activity. These actions are designed to result in positive conservation outcomes and may include research to improve the management and protection of existing conservation estate or contributions to State Government initiatives, policies or strategic funds.	Actions that do not directly offset the impacts on the protected matter, but are anticipated to lead to benefits for the impacted protected matter, for example funding for research or educational programs. Requirements for other compensatory measures.

Sources: Government of Western Australia (2011) and Government of Australia (2012).

6.2 Application of Offsets

Environmental offsets aim to counterbalance the significant residual environmental impacts or risks of a particular activity or project. Both the State and Commonwealth Governments provide advice on the application of offsets and principles for their use. The Western Australian Government endeavours to work cooperatively with the Commonwealth Government to avoid duplication of offsets, however, this is not always possible where a proposal or action is not jointly assessed under a bilateral agreement or a strategic assessment.

The State and Commonwealth Governments have formally agreed to conduct a strategic assessment in accordance with section 146 of the EPBC Act, focussing on the Perth and Peel regions of the SCP. While this proposal lies within the boundary of this strategic assessment, none of the proposed offsets are to be secured through the Strategic Assessment of the Perth and Peel Regions (SAPPR) process.

6.3 Offset Policies

6.3.1 State Offset Policy

The State's Environmental Offset Guidelines (Government of Western Australia, 2014) assist the EPA in the determination and application of environmental offsets on a project by project basis and ensure that decisions made on environmental offsets are consistent and accountable.

In general, significant residual impacts include those that affect rare and endangered plants and animals, areas within the formal conservation reserve system, important environmental systems and species that are protected under international agreement (e.g. Ramsar wetlands) (Government of Western Australia, 2014). A residual impact significance model has been developed to assist proponents in consistently determining the significance of residual impacts and when an offset is likely to, or may, require an offset (Government of Western Australia, 2014).

Following the determination of the level of significance for residual impacts, the type of offset should be determined in line with the EPA principles for the development of an offset package (Government of Western Australia, 2011). These are:

1. Environmental offsets will only be considered after avoidance and mitigation options have been pursued.
2. Environmental offsets are not appropriate for all projects.
3. Environmental offsets will be cost-effective, as well as relevant and proportionate to the significance of the environmental value being impacted.
4. Environmental offsets will be based on sound environmental information and knowledge.
5. Environmental offsets will be applied within a framework of adaptive management.
6. Environmental offsets will be focussed on longer term strategic outcomes.

6.3.2 Commonwealth Offset Policy

The Commonwealth's Offset Assessment Guide (DSEWPAC, 2012a) provides a framework to determine the suitability (i.e. appropriateness and adequacy) of proposed offsets for protected matters, including an impact and offset calculator. The Commonwealth outlines that (Government of Australia, 2012):

- Suitable offsets must deliver an overall conservation outcome that improves or maintains the viability of the protected matter.
- Suitable offsets must be built around direct offsets, but may include other compensatory measures.

- Suitable offsets must be in proportion to the level of statutory protection that applies to the protected matter.
- Suitable offsets must be of a size and scale proportionate to the residual impacts on the protected matter.
- Suitable offsets must effectively account for and manage the risks of the offset not succeeding.
- Suitable offsets must be additional to what is already required, determined by law or planning regulations or agreed to under other schemes and programs.
- Suitable offsets must be efficient, effective, timely, transparent, scientifically robust and reliable.
- Suitable offsets must have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced.

6.4 Rationale

The offset strategy for this proposal has been developed in consideration of field assessments and supporting studies and consultation with the EPA, DOTE, DPAW and the Department of the Premier and Cabinet. The objectives for this offset strategy are:

- A net environmental benefit.
- Offsets are 'like for like' or better, where possible.
- Significant residual impacts are offset.
- Regulatory requirements are met.
- Offsets are consistent with government policy.
- The strategy is enforceable and measurable, and adaptable, if required.

6.5 Summary of Significant Residual Impacts

A summary of significant residual impacts that are likely to require offsetting and the relevant offset proposal, under which they are addressed, is provided in Table 6.2.

Table 6.2 Summary of significant residual impacts requiring offset

Significant environmental value	Residual impact	Extent of significant residual impact[1]	Extent of significant residual impact outside SAPPR boundary	Relevant offset proposal[2]
Habitat for conservation significant fauna[3]	Removal of Carnaby's Black Cockatoo habitat.	207.2 ha foraging habitat[3,4,5,6], including: • 120.5 ha breeding habitat. • 763 potential breeding trees. • 56.5 ha roosting habitat.	5.15 ha of foraging, roosting and breeding habitat and 107 potential breeding trees.	1 and 2
	Removal of Forest Red-tailed Black Cockatoo habitat.	120.5 ha foraging habitat[3,4,5], including: • 120.5 ha breeding habitat. • 763 potential breeding trees. • 56.5 ha roosting habitat.	5.15 ha of foraging, roosting and breeding habitat and 107 potential breeding trees.	1 and 2
Wetlands and waterways	Partial or complete loss of seven CCWs	16.0 ha[4,6]	None.	2
Threatened Flora	Removal of critical habitat for *Caladenia huegelii*.	31.9 ha[4,6]	None.	3
TECs[3]	Removal of SCP20a (*Banksia attenuata* woodlands over species rich dense shrublands).	4.0 ha[3,4]	None.	4
Under-represented vegetation[3]	Removal of 124.9 ha of intact native vegetation within three vegetation complexes below the 30% retention target within the Perth to Peel Region.	• 62.1 ha[3,4] Bassendean Complex – Central and South. • 44.8 ha[3,4] Southern River Complex. • 18.0 ha[3,4] Yanga Complex.	5.5 ha Yanga Complex.	2 and 4
Conservation areas[5]	Excision of 10.1 ha of Class A Nature Reserve.	• 0.7 ha of Carnaby's Black Cockatoo foraging habitat.	None.	1
	Excision of 106 ha of State Forest.	• Under-represented vegetation: 2.1 ha Bassendean Complex – Central and South. • 34.8 ha of Carnaby's Black Cockatoo habitat, including 31.7 ha breeding habitat. • 31.7 ha of Forest Red-tailed Black Cockatoo foraging and breeding habitat.	None.	1 and 2

Significant environmental value	Residual impact	Extent of significant residual impact[1]	Extent of significant residual impact outside SAPPR boundary	Relevant offset proposal[2]
	Partial and complete removal of nine Bush Forever sites	• Under-represented vegetation: – 58.9 ha[7] Bassendean Complex – Central and South. – 18.6 ha Southern River Complex. – 3.4 ha Yanga Complex. • 124.5 ha[6, 7] of Carnaby's Black Cockatoo habitat, including 93.4 ha breeding habitat. • 93.4 ha of Forest Red-tailed Black Cockatoo foraging and breeding habitat. • 3.8 ha of TEC SCP20a.	None.	1, 2 and 4

Notes:
1. Total extent of residual impact, both inside and outside the SAPPR boundary. None of the proposed offsets will be secured through the SAPPR process.
2. For details relating to each of the offset proposals, see Section 6.6.
3. Inclusive of impacts discussed under conservation areas.
4. Impact includes the area to be cleared (i.e. proposal footprint) and any additional areas excised from conservation estate.
5. These figures represent the area to be impacted on both state and Commonwealth lands.
6. Impact includes severed portions that are not anticipated to persist, as discussed in the fragmentation analysis in Table 7.3.
7. Where an impact is within more than one type of conservation area, it has been attributed to the conservation area with the highest value (e.g., where an occurrence of or impact to a PEC is within both State Forest and Bush Forever site it has been attributed to State Forest).

6.6 Offset Proposals

6.6.1 Offset Proposal 1 – Ioppolo Road, Chittering

6.6.1.1 Commitment

MRWA will fund the acquisition of 673.5 ha of land at Lot M2091 (Plan 6457) Ioppolo Road, Chittering to be vested with the Conservation Commission for conservation purposes in perpetuity, and subsequent management by DPAW to offset the loss of Black Cockatoo habitat.

6.6.1.2 Description of Offset

The proposed 673.5 ha offset area occurs within a larger 983 ha block of land located on Lot M2091 (Plan 6457) Ioppolo Road, Chittering (herein referred to as Ioppolo Road). Ioppolo Road is surrounded by private land, with the exception of existing Class A and C Nature Reserves managed by DPAW to the west (Figure 6.1). It is currently zoned 'Agriculture Resource' under the Shire of Chittering Town Planning Scheme No. 6. MRWA has funded the purchase of Ioppolo Road by DPAW for the purpose of offsetting impacts of the wider NorthLink WA Project (including this proposal and the Tonkin Grade Separations project).

A field survey was undertaken to determine the existing environmental values within Ioppolo Road (Coffey, 2015c) (PER Appendix V, Preliminary Black Cockatoo Offset Considerations). The environmental assessment included a Level 1 flora and vegetation survey and a Level 1 fauna survey and Black Cockatoo habitat assessment (Coffey, 2015d). The results of this assessment are provided in Attachment D (Flora,

vegetation and fauna assessment – Lot M2091 Ioppolo Road, Chittering) to PER Appendix V, Preliminary Black Cockatoo Offset Considerations.

A follow-up survey to investigate the presence and extent of SCP20a within Ioppolo Road was completed in Spring 2015, and did not confirm the presence of SCP20a, as discussed in Chapter 3, Spring Ecological Surveys. Further consideration of the potential for *Caladenia huegelii* to occur within the offset site also determined that the site was unlikely to support this species and so no additional surveys for this species (or its habitat) were completed at Ioppolo Road.

Carnaby's Black Cockatoo foraging habitat within the offset area is associated with Eucalypt Woodland and Banksia Woodland and contains 17 species of foraging resources, including the following dominant species: *Eucalyptus marginata*, *E. todtiana*, *Corymbia calophylla*, *Allocasuarina humilis*, *Banksia menziesii* and *B. attenuata*. The Forest Red-tailed Black Cockatoo habitat within the offset area is associated with Eucalypt Woodland that contains *Eucalyptus marginata* and *Corymbia calophylla,* both of which are the main constituents of this species' diet (Figure 6.1).

Eucalypt Woodland habitat (specifically the stands of tall *Eucalyptus marginata*, *E. todtiana* and *Corymbia calophylla) w*ithin the offset area also represents Black Cockatoo breeding and roosting habitat. An estimated 6,300 potential breeding trees are present within the Eucalypt Woodland habitat, based on an average tree density of 20 trees per hectare. This habitat is considered to have current breeding potential given that tree age is sufficient to produce large hollows, the offset area is within the current modelled breeding and non-breeding range of Carnaby's Black Cockatoo (DSEWPAC, 2012) and is within 16 km of a number of significant roost sites at Gingin town site (Finn et al., 2014).

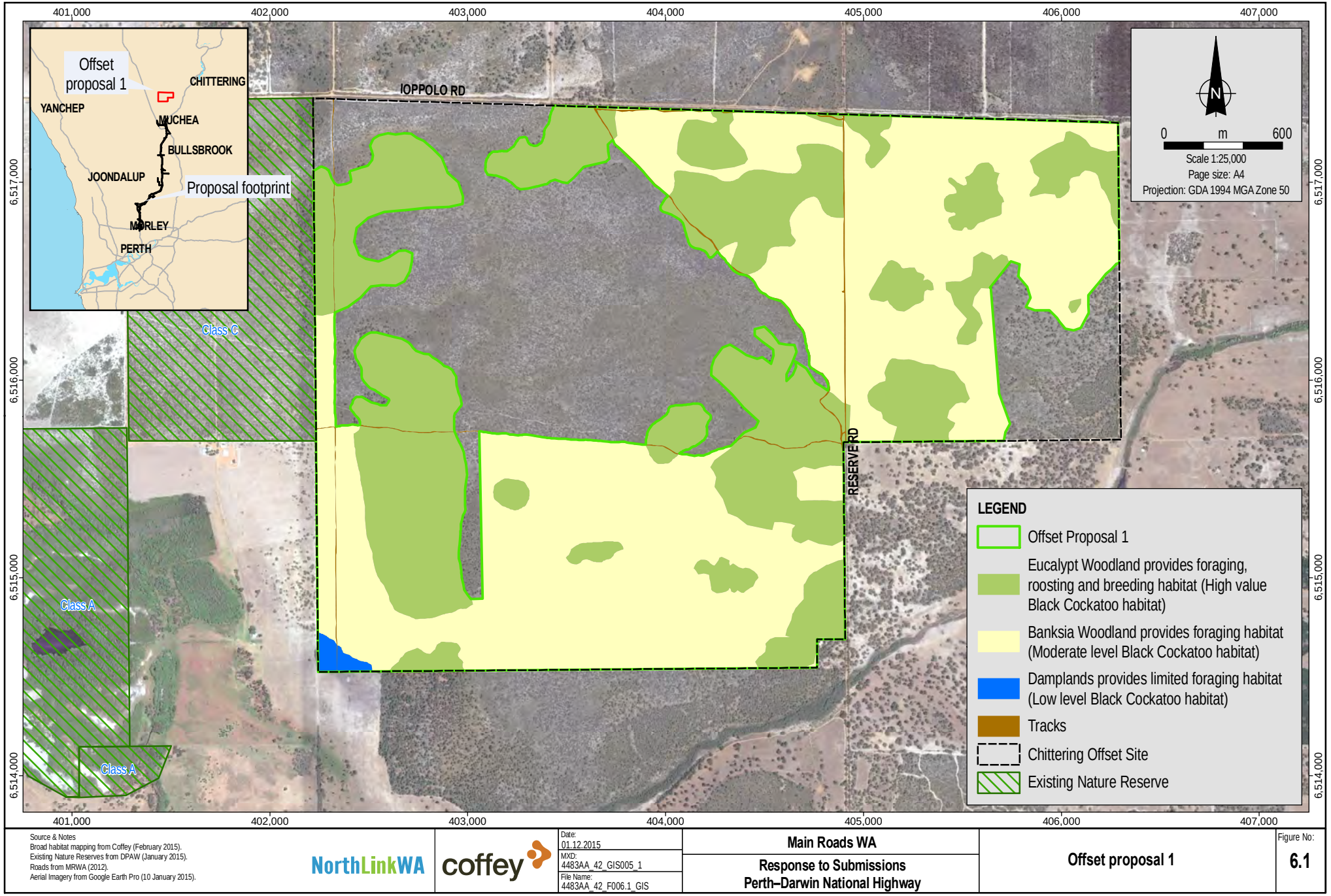
While this offset area is outside the modelled distribution for the Forest Red-tailed Black Cockatoo (DSEWPAC, 2012), DPAW has recently confirmed that there have been regular sightings of Forest Red-tailed Black Cockatoos in the surrounding area including as far north as Bindoon (Errington, pers. comm.). DPAW is currently arranging for these records to be incorporated into their database, which will extend the known range of this species to include this offset area.

6.6.1.3 Purpose of Offset

The primary purpose of Offset Proposal 1 is to offset the majority of the proposal's significant residual impact on Black Cockatoo habitat, including the loss of Black Cockatoo habitat from within conservation areas and within both State and Commonwealth land (see Table 6.2).

This offset proposal provides the following values for Black Cockatoos:

- Formal protection of 673.5 ha of foraging habitat for Carnaby's Black Cockatoo, including 279 ha of potential breeding habitat and approximately 5,580 trees. This is equivalent to 97.51% of this species offset requirement based on the Commonwealth offset assessment guide (see Appendix J, EPBC Act Offset Assessment Guide - Carnaby's Black Cockatoo).
- Formal protection of 279 ha of foraging and potential breeding habitat for Forest Red-tailed Black Cockatoo including approximately 5,580 trees. This is equivalent to 82.23% of this species offset requirement based on the Commonwealth offset assessment guide (see Appendix K, EPBC Act Offset Assessment Guide – Forest Red-tailed Black Cockatoo).



Source & Notes
Broad habitat mapping from Coffey (February 2015).
Existing Nature Reserves from DPAW (January 2015).
Roads from MRWA (2012).
Aerial Imagery from Google Earth Pro (10 January 2015).

NorthLinkWA

coffey

Date: 01.12.2015
MXD: 4483AA_42_GIS005_1
File Name: 4483AA_42_F006.1_GIS

Main Roads WA

Response to Submissions
Perth–Darwin National Highway

Offset proposal 1

Figure No: **6.1**

Offset Proposal 1 also provides the following additional values and net conservation benefits:

- Vesting with the Conservation Commission for long-term management as a conservation reserve.
- Vegetation in better condition (Excellent) than the majority of the vegetation to be cleared (although within different vegetation complexes) including increasing the pre-European extent remaining within formal protection of each of the following vegetation complexes, Coonambidgee (0.2%), Karamal (south) (0.8%), Mogumber (south) (3%), Moondah (0.6 ha) and Reagan (2.9%) vegetation complexes.
- One inferred TEC (SCP20b), one known TEC (SCP20c), and two inferred PECs (Banksia yellow-orange sands and SCP23b).
- One Threatened (*Chamelaucium* sp. Gingin (N.G. Marchant 6)) and one Priority flora species (*Hypolaena robusta* (P4)) were recorded, another four Priority listed plant taxa (Caustis sp. gigas (A.S. George 9318) (P2), *Schoenus griffinianus* (P3), *Verticordia rutilastra* (P3) and *Verticordia serrata* var. *linearis* (P3)) are known to occur. *Hypolaena robusta* (P4) is known from the proposal footprint.
- Known to support the Western Brush Wallaby (*Macropus irma*) (P4).
- Provides an ecological linkage to adjacent Class A and Class C conservation reserves and forms part of the catchment protecting Chandala wetlands, a significant conservation area.
- Management of Ioppolo Road as part of the conservation estate will include management of threatening processes such as dieback.

MRWA will continue to liaise with DPAW to reach agreement on the scope, duration and funding for ongoing management of this offset in line with DPAW's Corporate Guideline No. 14 Environmental Offsets – Proponent Land Management Contributions (DPAW, 2015). Details of the activities and funding arrangements for ongoing management will be documented in a Land Acquisition and Management Plan and may include such activities as rubbish removal, prevention of third party access, weed and dieback management. It is anticipated that MRWA will fund the ongoing management of this offset area for a period of up to 10 years, which is above the reasonable term of 5 to 7 years for implementing the works as recommended within the DPAW's Corporate Guideline No. 14 Environmental Offsets – Proponent Land Management Contributions (DPAW, 2015).

6.6.2 Offset Proposal 2 – Restoration Offset Plan

6.6.2.1 Commitment

MRWA will prepare a restoration offset plan that will include the acquisition and covenanting of several properties to be managed for conservation, including restoration and management funding for a period of 7 years (or until restoration completion criteria are met), to offset the loss of CCWs, Forest Red-tailed Black Cockatoo habitat and under-represented vegetation.

6.6.2.2 Purpose of Offset

The primary purpose of Offset Proposal 2 is to offset the loss of:

- 16 ha of CCWs in Completely Degraded to Excellent condition.
- 5.2 ha of Carnaby's Black Cockatoo habitat (remainder of proposal impact not addressed by Offset Proposal 1) in Completely Degraded to Pristine condition.
- 21 ha of Forest Red-tailed Black Cockatoo habitat (remainder of proposal impact not addressed by Offset Proposal 1) in Completely Degraded to Pristine condition.

- 124.9 ha of under-represented vegetation in Degraded to Excellent condition, including the loss of under-represented vegetation from within conservation areas (see Table 6.2).

This offset proposal will aim to:

- Protect and/or restore values to a commensurate or greater value/standard than those impacted.
- Locate offset sites as close to the proposal as possible, unless it can be demonstrated that an offset site achieves commensurate or greater value (e.g. wetland offsets which may not be in close proximity to the proposal but are located within the same consanguineous suite as impacted wetlands).

MRWA has identified three potential properties (31.5 ha) located close to the proposal footprint containing wetlands, Black Cockatoo habitat and under-represented vegetation (Yanga Complex) values. Based on a preliminary assessment of these sites, in consideration of the proposed restoration and using the EPBC Act offset assessment guide, the following ratios/areas will be required under this restoration offset plan to offset the loss of Black Cockatoo habitat:

- Carnaby's Black Cockatoo habitat: Ratio of 2.1:1 resulting in an offset requirement of 10.9 ha.
- Forest Red-tailed Black Cockatoo habitat: Ratio of 1.9:1 resulting in an offset requirement of 39.9 ha.

MRWA commits to a 3:1 offset ratio for CCWs, as has recently been recommended by the EPA for other assessments. Applied to this proposal an offset requirement of 48 ha of CCWs will be required under this restoration offset plan.

A 1:1 offset ratio, resulting in an offset requirement of 124.9 ha, is proposed for under-represented vegetation complexes in the Perth-Peel Region impacted by the proposal, on the basis that:

- Only minor area of the proposal's impact (2.1 ha or 1.4%) on vegetation complexes occurs within State Forest.
- While 80.9 ha (57.4%) of the proposal's impact on vegetation complexes occurs within Bush Forever sites, these vegetation complexes will still retain over 10% representation within the total area of Bush Forever sites.
- The remaining 41.9 ha impact on under-represented vegetation occurs outside conservation estate and Bush Forever.

Additional property/properties will need to be identified and included in the restoration offset plan to address the full offset requirement identified above. Specific details of the properties involved in the restoration offset plan will be made available following their acquisition.

This offset proposal will include the provision of funding for:

- Acquisition and vesting or covenanting of the properties with a suitable vesting authority.
- Restoration and ongoing management for a minimum of 7 years (or until restoration completion criteria are met).

The restoration offset plan will document the restoration and management (including monitoring) required over this period and will be provided to the OEPA and DPAW for comment ahead of implementation.

MRWA is considering opportunities to involve community groups in the delivery and management of this offset proposal. MRWA will ensure that the selected vesting authority/authorities are suitably qualified and experienced to implement the restoration offset plan.

6.6.3 Offset Proposal 3 – Critical Habitat for *Caladenia huegelii*

6.6.3.1 Commitment

MRWA is proposing to provide funding for a period of up to 10 years for the ongoing management of potential critical *Caladenia huegelii* habitat within existing reserves 46919 and 46875, Bush Forever Site 300 and Whiteman Park.

6.6.3.2 Purpose of Offset

The purpose of Offset Proposal 3 is to offset the loss of 31.9 ha of potential critical habitat for *Caladenia huegelii*.

The WA Environmental offsets policy states that:

> *Offsets will take account of, and contribute towards, broader State Government conservation objectives through existing programs, policies, initiatives and strategic funds. This includes the establishment and ongoing management of national parks, reserves and other conservation estate.*

The policy recognises that there are some environmental values that are not readily replaceable.

Due to the difficulty of replacing 'like-for-like' *Caladenia huegelii* habitat, MRWA proposes funding the development and implementation of an offset management plan for potential *Caladenia huegelli* critical habitat within reserves 46919 and 46875, Bush Forever Site 300 and Whiteman Park.

MRWA has currently proposed funding for a period of up to 10 years, which is above the reasonable term of 5 to 7 years for implementing management works as recommended within the DPAW's Corporate Guideline No. 14 Environmental Offsets – Proponent Land Management Contributions (DPAW, 2015). The scope, duration and funding of this plan will be determined in consultation with DPAW (and other landowners/managers) and in accordance with the Grand Spider Orchid (*Caladenia huegelii*) recovery plan (DEC, 2009).

The management plan will also ensure that, any proposed funding of DPAW management actions within reserves 46919 and 46875 are additional to the work already undertaken by the DPAW and not part of their normal responsibilities (in accordance with the WA Environmental Offsets Policy (Government of Western Australia, 2011).

The management plan may include the following:

- Weed and dieback mapping and control.
- Management of controlled access (e.g., installation of cable fencing).
- Additional surveys to identify and/or confirm critical habitat and the locations and distribution of populations/individuals.
- Monitoring of populations and habitat quality.

6.6.4 Offset Proposal 4 – SCP20a

6.6.4.1 Commitment

MRWA is proposing to fund the acquisition or covenanting of a property or properties to be managed for conservation, including management funding for a period of 7 years to offset the loss of SCP20a.

6.6.4.2 Purpose of Offset

The purpose of Offset Proposal 4 is to offset the loss of 4 ha of excellent quality SCP20a through protection of 23 ha of similar or better quality habitat. The acquisition of 23 ha of SCP20a of the same or better quality

than the area impacted will provide a ratio of 6:1, determined using the EPBC Act offset assessment guide (Appendix K). Where an offset site is identified that provides a restoration opportunity (lower quality start value) this ratio/area would be reduced. This offset proposal will include the provision of funding for:

- Acquisition and vesting or covenanting of the properties with a suitable vesting authority.
- Restoration and ongoing management for a minimum of 7 years (or until restoration completion criteria are met).

MRWA is considering opportunities to involve community groups in the delivery and management of this offset proposal. MRWA will ensure that the selected vesting authority/authorities are suitably qualified and experienced to implement the restoration offset plan.

6.6.5 Offset Summary

To effectively offset the significant residual impacts of the proposal MRWA will provide:

- Offset Proposal 1: Acquisition of 673.5 ha of land at Lot M2091 (Plan 6457) Ioppolo Road, Chittering to be vested with the Conservation Commission for conservation purposes in perpetuity, and subsequent management by DPAW to offset the loss of Black Cockatoo habitat.
- Offset Proposal 2: Preparation of a restoration offset plan that will include the acquisition and covenanting of several properties to be managed for conservation, including restoration and management funding for a period of 7 years (or until restoration completion criteria are met), to offset the loss of CCWs, Black Cockatoo habitat and under-represented vegetation.
- Offset Proposal 3: Funding for a period of up to 10 years for the ongoing management of potential critical *Caladenia huegelii* habitat within existing reserves 46919 and 46875, Bush Forever site 300 and Whiteman Park.
- Offset Proposal 4: Acquisition or covenanting of a property or properties to be managed for conservation, including management funding for a period of 7 years to offset the loss of SCP20a.

A summary of all four offset proposals using the WA offsets template is provided in Table 6.3.

This page is intentionally blank.

Table 6.3 Quantification of offset proposals

Existing environment and impact	Mitigation			Significant residual impact	Offset calculation methodology				
	Avoid and minimise	Rehabilitation type	Likely rehab. success		Type	Risk	Likely offset success	Time lag	Offset quantification
Carnaby's Black Cockatoo habitat Removal of foraging, breeding and roosting habitat.	The proposal predominantly (approximately 78.6%) follows existing infrastructure, cleared areas or secondary habitats, which reduces impacts to existing fauna habitats. Through design efficiencies the proposal footprint has been reduced from 1,028.4 ha to about 746 ha in size and reduced impacts to fauna habitats by a total of 49.6 ha across the alignment (PER, Terrestrial Fauna, Table 9.5). To avoid an area containing a high concentration of Black Cockatoo breeding trees, the width of the proposal footprint was reduced between Baal Street and Gnangara Road (see Figure 4.3), reducing the number of breeding trees cleared from 410 to 342.	Onsite rehabilitation opportunities will be limited to temporary construction areas. Furthermore the use of Banksia and other Black Cockatoo foraging resources will be limited as part of revegetation activities within 10 m of the road, as this increases the risk of bird strike. As MRWA will work to minimise its footprint, temporary areas of disturbance greater than 10 m from the road are anticipated to be limited.	N/A	**Extent:** Significant residual impact remains as 207.2 ha foraging habitat, inclusive of 120.0 ha breeding habitat (and 763 potential breeding trees) and 56.0 ha roosting habitat as potential area of suitable rehabilitation unknown at this stage. **Quality:** In accordance with the How to Use the Commonwealth Offset Assessment Guide (DSEWPAC, 2012a) the assessment of a threatened species' habitat must consider the site's condition, the site's context and the species' stocking rate. A Quality Score of 6 has been applied to this species habitat within the proposal footprint (see PER Appendix V, Preliminary Black Cockatoo Offset Considerations). **Conservation significance:** Endangered species. **Land tenure:** The following habitat features are located in conservation areas: • Nature Reserve: 0.7 ha of foraging habitat. • State Forest: 34.8 ha of foraging habitat inclusive of 31.7 ha of breeding habitat. • Bush Forever Site: 124.5 ha of foraging habitat inclusive of 93.4 ha of breeding habitat. **Timescale:** Permanent.	Offset Proposal 1 (Acquisition, protection and management, no restoration.)	Low – land to be acquired and transferred to conservation estate.	This is not applicable for land acquisition – see risk comments.	No time lag. The proposed offset site has already been acquired and has been ceded to the Conservation Commission for ongoing management by DPAW for the purpose of conservation.	In accordance with the EPBC Act Offset Assessment Guide (see Appendix J, EPBC Act Offset Assessment Guide – Carnaby's Black Cockatoo): 673.5 ha of foraging habitat, inclusive of 279 ha of Eucalyptus Woodland (which contains approximately 5,580 breeding/roosting trees) will offset this impact by 97.51%.
					Offset Proposal 2 (Acquisition, protection, restoration and management)	Low – land is expected to be vested with a suitable vesting authority with the intention that the land will be managed for conservation in perpetuity.	**Can the values be defined and measured:** Yes **Operator experience/ evidence:** MRWA will ensure that the selected vesting authority is suitably qualified and experienced to implement this offset proposal. **What is the type of vegetation being revegetated:** The restoration offset plan will endeavour to restore wetland and Carnaby's Black Cockatoo habitat, using local provenance species suited to the surrounding landscape characteristics.	Time until ecological benefit – 7 to 10 years for species to become productive.	In consideration of this proposal and the EPBC Act Offset Assessment Guide a ratio of 2.1:1, equivalent to an area of 10.9 ha of foraging and breeding habitat will be required.

Existing environment and impact	Mitigation			Significant residual impact	Offset calculation methodology				
	Avoid and minimise	Rehabilitation type	Likely rehab. success		Type	Risk	Likely offset success	Time lag	Offset quantification
Forest Red-tailed Black Cockatoo habitat Removal of 120.5 ha of foraging and breeding habitat (and 763 potential breeding trees), inclusive of 56.5 ha roosting habitat.	The proposal predominantly (approximately 78.6%) follows existing infrastructure, cleared areas or secondary habitats, which reduces impacts to existing fauna habitats. Through design efficiencies the proposal footprint has been reduced from 1,028.4 ha to about 746 ha in size and reduced impacts to fauna habitats by a total of 49.6 ha across the alignment (PER, Terrestrial Fauna, Table 9.5). To avoid an area containing a high concentration of Black Cockatoo breeding trees, the width of the proposal footprint was reduced between Baal Street and Gnangara Road (see Figure 4.3), reducing the number of breeding trees cleared from 410 to 342.	Onsite rehabilitation opportunities will be limited to temporary construction areas. Furthermore the use of Black Cockatoo foraging resources will be limited as part of revegetation activities within 10 m of the road, as this increases the risk of bird strike. As MRWA will work to minimise its footprint, temporary areas of disturbance greater than 10 m from the road are anticipated to be limited.	N/A	**Extent:** Significant residual impact remains as 120.1 ha foraging habitat, inclusive of 120.1 ha breeding habitat (and 763 potential breeding trees) and 58.6 ha roosting habitat as potential area of suitable rehabilitation unknown at this stage. **Quality:** In accordance with the How to Use the Commonwealth Offset Assessment Guide (DSEWPAC, 2012a), the assessment of a threatened species' habitat must consider the site's condition, the site's context and the species' stocking rate. A Quality Score of 6 has been applied to this species habitat within the proposal footprint (see Appendix V). **Conservation significance:** Vulnerable species. **Land tenure:** The following habitat features are located in conservation areas: • Nature Reserve: 0.7 ha of foraging habitat. • State Forest: 31.7 ha of foraging and breeding habitat. • Bush Forever Site: 93.4 ha of foraging and breeding habitat. **Timescale:** Permanent.	Offset Proposal 1 (Acquisition, protection and management, no restoration.)	Low – land to be acquired and transferred to conservation estate.	This is not applicable for land acquisition – see risk comments.	No time lag. The proposed offset site has already been acquired and has been ceded to the Conservation Commission for ongoing management by DPAW for the purpose of conservation.	In accordance with the EPBC Act Offset Assessment Guide (see Appendix K, EPBC Act Offset Assessment Guide – Forest Red-tailed Black Cockatoo): 279 ha of foraging and breeding habitat (which contains approximately 5,580 breeding/roosting trees) will offset this impact by 82.23%.
					Offset Proposal 2 (Acquisition, protection, restoration and management.)	Low – land is expected to be vested with a suitable vesting authority with the intention that the land will be managed for conservation in perpetuity.	**Can the values be defined and measured:** Yes **Operator experience/ evidence:** MRWA will ensure that the selected vesting authority is suitably qualified and experienced to implement this offset proposal. **What is the type of vegetation being revegetated:** The restoration offset plan will endeavour to restore wetland and Forest Red-tailed Black Cockatoo habitat, using local provenance species suited to the surrounding landscape characteristics.	Time until ecological benefit – 7 to 10 years for species to become productive.	In consideration of this proposal and the EPBC Act Offset Assessment Guide a ratio of 1.9:1, equivalent to an area of 39.9 ha of foraging and breeding habitat will be required.

Existing environment and impact	Mitigation			Significant residual impact	Offset calculation methodology				
	Avoid and minimise	Rehabilitation type	Likely rehab. success		Type	Risk	Likely offset success	Time lag	Offset quantification
CCWs Partial or complete loss of CCWs.	The proposal has been designed to avoid and minimise impacts to wetlands and other hydrological values as much as possible (including CCW 8800, CCW 8798, CCW 8926, Mound Springs SCP TEC at Gaston Road, Claypans of the SCP TEC) as depicted in PER, Chapter 10, Hydrological Processes and Inland Waters Environmental Quality, Figure 10.2.	No rehabilitation possible: Onsite rehabilitation opportunities will be limited to temporary construction areas. MRWA will work to minimise its footprint, and will locate any temporary construction areas (i.e. laydown areas) outside CCWs and their buffers.	N/A	**Extent:** Partial or complete loss of seven CCWs totalling 16 ha. **Quality:** Varying condition, Completely Degraded to Excellent. **Conservation significance:** Conservation Category wetland. **Land tenure:** N/A. **Timescale:** Permanent.	Offset proposal 2 (Acquisition, protection, restoration and management.)	Low – land is expected to be vested with a suitable vesting authority with the intention that the land will be managed for conservation in perpetuity.	**Can the values be defined and measured:** Yes **Operator experience/ evidence:** MRWA will ensure that the selected vesting authority is suitably qualified and experienced to implement this offset proposal. **What is the type of vegetation being revegetated:** The restoration offset plan will endeavour to restore wetland and Black Cockatoo habitat, using local provenance species suited to the surrounding landscape characteristics.	Time until ecological benefit – 7 to 10 years.	MRWA commits to a 3:1 offset ratio for CCWs, as has recently been recommended by the EPA for other assessments. Applied to this proposal an offset requirement of 48 ha of CCWs will be required under this restoration offset plan.
Under-represented vegetation Removal of 124.9 ha of under-represented vegetation in the Perth-Peel Region.	The alignment and width of the development envelope was reviewed to identify a proposal footprint that minimises clearing in areas with very good to pristine condition vegetation. Nearly 80% of the proposal footprint occurs within vegetation mapped as degraded or worse condition. Design measures including use of wire rope barriers along the full extent of the highway and installation of road safety barriers between the northbound and southbound lane have assisted in reducing road width.	No rehabilitation possible: Onsite rehabilitation opportunities will be limited to temporary construction areas. MRWA will work to minimise its footprint, and will locate any temporary construction areas (i.e. laydown areas) within existing disturbed areas or areas planned for future development under this proposal.	N/A	**Extent:** Removal of 124.9 ha of under-represented vegetation in the Perth-Peel Region, including: • 62.1 ha Bassendean Complex – Central and South. • 44.8 ha Southern River Complex. • 18.0 ha Yanga Complex. **Quality:** Varying condition, Degraded to Excellent. **Conservation significance:** Vegetation complexes below the 30% retention target within the Perth to Peel Region **Land tenure:** The following area of under-represented vegetation impacted is located in conservation areas: • State Forest: 2.1 ha. • Bush Forever Site: 80.9 ha. **Timescale:** Permanent.	Offset proposal 2 (Acquisition, protection, restoration and management.)	Low – land is expected to be vested with a suitable vesting authority with the intention that the land will be managed for conservation in perpetuity.	Moderate to high – based on restoration success.	Time until ecological benefit – 7 to 10 years.	In consideration of this proposal and that impacted vegetation complexes will still retain over 10% representation within Bush Forever sites a ratio of 1:1 is proposed, which is equivalent to 124.9 ha.

Existing environment and impact	Mitigation			Significant residual impact	Offset calculation methodology				
	Avoid and minimise	Rehabilitation type	Likely rehab. success		Type	Risk	Likely offset success	Time lag	Offset quantification
Threatened Flora Removal of critical habitat for *Caladenia huegelii*	The proposal was designed to avoid the single known individual of *Caladenia huegelii* within the development envelope. Design measures including use of wire rope barriers along the full extent of the highway and installation of road safety barriers between the northbound and southbound lane have assisted in reducing road width and impacts to habitat.	No rehabilitation possible: Onsite rehabilitation opportunities will be limited to temporary construction areas. MRWA will work to minimise its footprint, and will locate any temporary construction areas (i.e. laydown areas) within existing disturbed areas or areas planned for future development under this proposal.	N/A	**Extent:** 31.9 ha **Quality:** Varying condition, Completely Degraded to Pristine. **Conservation significance:** Threatened. **Land tenure:** The following areas of critical habitat impacted is located in conservation areas: • Nature Reserve: 0.4 ha. • Bush Forever Site: 13.7 ha. **Timescale:** Permanent	Offset Proposal 3 (On-ground management and research)	Low – land proposed to be managed and researched is already in conservation estate and/or Bush Forever.	**Can the values be defined and measured:** Yes **Operator experience/ evidence:** MRWA will ensure that the selected vesting authority is suitably qualified and experienced to implement this offset proposal. **What is the type of vegetation being revegetated:** N/A	Time until ecological benefit – 5 years.	Due to the difficulty of replacing like-for-like *Caladenia huegelii* habitat, MRWA proposes funding the management and research of potential critical habitat in existing conservation areas (reserves 46919 and 46875, Bush Forever site 300 and Whiteman Park) in accordance with the Grand Spider Orchid (*Caladenia huegelii*) recovery plan (DEC, 2009) for a period of up to 10 years
TECs Removal of inferred SCP20a	A location of inferred SCP20a along Reid Highway, east of the Reid Highway/Tonkin Highway interchange, has been avoided. Through design efficiencies the proposal footprint has been refined to reduce the impact to inferred SCP20a from 4.3 ha to 4.0 ha.	No rehabilitation possible: Onsite rehabilitation opportunities will be limited to temporary construction areas. MRWA will work to minimise its footprint, and will locate any temporary construction areas (i.e. laydown areas) outside of any known locations of this TEC and its buffer.	N/A	**Extent:** 4.0 ha of inferred SCP20a (*Banksia attenuata* woodlands over species rich dense shrublands). **Quality:** Mostly in Excellent condition. **Conservation significance:** State listed TEC. **Land tenure:** 3.8 ha of the impact to SCP20a occurs within Bush Forever. **Timescale:** Permanent.	Offset Proposal 4 (Acquisition, protection, and management, including restoration where possible)	Low – land is expected to be vested with a suitable vesting authority with the intention that the land will be managed for conservation in perpetuity.	The likely success of the offset will be assessed when a property or properties are identified.	Time until ecological benefit – 7 to 10 years.	In consideration of this proposal and the EPBC Act Offset Assessment Guide a ratio of 6:1 (equivalent to an area of 23 ha of TEC20a) would be required where the offset area had, or would be managed to retain values commensurate with the area impacted. Where an offset site is located that provides a restoration opportunity this ratio would be reduced.

7 RESPONSE TO OFFICE OF THE ENVIRONMENTAL PROTECTION AUTHORITY ISSUES

7.1 Route Selection Development

Consolidated issue 156 (contributing issue 257): Bush Forever site 480 at Victoria Road will be significantly impacted. How has the proponent tried to avoid and mitigate this significant impact through consideration of other interchange designs?

Bush Forever site 480 is impacted by the Reid/Tonkin interchange. A freeway to freeway, free-flowing interchange is required at this site to maintain traffic flow and separation. This complex interchange requires considerable land to achieve relevant road design criteria including sight distances, curve radii and merging distances. Assessments of interchanges with smaller footprints have been carried out but these proved to be unsafe and inefficient. The intersection is constrained by adjacent residential, commercial and industrial development, recreation facilities and Lightning Swamp. The configuration of the interchange results in an unavoidable impact on Bush Forever site 480 and associated CCW 15033.

The impact on Bush Forever site 480 is consistent with State Planning Policy 2.8 Bushland Policy for the Perth Metropolitan Region Scheme (SPP 2.8). The Reid Highway/Tonkin Highway interchange has been in the MRS as a primary regional road since before 1994. SPP 2.8 states that for public infrastructure proposals that impact Bush Forever sites, proposals should seek to protect regionally significant bushland as a priority, except where the proposal is consistent with the overall purpose and intent of an existing road reserve (regional or local). This proposal is consistent with the overall purpose and intent of the existing MRS Primary Regional Road reservation. MRWA has sought to reduce the impact through design, but is unable to compromise on road safety and design standards. During detailed design further efforts will be made to reduce the impact on this Bush Forever site.

7.2 Regulatory Context

Consolidated issue 190 (contributing issue 296): Please show how EPA policies relevant to the proposal have been considered.

Table 7.1 sets out EPA policies/guidelines relevant to the proposal, the relevance of each policy/guideline to the proposal and how the proposal has met the requirements of each policy/guideline.

Table 7.1 Adherence of proposal to EPA policies

Policy or guideline	Purpose of policy/guideline	Consideration given to policy/guideline
Flora and vegetation		
Guidance Statement No. 51 – Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in WA (June 2004)	Guidance Statement No. 51 sets out the minimum standards for flora and vegetation surveys for assessment of impacts on environmental factors. It implements two position statements: No. 3 Terrestrial Biological Surveys as an Element of Biodiversity Protection, and No. 2 Environmental Protection of Native Vegetation in Western Australia. The guidance statement encourages best practice in flora and vegetation survey and reporting. It advocates engagement and involvement with universities and the wider scientific community to develop skills, experience and a better understanding of Western Australian biodiversity. It seeks to ensure consistency with the principles, targets and objectives of other state and federal legislation and guidelines. Guidance and information on expected standards and protocols for terrestrial flora and vegetation surveys is provided to achieve the following environmental objectives: • Clarity on the scale of flora and vegetation survey required to understand and assess potential impacts. • Suitable quality and consistent methodology of surveys, analysis, interpretation and reporting. • Significant flora and vegetation is identified and protected.	Field surveys for the PER were conducted in accordance with Guidance Statement No. 51. Suitably qualified botanists were used to undertake the surveys and subject experts including the Western Australia Herbarium and taxonomic specialists consulted to confirm identification of floral species and Threatened Ecological Communities. The surveys were carried out at the optimum time for species identification (spring) and used the results of previous surveys to provide a comprehensive understanding of flora and vegetation in and adjacent to the proposal footprint; i.e., at the local scale. Peer review and follow-up surveys were used to resolve uncertainties in identification, extent and condition of flora and vegetation. The analysis, interpretation and reporting of potential impacts on flora and vegetation is consistent with current best practice being informed by recent decisions on similar or related projects and departmental advice. The quality of baseline information has enabled a comprehensive management and monitoring program to be developed to monitor edge effects and protect Threatened flora and Threatened Ecological Communities. PER Chapter 8, Flora and Vegetation presents the findings of the flora and vegetation surveys undertaken for the PER. The results of the surveys, analysis and interpretation are

Policy or guideline	Purpose of policy/guideline	Consideration given to policy/guideline
	• Surveys are capable of underpinning long-term observation and measurement for compliance and audit purposes. • Knowledge base developed over time to assist decision-making, particularly at the local scale.	presented in PER Appendix C, Level 2 Spring Flora and Vegetation Assessment and Response to Submissions Chapter 3, Spring Ecological Surveys and Appendices C, D, E, F and G.
Technical Guide – Flora and Vegetation Surveys for Environmental Impact Assessment (December 2015)	The technical guide applies to flora and vegetation surveys carried out to inform environmental impact assessment under Part IV of the Environmental Protection Act 1986. It aims to ensure adequate data of an appropriate standard for environmental impact assessment in the local and regional context. It provides advice on: • Survey preparation and licencing requirements; • Desktop study requirements; • Survey design and sampling techniques; • Data analysis and reporting. The guide acknowledges the diversity of Western Australia flora and vegetation, noting that deviation from the methods described in the document might be required in some instances.	This document has been updated since the surveys for the PER were conducted. It was released on 17 December 2015. Field surveys for the PER were conducted in accordance with the previous version of the technical guide. Qualified botanists were used to undertake the surveys and subject matter experts including the Western Australia Herbarium and taxonomic specialists were consulted to confirm identification of floral species and Threatened Ecological Communities. PER Chapter 8 Flora and Vegetation presents the findings of the flora and vegetation surveys undertaken for the PER. The results of the surveys, analysis and interpretation are presented in PER Appendix C, Level 2 Spring Flora and Vegetation Assessment and Response to Submissions Chapter 3 Spring Ecological Surveys and Appendices C, D, E, F and G.
Position Statement No. 2 – Environmental Protection of Native Vegetation in WA (December 2000)	Position Statement No. 2 outlines EPA's expectations that land clearing in agricultural areas will be reduced to relatively small areas and that mechanisms for protecting Western Australia's biodiversity will be considered. It seeks to stop and reverse the decline in remnant native vegetation, particularly from broad scale clearance.	The road alignment and design has been refined throughout planning of the proposal to avoid and minimise clearing of remnant native vegetation. Over 50% of the road alignment is located in cleared farmland or predominantly cleared farmland with sparse *Corymbia* and *Eucalyptus* species (PER Chapter 8, Flora and Vegetation, Tables 8.3 and 8.7). Existing infrastructure corridors or land adjacent to existing corridors

Policy or guideline	Purpose of policy/guideline	Consideration given to policy/guideline
	It adopts the principles and objectives of the National Strategy for the Conservation of Australia's Biological Diversity for removal of remnant native vegetation in agricultural and other land. The position statement seeks to preserve biodiversity in-situ and to protect remnant native vegetation through comprehensive, representative and adequate systems of ecologically viable protected areas. The Western Australian Government has sought to implement this objective through the Bush Forever program along with other initiatives.	has been utilised where possible, reducing the extent of remnant native vegetation impacted. Bush Forever site 13 has been avoided and impacts on other Bush Forever sites minimised. Impacts to Class A Nature Reserves have been minimised to the greatest extent possible, noting that road design constraints, particularly horizontal geometry (minimum radius curves, sight distances, carriageway separation) preclude avoidance. PER Chapter 2, Proposal Background and Justification and PER Chapter 3, Route Selection and Development describe how impacts on remnant native vegetation were considered in route selection and design of the road alignment. PER Chapter 8, Flora and Vegetation presents the findings of the flora and vegetation surveys undertaken for the PER, including measures to minimise impacts to remnant native vegetation.
Position Statement No. 3 – Terrestrial Biological Surveys as an Element of Biodiversity Protection (March 2002)	Position Statement No. 3 outlines EPA's expectations that impacts on biodiversity will be avoided and where not avoidable, the impacts will not result in unacceptable loss. To achieve this, EPA expects the significance of biodiversity to be integral to flora and vegetation surveys for environmental impact assessment. This position statement encourages best practice in terrestrial biological surveys and requires that surveys meet its standards, guidelines and protocols. It defines the principles the EPA uses to assess proposals that may impact on biodiversity values. It advocates adoption of the precautionary principle where protection of biodiversity values cannot be assured.	Terrestrial flora and vegetation surveys for the PER were conducted in accordance with Position Statement No. 3, specifically Guidance Statement 51, the technical guides for flora and vegetation surveys and associated standards and protocols. Required licences for taking flora for scientific purposes were obtained. PER Chapter 8, Flora and Vegetation presents the findings of the flora and vegetation surveys undertaken for the PER, including measures to minimise impacts to remnant native vegetation. The results of the surveys, analysis and interpretation are presented in PER Appendix C, Level 2 Spring Flora and Vegetation Assessment and Response to Submissions Chapter 3, Spring Ecological Surveys and Appendices C, D, E, F and G.

Policy or guideline	Purpose of policy/guideline	Consideration given to policy/guideline
Environmental Protection Bulletin No. 20 – Protection of naturally vegetated areas through planning and development (December 2013)	Environmental Protection Bulletin No. 20 sets out EPA's expectations for the design of urban, new residential and rural residential developments to protect naturally vegetated areas. It complements other guidance statements, clearing principles and Bush Forever. The bulletin aims to maintain biodiversity through adequate representation of flora, vegetation and fauna (habitat) at the species, population and assemblage/community level. Its focus is on regionally significant natural areas. The bulletin nominates the following as defining regionally significant natural areas: • Adequate representation of the range of ecological communities. • Areas with a high diversity of landforms, flora and/or fauna species or communities. • Areas containing rare or threatened species or communities. • Maintaining ecological processes or natural systems. • Areas of scientific or evolutionary importance. • Areas of wetland, streamline and estuarine fringing vegetation and coastal vegetation. The bulletin seeks to protect the above significant natural areas through design. The design guidelines for planning and development are: 1. Locate development on cleared land. 2. Consider the impact of fire protection requirements	The proposal addresses the design guidelines in Environmental Protection Bulletin No. 20 as follows: • Over 50% of the road alignment is located in cleared farmland or predominantly cleared farmland with sparse *Corymbia* and *Eucalyptus* species (PER Chapter 8, Flora and Vegetation, Tables 8.3 and 8.7). • The proposed highway has avoided naturally vegetated areas to the greatest extent possible noting that road design constraints, particularly horizontal geometry (minimum radius curves, sight distances, carriageway separation) preclude avoidance in all instances. The road has been located adjacent to Ellenbrook reducing the fire protection requirements adjacent to this residential subdivision. • PER Chapter 2 Proposal Background and Justification and PER Chapter 3 Route Selection and Development describe how route selection and road (alignment) design minimised impacts on large consolidated naturally vegetated areas including Whiteman Park/Cullacabardee Bushland and Maralla Road Bushland. • Regional ecological linkages have been identified and described in PER Section 9.2.8 and shown in Figures 9.4A and 9.4B. Connectivity will be maintained through the installation of fauna underpasses to facilitate fauna movement in the Whiteman Park/Cullacabardee Bushland and Maralla Road Bushland. • Temporary workspaces, excess land and road reserves will be rehabilitation and revegetated with local provenance species in areas of remnant native vegetation, principally

Policy or guideline	Purpose of policy/guideline	Consideration given to policy/guideline
	on biodiversity. 3. Protect large consolidated naturally vegetated areas 4. Ecological linkages should be planned in the regional context and connect large naturally occurred vegetated areas. 5. Ensure clear and ongoing management responsibilities in retained naturally vegetated areas. 6. Infrastructure should not be located within consolidated retained naturally vegetated areas.	the section of highway between Hepburn Avenue and Maralla Road. The construction EMP will include measures for weed and plant pathogen (*Phytopthora cinnamomi*) disease control. Edge effects will be monitored (refer Flora and Vegetation Management and Monitoring Plan). • Avoidance of retained naturally vegetated areas is not possible because of road design constraints, particularly horizontal geometry including minimum radius curves, sight distances and carriageway separation. Fragmentation of large tracts has been minimised. Response to Submissions Section 7.2.2 and Table 2 present an analysis of fragmentation of naturally vegetated areas. The analysis concludes that most fragments will persist with only the smaller, narrower fragments being less viable.
Terrestrial fauna		
Guidance Statement No. 56 – Terrestrial Fauna Surveys for Environmental Impact Assessment in WA (June 2004)	Guidance Statement No. 56 provides direction and information on general standards and protocols for terrestrial fauna surveys including the minimum requirements. It implements Position Statement No 3. Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA, 2002). The guidance statement encourages sufficient rigour in survey work to enable discrete surveys to contribute to a more systematic inventory of Western Australia's terrestrial and aquatic fauna. Guidance and information on expected standards and	Terrestrial fauna surveys for the PER were conducted in accordance with Guidance Statement No. 56. Suitably experienced zoologists were used to undertake the surveys and advice sought from subject matter experts to address uncertainty in understanding the behavioural characteristics and habitat requirements of threatened fauna. The analysis, interpretation and reporting of potential impacts on fauna is consistent with best practice being informed by recent decisions on similar or related projects and DPAW advice. PER Chapter 9. Terrestrial Fauna presents the findings of the fauna surveys undertaken for the PER. The results of the

Policy or guideline	Purpose of policy/guideline	Consideration given to policy/guideline
	protocols for terrestrial fauna and faunal assemblage is provided to achieve the following environmental outcomes: • The scale of fauna and faunal assemblage survey is appropriate for different areas. • Suitable quality and consistent methodology of surveys, analysis, interpretation and reporting. • Significant fauna and faunal assemblages is identified and protected through application of best practice. • Surveys are capable of underpinning long-term observation and measurement for compliance and audit purposes. • Knowledge base developed over time to assist decision-making at the local and regional scales.	survey are presented in PER Appendix G, Level 2 Targeted Fauna Assessment.
Position Statement No. 3 – Terrestrial Biological Surveys as an Element of Biodiversity Protection (March 2002)	Position Statement No. 3 outlines EPA's expectations that impacts on biodiversity will be avoided and where not avoidable, the impacts will not result in unacceptable loss. To achieve this, EPA expects the significance of biodiversity to be integral to flora and vegetation surveys for environmental impact assessment. This position statement encourages best practice in terrestrial biological surveys and requires that surveys meet its standards, guidelines and protocols. It defines the principles the EPA uses to assess proposals that may impact on biodiversity values. It advocates adoption of the precautionary principle where protection of	Terrestrial fauna surveys for the PER were conducted in accordance with Position Statement No. 3, specifically Guidance Statement No. 56 – Terrestrial Fauna Surveys for Environmental Impact Assessment in WA. Required licences for trapping animals for scientific purposes were obtained. PER Chapter 9, Terrestrial Fauna presents the findings of the fauna surveys undertaken for the PER. The results of the survey are presented in PER Appendix G, Level 2 Targeted Fauna Assessment.

Policy or guideline	Purpose of policy/guideline	Consideration given to policy/guideline
	biodiversity values cannot be assured.	
Technical Guide on Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (September 2010)	The technical guide sets outs guidance to ensure adequate data of a high standard is obtained for environmental impact assessment (EIA). It sets out EPA's expectations for Level 1 and Level 2 terrestrial vertebrate surveys and the associated protocols and standards. It provides advice on fauna sampling techniques and methods for different regions of the state and includes the requirements for analysis, interpretation and reporting for EIA	Terrestrial fauna surveys for the PER were conducted in accordance with this Technical Guide. Suitably qualified and experienced zoologists were used to undertake the surveys. The minimum requirement was exceeded with eight consecutive trapping nights (minimum requirement is seven consecutive nights). A DPAW Regulation 17 Licence (SF010008) and a DPAW Regulation 4 Authority Licence (CE004607) were obtained. The analysis, interpretation and reporting of potential impacts on fauna is consistent with best practice being informed by recent decisions on similar or related projects and DPAW advice. PER Chapter 9, Terrestrial Fauna presents the findings of the fauna surveys undertaken for the PER. The results of the survey are presented in PER Appendix G, Level 2 Targeted Fauna Assessment.
Environmental Protection Bulletin No. 20 – Protection of naturally vegetated areas through planning and development (December 2013)	Environmental Protection Bulletin No. 20 sets out EPA's expectations for the design of urban, new residential and rural residential developments to protect naturally vegetated areas. It complements other guidance statements, clearing principles and Bush Forever. The bulletin aims to maintain biodiversity through adequate representation of flora, vegetation and fauna (habitat) at the species, population and assemblage/community level. Its focus is on regionally significant natural areas. The bulletin nominates the following as defining regionally significant natural areas:	The proposal addresses the design guidelines in Environmental Protection Bulletin No. 20 as follows: 1. Over 50% of the road alignment is located in cleared farmland or predominantly cleared farmland with sparse *Corymbia* and *Eucalyptus* species (PER Chapter 8, Flora and Vegetation, Tables 8.3 and 8.7). 2. The proposed highway has avoided naturally vegetated areas to the greatest extent possible noting that road design constraints, particularly horizontal geometry (minimum radius curves, sight distances, carriageway separation) preclude avoidance in all instances. The road

Policy or guideline	Purpose of policy/guideline	Consideration given to policy/guideline
	• Adequate representation of the range of ecological communities. • Areas with a high diversity of landforms, flora and/or fauna species or communities. • Areas containing rare or threatened species or communities. • Maintaining ecological processes or natural systems. • Areas of scientific or evolutionary importance. • Areas of wetland, streamline and estuarine fringing vegetation and coastal vegetation. The bulletin seeks to protect the above significant natural areas through design. The design guidelines for planning and development are: 1. Locate development on cleared land. 2. Consider the impact of fire protection requirements on biodiversity. 3. Protect large consolidated naturally vegetated areas 4. Ecological linkages should be planned in the regional context and connect large naturally occurred vegetated areas. 5. Ensure clear and ongoing management responsibilities in retained naturally vegetated areas. 6. Infrastructure should not be located within consolidated retained naturally vegetated areas.	has been located adjacent to Ellenbrook reducing the fire protection requirements adjacent to this residential subdivision. 3. PER Chapter 2 Proposal Background and Justification and PER Chapter 3 Route Selection and Development describe how route selection and road (alignment) design minimised impacts on large consolidated naturally vegetated areas including Whiteman Park/Cullacabardee Bushland and Maralla Road Bushland. 4. Regional ecological linkages have been identified and described in PER Section 9.2.8 and shown in Figures 9.4A and 9.4B. Connectivity will be maintained through the installation of fauna underpasses to facilitate fauna movement in the Whiteman Park/Cullacabardee Bushland and Maralla Road Bushland. 5. Temporary workspaces, excess land and road reserves will be rehabilitation and revegetated with local provenance species in areas of remnant native vegetation, principally the section of highway between Hepburn Avenue and Maralla Road. The construction EMP will include measures for weed and plant pathogen (*Phytopthora cinnamomi*) disease control. Edge effects will be monitored (refer Flora and Vegetation Management and Monitoring Plan). 6. Avoidance of retained naturally vegetated areas is not possible because of road design constraints, particularly horizontal geometry including minimum radius curves, sight distances and carriageway separation. Fragmentation of large tracts has been minimised. Response to Submissions Section 7.2.2 and Table 2

Policy or guideline	Purpose of policy/guideline	Consideration given to policy/guideline
		present an analysis of fragmentation of naturally vegetated areas. The analysis concludes that most fragments will persist with only the smaller, narrower fragments being less viable.
Hydrological Process and Inland Waters Environmental Quality		
Position Statement No. 4 – Environmental Protection of Wetlands (November 2004)	Position Statement No. 4 sets out EPA's expectations for the protection of wetlands during development of project proposals. It requires consideration of prudent and feasible alternatives to direct and indirect impacts on remaining wetlands. The statement lists the environmental values and functions that are important and establishes principles for environmental protection. It seeks to: • Protect wetland values and functions. • Protect and restore the biological diversity of wetland habitats. • Protect the quality of wetland ecosystems through various principles including ecologically sustainable development. • Achieve the aspirational goal of no net loss of wetland values and functions.	The road alignment and design has been refined throughout planning of the proposal to avoid direct and indirect impacts on wetlands (PER Chapter 2, Proposal Background and Justification and PER Chapter 3, Route Selection and Development describe how the road design took into account the environmental values). The road alignment avoids a number of CCW and REW and minimises impacts on other wetlands as far as practicable (PER Chapter 10 Hydrological Processes and Inland Waters Environmental Quality, Section 10.4.6). Wetland ecosystems and function are highly dependent on the maintenance of hydrology. The road has been designed to maintain existing hydrology and water quality. Retention and infiltration basins will assist in maintaining water quality in wetlands and surface water features supporting wetlands PER Chapter 10 Hydrological processes and inland waters environmental quality and PER Appendix H, Drainage Strategy describe the existing hydrology and how it will be maintained. Rehabilitation and restoration of wetland riparian vegetation will be undertaken where wetlands are partially disturbed. Revegetation. Offset proposals for unavoidable losses include formal protection and enhancement of CCW and REW which might be exposed to future development proposals. PER Chapter 10 Hydrological Processes and Inland Waters

Policy or guideline	Purpose of policy/guideline	Consideration given to policy/guideline
		Environmental Quality presents the findings of the wetland assessment undertaken for the PER. The assessment and results are presented in PER Appendix I, Wetland Assessment, which considers wetland stratigraphy, hydrology and vegetation.
Environmental Protection (Western Swamp Tortoise Habitat) Policy 2011	The purpose of the Environmental Protection (Western Swamp Tortoise Habitat) Policy 2011 is to protect habitat suitable for long term survival of wild populations of the Western Swamp Tortoise. The policy applies to the area defined in Schedule 1 and shown in the map attached as Schedule 2. The policy seeks to protect the Western Swamp Tortoise and its habitat by ensuring discharges do not exceed water quality limits, water quality and quantity is maintained, interconnections between terrestrial and aquatic ecosystems and processes are understood and land is appropriately managed to protect the tortoise and its habitat. Where uncertainty exists, it recommends the precautionary principle is applied.	The proposal has avoided any direct or indirect impact on the Environmental Protection (Western Swamp Tortoise Habitat) Policy 2011 policy area. The proposal is located 500 m west of the Western Swamp Tortoise policy area which encompasses the catchment of Twin Swamps Nature Reserve (2.6 km east of the proposed highway), critical habitat for the tortoise. Ellen Brook Nature Reserve which also contains critical habitat is located in the southern part of the policy area 4.8 km east-southeast of the proposed road alignment. Ellenbrook and The Vines residential subdivisions are located between Ellen Brook Nature Reserve and the proposed highway. PER Chapter 10, Hydrological Processes and Inland Waters Environmental Quality, Section 10.4 presents the assessment of impacts on Ellen Brook and Twin Swamps Nature Reserve. It notes that potential impacts on surface water flow and quality in the swamps are unlikely given the separation distance and arrangement of drainage line which bypass Twin Swamps Nature Reserve. Groundwater contaminated by road pavement runoff or spills is unlikely to impact these wetlands due to distance and groundwater flow rate which is predicted to be over 60 years for Twin Swamps Nature Reserve. Two position papers were prepared for the PER (PER Appendix J, Twins Swamps Hydrology and PER Appendix N, Ellen Brook Nature Reserve). The papers present the findings of the assessment of potential impacts on these wetlands.

Policy or guideline	Purpose of policy/guideline	Consideration given to policy/guideline
		The assessment of potential impacts on Western Swamp Tortoise is presented in PER Chapter 9, Terrestrial Fauna. Impacts on its habitat are described in PER Chapter 10 Hydrological Processes and Inland Waters Environmental Quality.
Guidance Statement No. 7 – Protection of the Western Swamp Tortoise Habitat, Upper Swan/Bullsbrook (June 2006)	Guidance Statement No. 7 has been prepared to protect the habitat of the critically endangered Western Swamp Tortoise through managing activities and land use in catchments containing habitat. Specifically, the statement applies to habitat in the policy area which is defined in Schedule 1 and shown in Schedule 2 of the Environmental Protection (Western Swamp Tortoise Habitat) Policy 2002. The key habitats protected by the policy area are Twin Swamps Nature Reserve and Ellen Brook Nature Reserve. The guidance statement focuses on development in the policy area outside these reserves. Key threats to the Western Swamp Tortoise and its habitat are: • Impacts from intensive land use; e.g., residential and rural residential estates. • Changed land use that results in adverse impacts on the catchments of the wetlands protected by the reserves. • Increased pressure from human activity including manmade structures and land use practices. • Reduced rainfall as a consequence of climate change.	The proposal is located 500 m west of the Western Swamp Tortoise policy area which encompasses the catchment of Twin Swamps Nature Reserve (2.6 km east of the proposed highway), critical habitat for the tortoise. Ellen Brook Nature Reserve which also contains critical habitat is located in the southern part of the policy area 4.8 km east-southeast of the proposed road alignment. Ellenbrook and The Vines residential subdivisions are located between Ellen Brook Nature Reserve and the proposed highway. The proposed highway is outside the policy area to which the guidance statement applies. Construction and operation of the highway will not result in adverse impacts on the catchments of the wetlands protected by Twin Swamps Nature Reserve and Ellen Brook Nature Reserve.

Policy or guideline	Purpose of policy/guideline	Consideration given to policy/guideline
Amenity (Noise and Vibration)		
Environmental Assessment Guideline (EAG) 13 - Consideration of environmental impacts from noise. (September 2014)	EAG 13 sets out how EPA considers the impacts from noise emissions in environmental impact assessment. It encourages the use of best practice in noise management by requiring adherence to State Planning Policy 5.4 Road and Rail Transport Noise and Freight Considerations in Land Use Planning to achieve compliance and protect human health and amenity. EAG 13 provides guidance on applicable regulatory standards, how noise impacts are considered by EPA in the environmental impact assessment process and understanding if noise emissions could have a significant impact.	Noise monitoring was conducted in accordance with Australian Standard 2702:1984 Acoustics – Methods for the Measurement of Road Traffic Noise. Noise modelling was done using SoundPlan and the CORTN algorithm, adjusted to account for Australian road traffic conditions. The noise model was calibrated using noise measurements from the Great Northern Highway at Muchea, which is indicative of rural highway traffic. The significance of noise emissions was determined by comparison of predicted noise levels to the targets and limits from State Planning Policy 5.4. Noise mitigation was applied in accordance with the procedures in SPP 5.4 to ensure the targets and/or limits were met at sensitive receivers. Where noise limits could not be achieved, reasonable and practicable mitigation measures will be implemented in accordance with State Planning Policy 5.4. These will be discussed and agreed with affected property owners. PER Chapter 11, Amenity (Noise and Vibration) presents the findings of the Traffic Noise Assessment undertaken for the PER. The results, analysis and interpretation are presented in PER Appendix O, Traffic Noise Assessment and Response to Submissions Chapter 4, Amenity (Noise and Vibration) and Appendix I, Revised Transportation Noise Assessment.
Heritage		
Guidance Statement No. 41 – Assessment of Aboriginal Heritage (April 2004)	Guidance Statement No. 41 provides advice regarding the minimum requirements for assessment of Aboriginal heritage, where it is a relevant environmental factor in proposals. The statement acknowledges the relationships between	Aboriginal heritage was not identified as a key environmental factor in the Environmental Scoping Document but was recognised as an environmental factor that required consideration. Consequently, a desktop study, field survey and consultation were carried out in accordance with the

Policy or guideline	Purpose of policy/guideline	Consideration given to policy/guideline
	the aesthetic, social, cultural, physical and biological environments and notes that these environments apply to specific places to which Indigenous people relate. Guidance Statement No. 41 requires that EPA has sufficient information to determine whether Aboriginal heritage is a key environmental factor and if so, sufficient information to consider the nature of the impact and report to the relevant minister.	*Aboriginal Heritage Act 1972* and Guidance Statement No. 41. PER Chapter 13, Aboriginal Heritage presents the findings of the Aboriginal heritage surveys undertaken for the PER. The results and interpretation are presented in PER Appendix P, Aboriginal Heritage Desktop Assessment, Appendix Q, Ethnographic Aboriginal Heritage Survey and Appendix R, Aboriginal Archaeological Assessment. MRWA will be seeking consent to disturb Aboriginal heritage sites under the *Aboriginal Heritage Act 1972*
Offsets		
WA Environmental Offsets Policy	WA Environmental Offset Policy sets out the Western Australian Government's expectation for environmental offsets. It seeks to protect and conserve environmental and biodiversity values through compensation for unavoidable residual impacts on biodiversity values. The policy states that offsets are a last resort when avoidance and minimisation options have been exhausted. It seeks to ensure transparency in the provision of offsets to provide certainty that they will be adequate and achieve the desired goals. It recommends cooperation between the Western Australian and Australian Governments to ensure, where possible and permitted by each jurisdictions legislation and regulations, that offsets are not duplicated. The policy outlines the principles for use of environmental offsets which may be either direct or indirect. It notes that offsets must be proportionate to	The proposal addresses the principles for use of environmental offsets as follows: 1. MRWA has applied the mitigation hierarchy to this proposal as far as practicably possible. However after all avoidance and minimisation options have been exhausted, a residual environmental impact remains. PER Chapter 2 Proposal Background and Justification and PER Chapter 3 Route Selection and Development describe how route selection and road (alignment) design minimised impacts on significant remnant native vegetation including Whiteman Park/Cullacabardee Bushland and Maralla Road Bushland. 2. The proposal will have a significant impact on

Policy or guideline	Purpose of policy/guideline	Consideration given to policy/guideline
	the significance of the impact. The principles are: 1. Environmental offsets will only be considered after avoidance and mitigation options have been pursued. 2. Environmental offsets are not appropriate for all projects. 3. Environmental offsets will be cost-effective, as well as relevant and proportionate to the significance of the environmental value being impacted. 4. Environmental offsets will be based on sound environmental information and knowledge. 5. Environmental offsets will be applied within a framework of adaptive management. 6. Environmental offsets will be focussed on longer term strategic outcomes.	Threatened Ecological Communities and Threatened species through loss of individuals and habitat. The significant impacts require offsets. 3. MRWA has proposed a suite of offsets to compensate for unavoidable losses of environmental values including threatened species and ecological communities listed under state and federal legislation. The offset packages comprise multiple values highlighting a focus on ecosystem function. Recent decisions and MRWA's experience on other road projects has informed the offset proposals including multipliers that reflect the conservation and biodiversity significance of lost species and ecological communities. 4. Desktop study and preliminary and detailed survey has informed the identification of suitable offsets. DPaW has been consulted on the suitability of the sites. The offsets increase the environmental values under protection. 5. MRWA intends to vest the land in DPaW or an appropriate land manager and fund the management of the offsets for a period to be agreed with DPaW and/or the land manager. Preliminary discussions have been held with DPaW regarding management of the offset

Policy or guideline	Purpose of policy/guideline	Consideration given to policy/guideline
		properties. 6. Offsets that are contiguous with Nature Reserves, Bush Forever sites and other Crown land managed for conservation purposes have been favoured over isolated parcels. Excess land from acquisition of the road reserve has also been considered and proposed as an offset where it enhances or augments existing corridors and regional ecological linkages. 7. PER Chapter 17, Offsets outlines the impacts of the proposal on key environmental factors and the rationale for proposed offsets. Response to Submissions Chapter 6, Environmental Offsets provides updated offset proposals. The updated proposals reflect the revised assessment of impacts on threatened flora and critical habitat resulting from the spring ecological surveys (Response to Submissions Chapter 3, Spring Ecological Surveys and Appendices C, D, E, F and G).
WA Environmental Offsets Guidelines (August 2014)	WA Environmental Offsets Guidelines clarify the determination and application of environmental offsets in Western Australia. The guidelines seek to ensure a consistent approach to the provision of offsets regardless of the legislative instrument. They provide further detail on the Western Australian Government's expectations for demonstrating application of the mitigation hierarchy and seek to	The mitigation hierarchy was implemented in planning, designing and developing management measures for the proposed highway. Avoidance of significant environmental values was a key objective of route selection and alignment design. Road design has minimised impacts on sensitive environmental values through realignment and narrowing of the road carriageways to avoid threatened species and their habitat.

Policy or guideline	Purpose of policy/guideline	Consideration given to policy/guideline
	ensure consistency through application of the residual impact significance model. The model identifies four levels of significance: • Unacceptable impacts (offsets not appropriate). • Significant impacts requiring an offset. • Potentially significant impacts which may require an offset. • Impacts which are not significant and do not require an offset. The guidelines provide advice on appropriate offsets including quantification, implementation and audit/review to determine success.	The impact assessment presented in PER Chapters 8 to 16 has identified significant residual impacts that require offset. No unacceptable impacts were identified. The residual impact significance model was used in developing the offset proposals presented in PER Chapter 17, Offsets and the revised proposals presented in Response to Submissions Chapter 6, Environmental Offsets. Where appropriate the requirements of the Australian Government under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) have been considered.
Environmental Protection Bulletin No. 1 – Environmental Offsets (August 2014).	Environmental Protection Bulletin No. 1 clarifies how the EPA considers offsets through the environmental impact assessment process. It provides a summary of the key requirements of the WA Environmental Offset Policy and WA Environmental Offset Guidelines including the mitigation hierarchy need to use the Residual Impact Significance Model, and information required by the OEPA to decide on the appropriateness of offsets to compensate for the significant residual impacts. It explains what feedback will be provided by OEPA and information on related matters including existing approvals and offsets for non-biodiversity matters.	The mitigation hierarchy was implemented in planning, designing and developing management measures for the proposed highway. Avoidance of significant environmental values was a key objective of route selection and alignment design. Road design has minimised impacts on sensitive environmental values through realignment and narrowing of the road carriageways to avoid threatened species and their habitat. The impact assessment presented in PER Chapters 8 to 16 has identified significant residual impacts that require offset. No unacceptable impacts were identified. The residual impact significance model was used in developing the offset proposals presented in PER Chapter 17, Offsets and the revised proposals presented in Response to Submissions Chapter 6, Environmental Offsets. Where appropriate the requirements of the Australian Government

Policy or guideline	Purpose of policy/guideline	Consideration given to policy/guideline
		under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) have been considered.
Rehabilitation and decommissioning		
Guidance Statement No. 6 – Rehabilitation of Terrestrial Ecosystems (June 2006)	Guidance Statement No. 6 sets out minimum standards necessary for rehabilitation of terrestrial ecosystems including wetlands. The aim of the statement is to ensure the return of biodiversity values in rehabilitated areas. It seeks to achieve this goal by improving the quality, uniformity and efficiency of standards and processes for rehabilitation of native vegetation. It also seeks more effective monitoring and auditing of outcomes. Guidance is provided to achieve the following outcomes: • Greater awareness on the limitations of rehabilitation in WA and the environmental impacts of permanent changes to ecosystems. • Compare internationally recognised standards with those used in WA for assessing outcomes. • General standards and common framework for setting rehabilitation objectives for EIA. • Uniform standards for analysis, interpretation and reporting of outcomes for auditing purposes and increased data access. • Acknowledge the importance of scientific knowledge as a basis for effective rehabilitation. • List sources of further information and summarise	Temporary work areas and excess land will be rehabilitated. Roadside revegetation using endemic species will augment rehabilitation which will be done using local provenance species. Where practicable it will restore and enhance ecological linkages, specifically north of Maralla Road. Rehabilitation has been designed to reflect the landscapes through which the proposed highway runs: urban zone, transition zone and rural zone. MRWA experience in rehabilitating roads in similar landscapes and ecosystems will be utilised. Rehabilitation will be implemented and managed through the construction environmental management plan which will include measures for the control of weeds and pathogens, completion criteria and performance measurement. The revegetation strategy is described in PER Chapter 12, Rehabilitation and Decommissioning.

Policy or guideline	Purpose of policy/guideline	Consideration given to policy/guideline
	stakeholder roles and responsibilities. The guidance statement encourages the use of completion criteria, which should be: • Specific enough to reflect unique set of environmental, social and economic circumstances. • Flexible enough to adapt to changing circumstances without compromising objectives. • Include environmental indicators suitable for demonstrating that rehabilitation trends are heading in the right direction. • Undergo periodic review resulting in modification if required due to changed circumstances or improved knowledge. • Based on targeted research which results in more informed decisions.	

7.3 Flora and Vegetation

7.3.1 Threatened Flora

Consolidated issue 152: Risk from proposal to *Grevillea curviloba* subsp. *incurva* is understated. The PDNH needs to be moved further from individuals. Every effort needs to be taken to protect, and if possible re-introduce, this species in its critical habitat area.

Contributing issues:

71: Risk from proposal to *Grevillea curviloba* subsp. *incurva* is understated. The PDNH needs to be moved further from individuals. Every effort needs to be taken to protect, and if possible re-introduce, this species in its critical habitat area.

263: Please provide justification as to why a 10 m buffer is sufficient for avoiding indirect impacts to *Grevillea curviloba* subsp. *incurva* given that a 50 m buffer is proposed for *Caladenia huegelii*.

The population of *Grevillea curviloba* subsp. *incurva* is located in a 20-m-wide strip of degraded, weedy vegetation located between Brand Highway and the Midland–Geraldton railway line. The populations in this location are already confined with the distance of individuals from current active transport corridors a maximum of 10 m away.

Direct impacts to this population have been avoided through the construction of a bridge over the railway, Brand Highway and the railway/road reserve, which spans the location of this population. No section of the proposed highway will be positioned closer to individuals than the current Brand Highway.

The draft EMP (PER Appendix F, Environmental Management Plan) contains measures to protect Threatened and Priority flora from accidental disturbance and prevent the introduction and spread of weeds and dieback. The implementation of weed control measures may lead to an improvement in the condition of the *Grevillea curviloba* subsp. *incurva* critical habitat in the road reserve.

Consolidated issue 171 (contributing issue 260): Please provide additional detail on the management, monitoring and mitigation measures to be implemented to demonstrate that indirect impacts of the proposal will not impact *Caladenia huegelii.*

A 50 m buffer around the *Caladenia huegelii* individual will be established and maintained for the duration of construction to ensure that direct impacts to the *Caladenia huegelii* individual are avoided.

A construction Environmental Management Plan (EMP) to be prepared before construction commences will include management measures for indirect impacts including weed and dieback management, drainage management and management of uncontrolled access, fire and dust (PER Chapter 8, Flora and Vegetation, Section 8.5 and summarised in PER Chapter 8, Flora and Vegetation, Section 8.6, Table 8.16). The implementation of these management measures will ensure that indirect impacts to the known location of *Caladenia huegelii* can be minimised.

MRWA will develop and implement a FVMMP to manage impacts on significant vegetation, including threatened flora, priority flora, TECs and PECs. This will include: establishing baseline condition, undertaking monitoring and implementing contingencies should changes to vegetation health and condition be detected. The FVMMP will include monitoring of the buffer protecting the known occurrence of *Caladenia huegelii*. The plan will be prepared in consultation with DPAW.

Consolidated issue 172 (contributing issue 259): Please provide additional detail on the significance of the impact to *Caladenia huegelii* critical habitat.

A total of 228.3 ha of *Caladenia huegelii* critical habitat was mapped in the study area (see PER Appendix C, Level 2 Spring Flora and Vegetation Assessment, Section 5.7.1.1). This area of critical habitat comprises two areas: one adjacent to Ellenbrook (184.6 ha) and one in Whiteman Park (43.7 ha). A very small part of the Whiteman Park habitat is impacted by the proposal (less than 0.1 ha).

The extent of the Ellenbrook habitat was revised to 141.4 ha in the 2015 spring survey (Appendix C, Assessment & Refinement of Potential Critical Habitat for *Caladenia huegelii* (T-DRF) within the Development Envelope). Following further surveys, the proposal's direct impact of 39.2 ha (see PER Chapter 8, Flora and Vegetation, Section 8.4.5) has subsequently been revised to 30 ha. This impact constitutes 16.2% of *Caladenia huegelii* critical habitat known in the study area (185.1 ha). Although not mapped, it is likely that *Caladenia huegelii* critical habitat extends beyond the study area, particularly to the northwest of the mapped critical habitat in the nature reserve west of Ellenbrook.

7.3.2 Impact Assessment

Consolidated issue 154: Please provide further analysis on indirect impacts to wetlands, TECs, threatened flora/fauna and reserves remaining after construction. If long term persistence is unlikely, the significance should be considered as the whole occurrence of the value.

Contributing issues:

268: Please provide further analysis on indirect impacts, particularly relating to TECs and threatened flora that will remain after construction. If long-term persistence is unlikely, the significance should be considered as the whole occurrence of the value.

269: Please provide further analysis on indirect impacts, particularly with regards to threatened fauna that will remain after construction. If long-term persistence is unlikely, the significance should be considered as the whole occurrence of the value.

270: Please provide further analysis on indirect impacts, particularly with regards to wetlands that will remain after construction. If long-term persistence is unlikely, the significance should be considered as the whole occurrence of the value.

271: Please provide further analysis on indirect impacts, particularly with regards to conservation reserves that will remain after construction. If long-term persistence is unlikely, the significance should be considered as the whole occurrence of the value.

The PER considers both direct and indirect impacts to each of the key environmental factors in PER Chapters 8 to 15 and MNES in PER Chapter 16. Conservation significant values such as Threatened Ecological Communities (TECs), threatened flora, threatened fauna, conservation areas and wetlands have the potential to be indirectly impacted through edge effects and fragmentation.

Edge effects are identifiable as any difference in environment between the edge and the interior of a particular patch of vegetation. For example, edge effects can occur along the boundary of two different vegetation communities as well as edges with cleared areas (see PER Chapter 8, Flora and Vegetation, Section 8.4.9). The average width of edge effects on other major MRWA road projects has been demonstrated to be less than 10 m and in some cases almost zero where road fill batters are present (South Metro Connect, 2011).

An analysis of potential indirect impacts of edge effects on conservation significant values was undertaken. The analysis identified all conservation significant values within 10 m of the proposal footprint. Table 7.2 summarises potential indirect impacts of edge effects on conservation significant values. Potential indirect impacts occurring within conservation areas (including Class A Nature Reserve 46919, Class A Nature Reserve 46920, Gnangara–Moore River State Forest No. 65 and Bush Forever sites) are also provided in Table 7.2.

Table 7.2 Potential indirect impacts of edge effects on conservation significant values

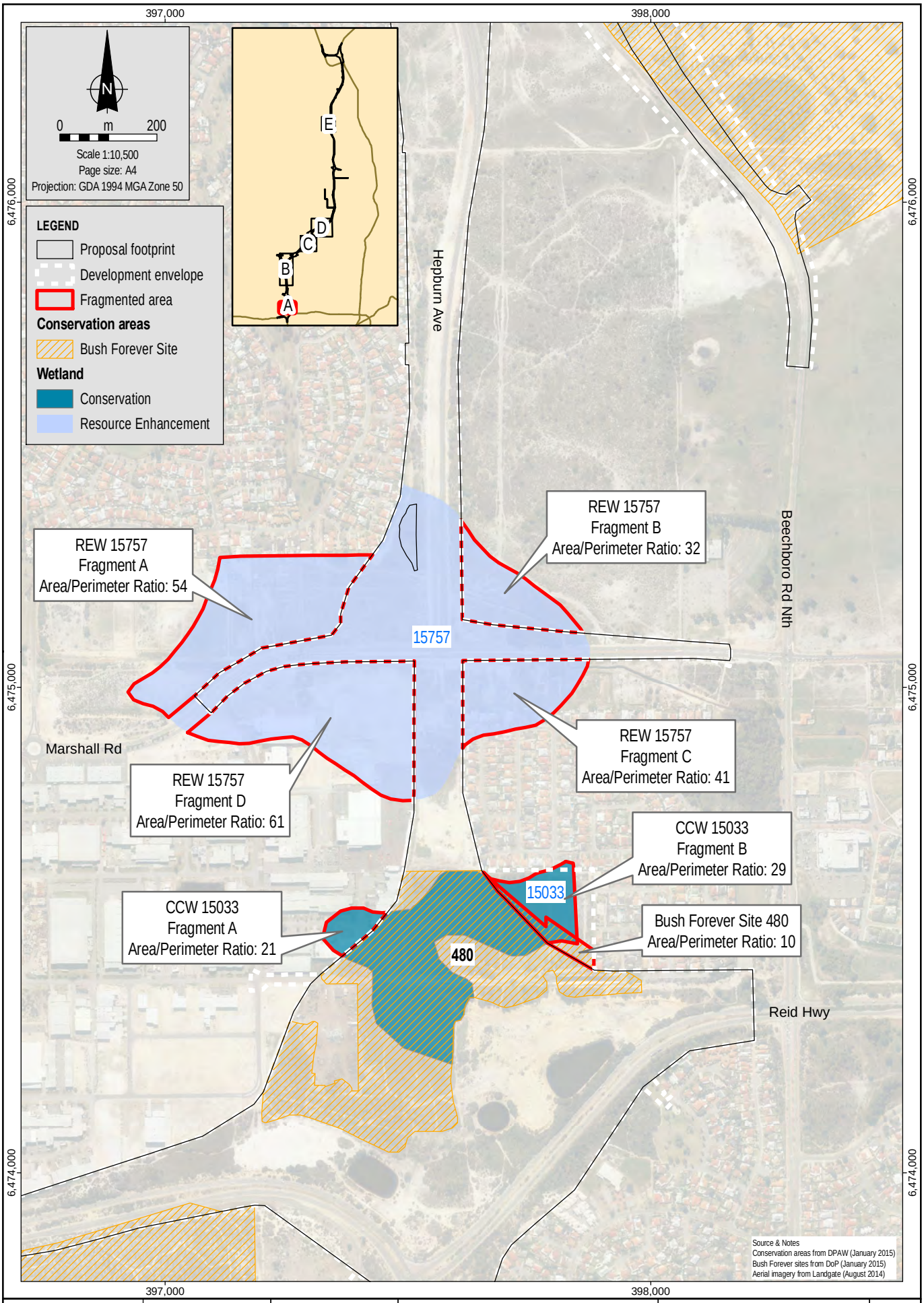
Conservation significant value		Total potential indirect impact	Potential indirect impact within conservation areas
Vegetation complexes	Bassendean Complex – Central and South	6.2 ha	6.1 ha
	Bassendean Complex – North	8.8 ha	5.2 ha
	Bassendean Complex – North Transition Vegetation Complex	1.4 ha	1.4 ha
	Southern River Complex	2.6 ha	0.9 ha
	Yanga Complex	4.2 ha	0.7 ha
TEC	SCP20a (Endangered)	0.5 ha	0.5 ha
PEC	SCP21c (Priority 3)	7.1 ha	5.2 ha
	SCP22 (Priority 2)	0.1 ha	0.1 ha
	SCP23b (Priority 3)	1.2 ha	0.7 ha
	SCP24 (Priority 3)	0.3 ha	0.3 ha
	Banksia dominated woodlands on the Swan Coastal Plain (Priority 3)	6.2 ha	4.4 ha
Wetlands	Conservation category wetland (CCW)	1.6 ha	1.2 ha
	Resource enhancement wetland (REW)	3.4 ha	–
Critical habitat	*Caladenia huegelii*	4.9 ha	3.3 ha
	Grevillea curviloba subsp. *incurva*	1.6 ha	–
Threatened flora	*Grevillea curviloba* subsp. *incurva*	4 records	–
Priority flora	*Poranthera moorokatta* (P2)	1 record	1 record
	Hypolaena robusta (P4)	1 record	1 record

Note: not all values in this table are mutually exclusive. For example, an area may be mapped as both a particular vegetation complex and a PEC.

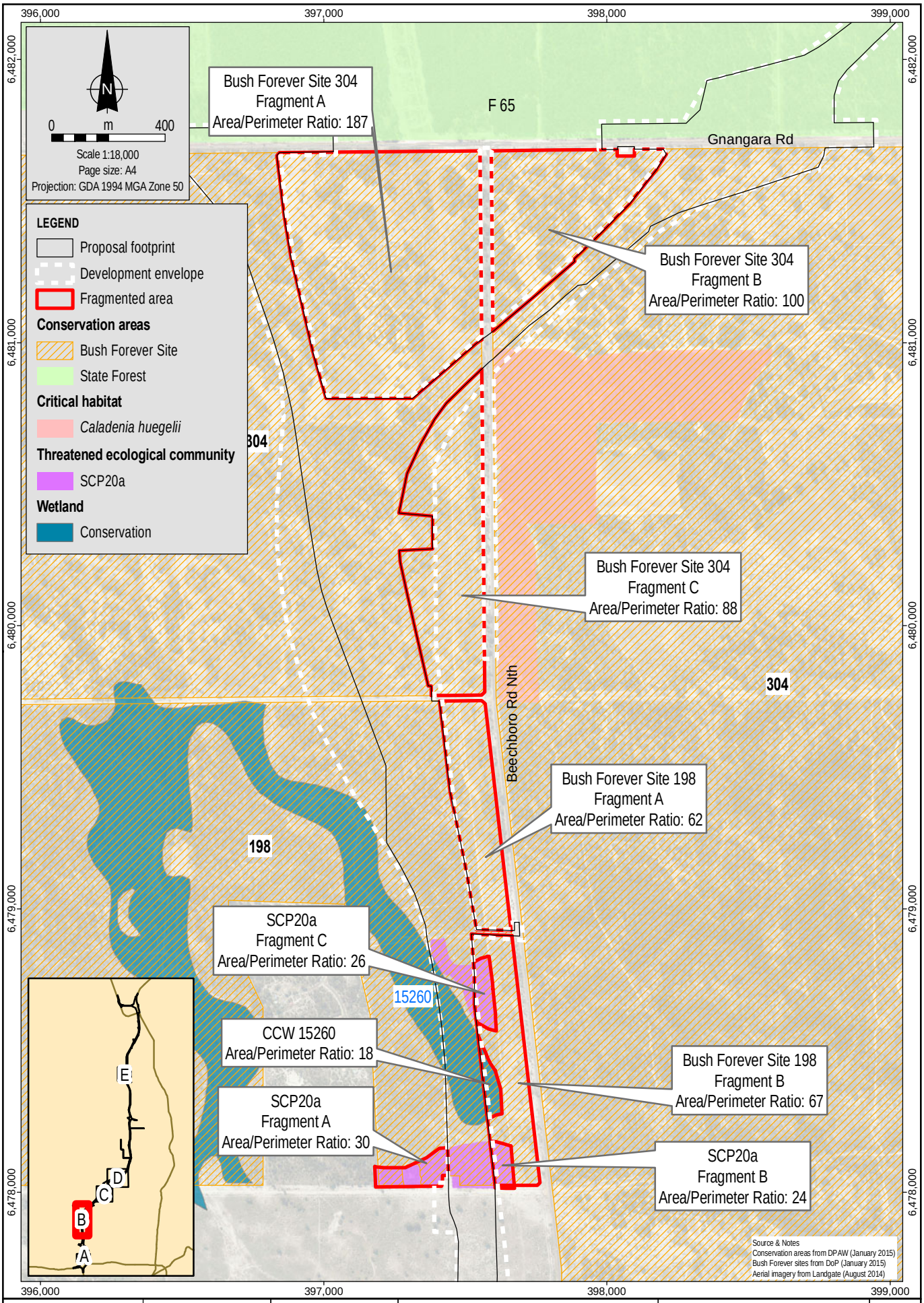
Fragmentation occurs when one part of a conservation significant value is severed or isolated from another. In general, smaller fragments are less likely to retain the same values as larger fragments. A long and narrow fragment is also likely to retain fewer values and be more exposed to edge effects than a circular fragment of the same size. The area-to-perimeter is one measure of potential viability of a fragment. Its area, proximity to adjacent vegetation and exposure to threatening processes all contribute to its viability. For example, Bush Forever site 298 with an area-to-perimeter ratio of 48 persists as a viable patch (see PER Chapter 15, Amenity (Reserves), Figures 15.3B and 15.3C).

The persistence of fragments of native vegetation depends on management such as restricting access, weed control and, where practicable, reconnection with other areas of native vegetation through rehabilitation. Ecologically-connected remnants are likely to remain viable for fauna provided they are managed appropriately (see Appendix M, Technical Advice on Fauna Issues and consolidated issue 154 in Chapter 7, Response to Office of the Environmental Protection Authority Issues, Section 7.3.2). Management measures set out in PER Chapter 8, Flora and Vegetation, Table 8.16 and PER Chapter 12, Rehabilitation and Decommissioning, Table 12.1 will assist in maintaining the viability of fragments. Management of impacts to wetland and dampland habitat fragments is set out in PER Chapter 10, Hydrological Processes and Inland Waters Environmental Quality, Table 10.9. Connectivity through rehabilitation or use of underpasses is important to connect isolated fragments (PER Chapter 9, Terrestrial Fauna, Table 9.7). Advice on the impacts of habitat fragmentation on fauna is provided in Appendix M, Technical Advice on Fauna Issues and consolidated issue 154 in Chapter 7, Response to Office of the Environmental Protection Authority Issues, Section 7.3.2.

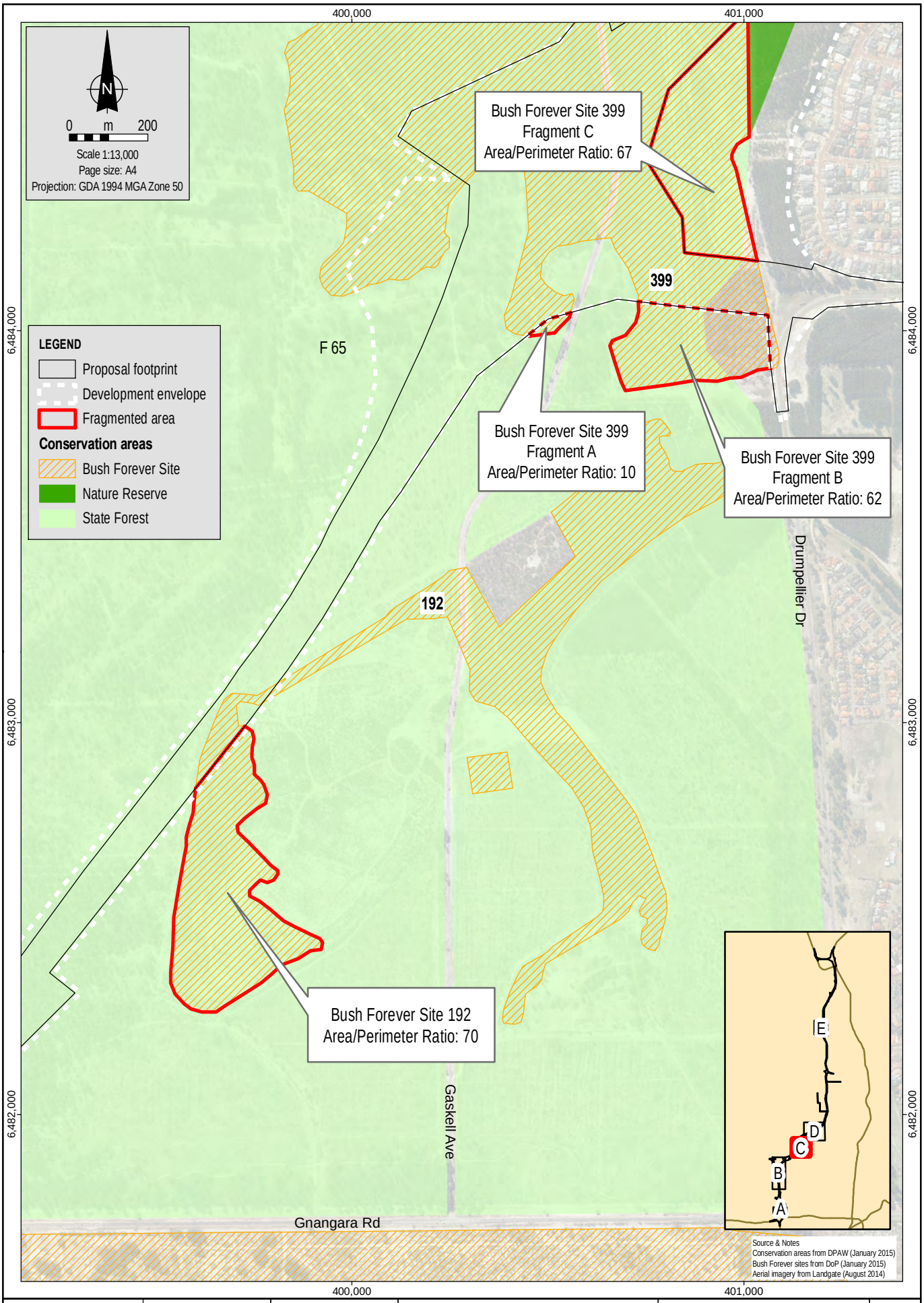
A fragmentation analysis was undertaken to identify conservation significant values that may be fragmented by the proposal. Figure 7.1 shows occurrences of conservation significant values that will be fragmented by the proposal. Table 7.3 summarises each of the fragments shown on Figure 7.1 and discusses their likely persistence following construction of the proposal. The discussion on persistence considers the area-to-perimeter of each fragment (shown on Figure 7.1), which favours fragments with shorter perimeters (e.g. circles), and the likelihood that the values of each fragment will be retained.



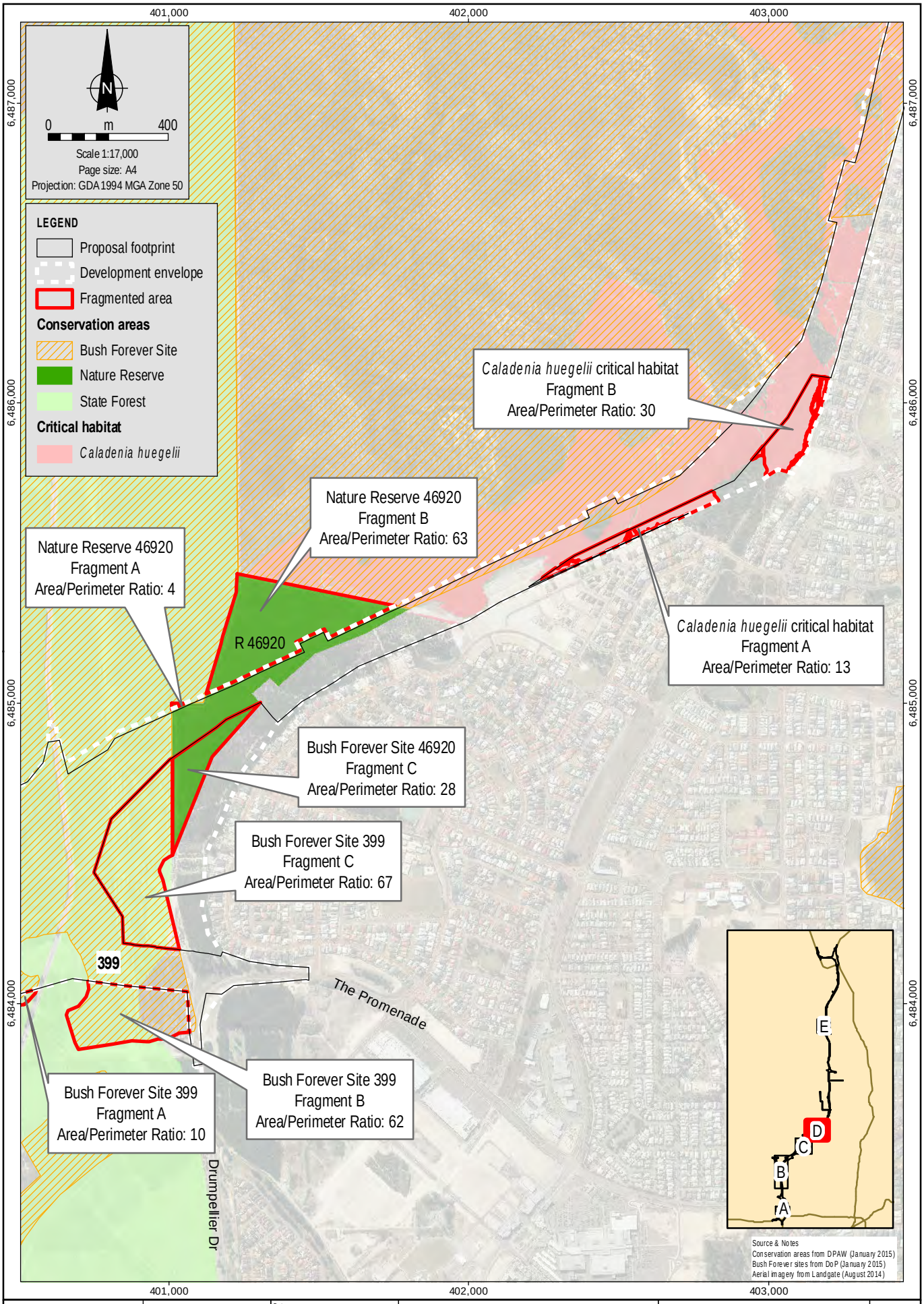
NorthLinkWA	coffey	Date: 05.12.2015 MXD: 4483AA_42_GIS007 File Name: 4483AA_42_F007.1A_GIS	Main Roads WA Response to Submissions Perth–Darwin National Highway	Fragmentation analysis Map 1 of 5	Figure No: 7.1A



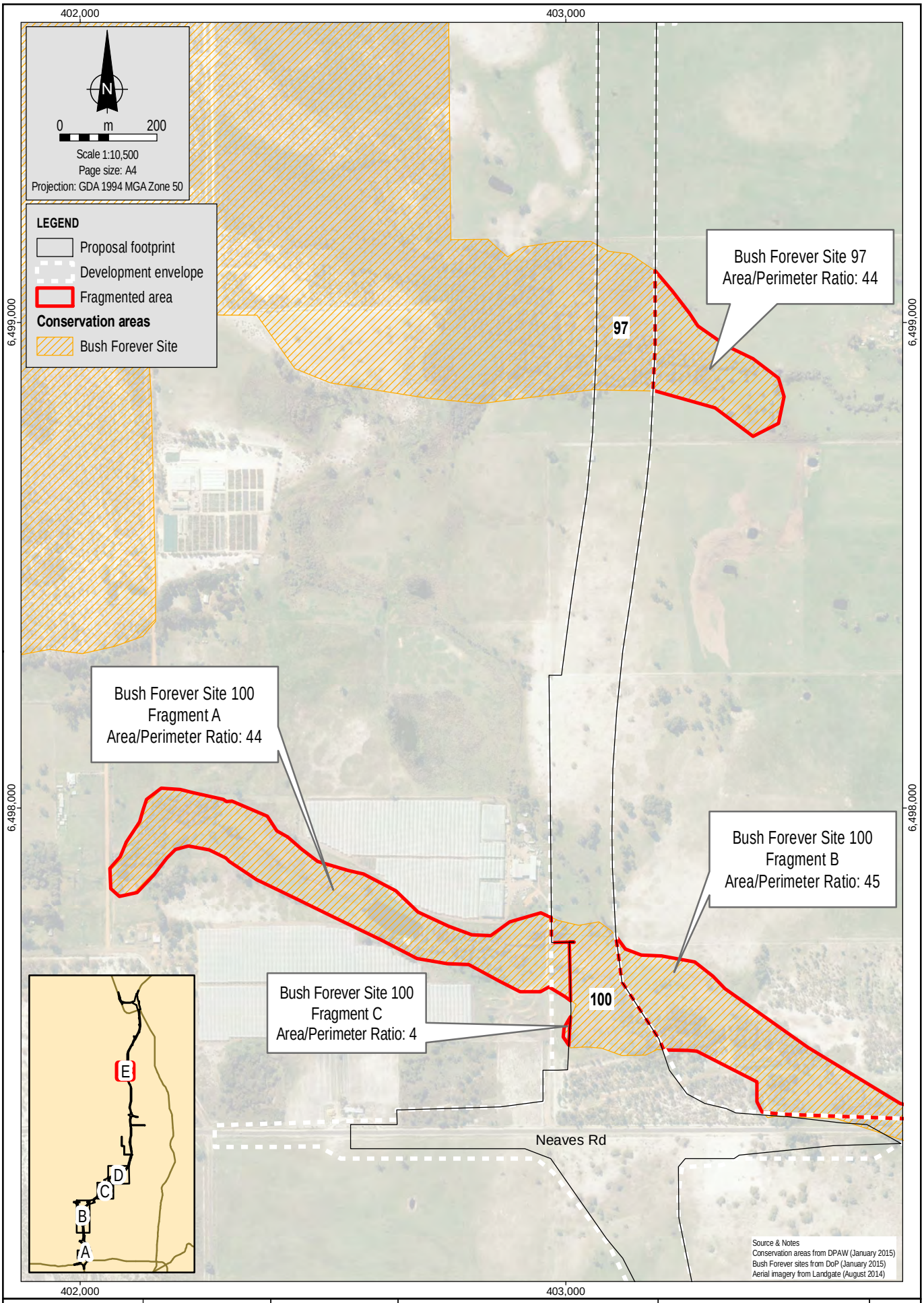
NorthLinkWA	coffey	Date: 01.03.2016 MXD: 4483AA_42_GIS007 File Name: 4483AA_42_F007.1B_GIS_3	Main Roads WA Response to Submissions Perth Darwin National Highway	Fragmentation analysis Map 2 of 5	Figure No: 7.1B



NorthLinkWA	coffey	Date: 05.12.2015 MXD: 4483AA_42_GIS007 File Name: 4483AA_42_F007.1C_GIS	Main Roads WA Response to Submissions Perth–Darwin National Highway	Fragmentation analysis Map 3 of 5	Figure No: 7.1C



NorthLinkWA	coffey	Date: 09.02.2016 MXD: 4483AA_42_GIS007 File Name: 4483AA_42_F007.1D_GIS_2	Main Roads WA Response to Submissions Perth–Darwin National Highway	Fragmentation analysis Map 4 of 5	Figure No: 7.1D



NorthLinkWA	coffey	Date: 05.12.2015 MXD: 4483AA_42_GIS007 File Name: 4483AA_42_F007.1E_GIS	Main Roads WA Response to Submissions Perth–Darwin National Highway	Fragmentation analysis Map 5 of 5	Figure No: 7.1E

Table 7.3 Potential indirect impacts of fragmentation on conservation significant values

Value	Discussion	Figure reference
Bush Forever		
Bush Forever site 480	Although this fragment is 0.7 ha and has a small area-to-perimeter ratio of 10, it is likely that its values will be retained given the larger remnant portion of CCW 15033 within and immediately adjacent to the fragment. CCW 15033 is mapped in association with vegetation in Very Good and Excellent to Very Good condition.	Figure 7.1A
Bush Forever site 198	Fragments A and B of Bush Forever site 198 are contiguous with Bush Forever site 304 to the east and north, forming part of the greater Bush Forever reserve coincident with Whiteman Park. Given their larger area-to-perimeter ratios and connectivity with adjacent Bush Forever, these fragments are both likely to retain their values.	Figure 7.1B
Bush Forever site 304	Fragments A, B and C of Bush Forever site 304 are contiguous with larger sections of the site and Bush Forever site 198 to the south, forming part of the greater Bush Forever reserve coincident with Whiteman Park. Given their large area-to-perimeter ratios and connectivity with adjacent Bush Forever, these fragments are all likely to retain their values.	Figure 7.1B
Bush Forever site 192	Bush Forever site 192 contains two larger areas connected by a narrow strip 40 m wide and 500 m long. The proposal will clear a small portion of the connecting part of Bush Forever site 192. The resulting fragment is bordered by a quarry to the east and will be bordered by the proposal on the west and north. Despite the loss of connectivity to the remainder of the site, it is likely to retain its values as a Bush Forever site given its relatively large size (13.9 ha) and high area-to-perimeter ratio (70).	Figure 7.1C
Bush Forever site 399	The proposal's Ellenbrook interchange will result in three areas of Bush Forever site 399 being isolated on the eastern side of the proposal from the remainder of Bush Forever site 399 to the west and north of the proposal. Fragment A is unlikely retain its value given its small size (0.3 ha) and low area-to-perimeter ratio (10). This fragment contains vegetation mapped in SCP21c (P3) and is within vegetation complex Bassendean Complex–North. It does not any records of Threatened or Priority flora. Fragment A likely comprises foraging habitat for Carnaby's Black Cockatoo by extension of the Black Cockatoo habitat mapping shown in PER Chapter 9, Terrestrial Fauna, Figure 9.2C. The proposal's offsets include the loss of Carnaby's Black Cockatoo foraging habitat from this fragment (see Chapter 6, Environmental Offsets). Fragment B is likely to retain its values given its size (6.9 ha), relatively high area-to-perimeter ratio (62) and connectivity with bushland immediately to the south leading into Bush Forever site 192. Fragment C is located within the development envelope between the interchange and Ellenbrook residential areas. It is likely to retain its values given its size (10.7 ha), high area-to-perimeter ratio (67) and connectivity to other remnant native vegetation also in the development envelope but outside the proposal footprint.	Figure 7.1C, Figure 7.1D

Value	Discussion	Figure reference
Bush Forever site 100	Bush Forever site 100 occurs in connection with a drainage line and wetlands adjacent to Neaves Road. Fragment A is not expected to lose any of its values as Bush Forever due to its 10.9 ha size and location upstream of the proposal. While downstream of the proposal, the use of culverts (see PER Appendix H, Drainage Strategy) will ensure the maintenance of surface water flows to Fragment B. Fauna underpasses installed adjacent to the watercourse will enable wildlife movement between the fragments. Fragment B is expected to retain its values as Bush Forever. Fragment C is too small (0.05 ha) to be likely to retain its values, even with adjacent revegetation works completed as part of the proposal. The vegetation in this fragment is from the vegetation complex Bassendean Complex–North. It contains low value Black Cockatoo foraging and/or roosting habitat. There are no records of TECs, PECs, Priority flora or Threatened flora in this fragment.	Figure 7.1E
Bush Forever site 97	Bush Forever site 97 will be severed by the proposal, with the majority of the site remaining intact on the western side of the proposal footprint. A 4.3 ha fragment will be isolated on the eastern side of the proposal. This fragment occurs downstream of Mound Springs SCP TEC. The use of culverts (see PER Appendix H, Drainage Strategy) will ensure the maintenance of surface water flows across the proposal. Fauna underpasses will enable wildlife movement between the fragments. Road reserve revegetation will link this fragment with the Bush Forever site 100 fragment enabling fauna movement. These management measures will minimise impacts to its values as Bush Forever.	Figure 7.1E
Critical habitat for Threatened flora		
Caladenia huegelii	While the majority of *Caladenia huegelii* critical habitat adjacent to Ellenbrook is west of the proposal, two fragments will be left isolated between the proposal and the rear of residential areas in Ellenbrook. Fragment A is less likely to retain its values as it is smaller in size (1.9 ha) and has a much smaller area-to-perimeter ratio of 13. The proposal's offsets include the loss of *Caladenia huegelii* critical habitat from this fragment (see Chapter 6, Environmental Offsets). Fragment B, which contains one *Caladenia huegelii* individual, is likely to retain its values given its moderate area-to-perimeter ratio and 4.9 ha size. There are many instances where populations of *Caladenia huegelii* have existed for many years within 50 m or less of roads including the busy Roe Highway (Stage 7). Indirect impacts to *Caladenia huegelii* critical habitat including impacts associated with uncontrolled access, fires, spread of introduced weeds and *Phytophthora* dieback will be managed through the management measures proposed in PER Chapter 8, Flora and Vegetation, Section 8.5.	Figure 7.1D
Nature Reserves		
Class A Nature Reserve 46920	The proposal will result in the loss of about half of Class A Nature Reserve 46920. While fragment A is small and has a small area-to-perimeter ratio of 4, the values currently in reservation in fragments A, B and C (predominantly pine plantation) are likely to be retained given its connectivity with similar vegetation and habitats in the adjoining Gnangara–Moore River State Forest No. 65.	Figure 7.1D

Value	Discussion	Figure reference
Threatened Ecological Communities		
SCP20a	SCP20a has been mapped in two occurrences along Beechboro Road North. The proposal will sever the southern occurrence, resulting in a 2.2 ha fragment to the west of the proposal (fragment A) and a 1.1 ha fragment to the east (fragment B). A second occurrence of SCP20a to the north will be isolated, also on the eastern side of the proposal footprint (fragment C). Fragments B and C both occur in a narrow corridor between the proposal footprint, a high voltage powerline easement and Beechboro Road North. Despite their low area-to-perimeter ratios, these fragments are likely to retain their values given their co-location with the larger patch of Bush Forever site 198, which is contiguous with Bush Forever site 304 immediately to the north and east. Fragment A has a higher area-to-perimeter ratio and is likely to retain its values.	Figure 7.1B
Wetlands		
CCW 15033	A Wetland Management and Monitoring Plan will be developed and implemented including groundwater monitoring to ensure impacts to wetlands are appropriately managed and there are no unforeseen impacts (see PER Chapter 10, Hydrological Processes and Inland Waters Environmental Quality, Section 10.5). The Wetland Management and Monitoring Plan will consider the conservation status and proximity of wetlands to the proposal. The plan will include monitoring of CCW 15033 in fragment B and will ensure the retention of values of this fragment. Fragment A has already been impacted by historical clearing and development in Milly Court, Malaga and no longer exists.	Figure 7.1A
REW 15757	REW 15757 has already been impacted and modified by historical clearing, residential and industrial developments including the presence of Marshall Road and Hepburn Avenue. As a result, fragments A and B already exist and will not be created as a result of the proposal. Fragment A will be reduced in size by about 35% but is expected to retain its values with an area-to-perimeter ratio of 54. Fragment D is already highly altered by clearing and land development and no longer exists. Fragment C already exists albeit to a larger extent including the proposal footprint south of Marshall Road. Construction of the proposal will result in fragment C reducing in size but it will retain an area-to-perimeter ratio of 41 and is likely to retain its values.	Figure 7.1A
CCW 15260	CCW 15260 is mapped over a large area in Cullacabardee. The proposal will isolate a fragment of CCW 15260 in a narrow corridor between the proposal footprint, a high voltage powerline easement and Beechboro Road North. This wetland is unlikely to retain its values as a CCW given its low area-to-perimeter ratio, its shape and the degraded condition of the vegetation in this corridor (see PER Chapter 8, Flora and Vegetation, Figure 8.6). This impact is discussed in PER Chapter 10, Hydrological Processes and Inland Waters Environmental Quality, Section 10.4.6.1.	Figure 7.1B

Consolidated issue 173 (contributing issue 262): The Swan Coastal Plain Interim Biogeographic Regionalisation for Australia (SWA IBRA) bioregion is incorrectly stated as being a constrained area, when it is portions of the Swan Coastal Plain that are considered constrained.

The constrained area within the Metropolitan Region Scheme (MRS) is defined as urban, urban deferred, industrial areas and roads. The proposal alignment does not traverse any of these zones, with the exception of the existing Tonkin Highway/Reid Highway intersection.

Three of the five vegetation complexes occurring within the proposal footprint are below the retention target of 30%; Bassendean Complex – Central and South (21.3%), Southern River (16.8%) and Yanga Complex (13.5%) (EPA, 2015a).

Consolidated issue 174 (contributing issue 261): Please revise PER Table 8.2 with the recently updated remaining extents of vegetation complexes on the Swan Coastal Plain.

PER Chapter 8, Flora and Vegetation, Table 8.2, Native vegetation extent remaining on the Swan Coastal Plain has been revised to reflect the updated figures for the remaining extent of vegetation complexes on the Swan Coastal Plain (EPA, 2015a), including a revised assessment of the proposal's impacts (see Table 7.4).

Less than 30% of the pre-European extent of Bassendean Complex – Central and South, Southern River Complex and Yanga Complex is currently remaining in the Perth-Peel Region, and will be further reduced by the proposal (0.1 to 0.3%). The Bassendean Complex North – Transition Vegetation Complex and Bassendean Complex North have more than 30% of their pre-European extent remaining. The proposal will not reduce these two vegetation complexes below the 30% retention target.

Consolidated issue 177 (contributing issue 258): Please provide additional information to demonstrate that impacts to SCP23b are not likely to be significant despite the proposal removing 20% of its known extent.

One recorded occurrence of SCP23b – Northern *Banksia attenuata* – *Banksia menziesii* woodlands within the proposal footprint was identified in geospatial database searches. This record was not able to be confirmed during the 2014 survey (Coffey, 2015b). The 2014 survey did however record eight occurrences of SCP23b in the study area totalling 57.5 ha, including five within the proposal footprint (11.6 ha).

Keighery et al. (2012) identified 79 occurrences of SCP23b in the region, 23 of which occur within 15 km of the development envelope. The majority of these occurrences are in Bush Forever sites and/or within state forest.

The proposal will remove 11.6 ha of SCP23b which is approximately 20% of the mapped extent within the study area. Based on Keighery et al.'s assessment of SCP23b distribution, the total extent of SCP23b in the region will be considerably larger than that mapped within the study area and so the proposal is unlikely to have a significant impact on this priority ecological community.

Table 7.4 Native vegetation extent remaining within the Perth and Peel regions for the Swan Coastal Plain

Vegetation complex	IBRA region			Perth-Peel Region (PPR)						
	IBRA Pre-European extent (ha)[1]	2015 extent (ha)[2]	Extent remaining 2015 (%)[3]	PPR Pre-European extent (ha)[4]	PPR 2015 extent (ha)[5]	PPR % remaining 2015[6]	PPR Secure for conservation (ha)[7]	PPR Secure for conservation (%)[8]	Extent of intact native vegetation to be removed by the proposal (ha) [9,10]	Pre-European extent remaining after proposal (ha)
Bassendean Dunes										
Bassendean Complex – Central and South	87,416	22,846	26.1	63,451	13,486	21.3	733	1.2	62.1	13423.9 (21.2%)
Bassendean Complex North Transition Vegetation Complex	17,644	16,069	91.1	4,594	3,498	76.2	2,200	47.9	19.2	3,478.8 (75.7%)
Bassendean Complex North	74,131	53,218	71.8	35,389	23,859	67.4	9,092	25.7	73.4	23,785.6 (67.2%)
Combinations of Bassendean Dunes / Pinjarra Plain										
Southern River Complex	57,163	10,533	18.4	41,192	6,936	16.8	629	1.5	44.8	6,891.2 (16.7%)
Pinjarra Plain										
Yanga Complex	26,176	4,312	16.5	5,776	777	13.4	247	4.3	18.0	759 (13.2%)

Source: EPA (2015a).

Notes to Table 7.4:

1. Pre-clearing extent of vegetation complex (EPA, 2015a).
2. Current extent of the vegetation complex in 2015 (EPA, 2015a).
3. The remaining area of complex in 2015 as a percentage of its pre-clearing extent (EPA, 2015a).
4. Pre-clearing extent of the vegetation complex within PPR.
5. Current extent of the vegetation complex within PPR in 2015.
6. Percentage of remaining area of complex within PPR in 2015.
7. Remaining area of complex within PPR with some form of conservation purpose in 2015.
8. Percentage of remaining area of complex within PPR with some form of conservation purpose in 2015.
9. Intact native vegetation is defined as areas of vegetation where; both the vegetation condition is 'Degraded' or better and the vegetation is not mapped as cleared, highly altered or non-native vegetation associations (excluding rehabilitation).
10. The area removed includes the area to be cleared (i.e. proposal footprint) and any additional areas excised from conservation estate.

Consolidated issue 178 (contributing issue 256): Please provide detail on how the 205 ha extent of native vegetation was calculated and whether it accords with the definitions of native vegetation in the EP Act and regulations.

The total area of intact native vegetation within the proposal footprint in PER Chapter 8, Flora and Vegetation, Table 8.10 is 205 ha. Intact native vegetation is defined in the PER as areas of vegetation where both:

- The vegetation condition is in the category 'Degraded' or better (i.e. excludes vegetation mapped as 'Degraded to Completely Degraded', 'Completely Degraded', 'Cleared', 'Infrastructure' and 'Road').
- The vegetation is not mapped as one of the following cleared, highly altered or non-native vegetation associations: Cc1, CcMpMr, ErCo, MpAl, Xp^2, $CcEr^3$, Pr, Pp, R, Rehab, Former Settlement or any variant of Cl.

Chapter 8, Flora and Vegetation, Section 8.4.1 'Permanent Loss of Native Vegetation' is more accurately titled 'Permanent Loss of Vegetation' because the section considers both native and non-native vegetation. In this section, Table 8.9 includes not only native vegetation but also non-native vegetation that may be in a degraded or better condition (e.g., plantations of *Pinus pinaster* mapped as the Pp vegetation association). The sum of values from Table 8.9 column 'Extent to be cleared within the proposal footprint' and rows 'Pristine' to 'Degraded' exceeds 205 ha because these values include non-native vegetation. The 205 ha total of intact native vegetation to be cleared does not include non-native vegetation.

Native vegetation is defined in the EP Act as "indigenous aquatic or terrestrial vegetation, and includes dead vegetation unless that dead vegetation is of a class declared by regulation to be excluded from this definition but does not include vegetation in a plantation". It "does not include vegetation that was intentionally sown, planted or propagated unless [it was done] under this Act or another written law" or for similar purposes in accordance with Regulation 4 of the Environment Protection (Clearing of Native Vegetation) Regulations 2004 (Clearing Regulations). The criteria used in the PER for intact native vegetation were formulated to include areas of vegetation that would be considered native vegetation under the EP Act and Clearing Regulations (see PER Chapter 8, Flora and Vegetation, Section 8.4.1.1). Further consultation with the OEPA has identified that vegetation mapped as the Rehab vegetation association should be included in the calculation of intact native vegetation if the vegetation was intentionally sown, planted or propagated as described in the EP Act and Clearing Regulations.

Following revisions to the development envelope and proposal footprint described in Section 2.1, the extent of intact native vegetation within the proposal footprint is 206 ha. This value incorporates two areas of vegetation mapped as the Rehab vegetation association that meet the legislated definition of native vegetation.

Consolidated issue 179 (contributing issue 255): It is not clear whether the 205 ha of native vegetation to be cleared includes or is separate from values of GDEs, Bush Forever, TECs, PECs, *Caladenia huegelii* critical habitat and *Grevillea curviloba* subsp. *incurva* critical habitat.

The extent of intact native vegetation in the proposal footprint (revised to 206 ha) is inclusive of groundwater dependent ecosystems (GDEs), Bush Forever, TECs, PECs, Caladenia *huegelii* critical habitat and *Grevillea curviloba* subsp. *incurva* critical habitat.

Consolidated issue 180 (contributing issue 264): Assessment of local vegetation units is not at the appropriate scale for considering impacts in the region. Significance of impacts to 4 local vegetation units may be overstated. Please provide additional information in this regard.

PER Chapter 8, Flora and Vegetation, Table 8.10 presents the proposal's local impact on vegetation associations within the study area. Impacts to four of the vegetation associations (AsMIEvCl, Ba, BaBmMp and CcMp) appear high given this assessment is focused on the mapped extent within study area and does not consider their regional extent. To address this issue, vegetation associations have been linked with the relevant FCT for which regional scale information is available (Table 7.5).

Table 7.5 Relationship of vegetation associate to floristic community type

Vegetation association	Related quadrat	FCT	Other occurrences of FCT within the region
AsMIEv(Cl)	SVB002	SCP13	8
	SVB005	SCP12	8
Ba	SVB004	SCP21c	35
BaBmMp	360Q29	SCP21c	
CcMp	360Q15	SCP21c	

Vegetation association AsMIEvCl is associated with quadrats SVB002 and SVB005 (PER Appendix C, Level 2 Spring Flora and Vegetation Assessment, Table 18). Quadrat SVB002 is associated with SCP13 (PER Appendix C, Level 2 Spring Flora and Vegetation Assessment, Table 19) which is not a listed FCT. There are eight known occurrences of SCP13 in the region (Keighery et al., 2012) ranging from as far south as Ruabon, near Busselton, to near Yeal in the north (approximately 25 km northwest of the development envelope).

Quadrat SVB005 is associated with SCP12 (PER Appendix C, Level 2 Spring Flora and Vegetation Assessment, Table 19) which is not a listed FCT. There are eight known occurrences of SCP12 in the region. SCP12 ranges from Capel in the south to approximately 15 km southwest of Muchea in the north (Keighery et al., 2012). The nearest occurrence of SCP12 to the development envelope is approximately 9 km southeast of the Reid/Tonkin highways interchange.

Vegetation association Ba is associated with quadrat SVB004, vegetation association BaBmMp with quadrat 360Q29 and vegetation association CcMp with quadrat 360Q15 (PER Appendix C, Level 2 Spring Flora and Vegetation Assessment, Table 18). All three quadrats are associated with SCP21c, which is listed as PEC (P3). Twenty seven records were returned from DPAW 2005 Swan Coastal Plain dataset (Keighery et al., 2012) and a further eight records were returned in a custom search of DPAW's databases for existing records of SCP21c within 10 km of the proposal. SCP21c ranges from approximately 10 km north of Muchea, along Ioppolo Road to approximately 12 km south of Bunbury (Keighery et al., 2012). The closest occurrences of SCP21c are approximately 1 km east of the development envelope near Maralla Road.

When considered in this regional context, impacts on these vegetation associations are not considered to be significant, as the vegetation association is well represented outside the development envelope.

Consolidated issue 182 (contributing issue 272): Please resolve inconsistencies in extent of direct impact to Bush Forever sites.

The proposal footprint intersects 188.7 ha of Bush Forever sites. However, the proposal will impact only 129.9 ha of intact native vegetation within Bush Forever sites. Impacts to Bush Forever sites are shown in Table 7.6.

Table 7.6 Impacts to Bush Forever sites

Bush Forever site	Extent of intact native vegetation impacted by proposal (ha)	Total area impacted by proposal (ha)
No. 97 – Kirby Road bushland, Bullsbrook	3.3	3.3
No. 100 – Neaves Road creek, Bullsbrook	0.2	3.5
No. 192 – Wetherell Road bushland, Lexia/Ellenbrook	1.3	1.3
No. 198 – Beechboro Road bushland, Cullacabardee/Ballajura	30.7	31.3
No. 300 – Maralla Road bushland, Ellenbrook/Upper Swan	16.9	16.9
No. 304 – Whiteman Park, Whiteman/West Swan	29.9	75.1
No. 307 – Lightning Swamp and adjacent bushland, Noranda	1.0	1.1
No. 399 – Melaleuca Park and adjacent bushland, Bullsbrook/Lexia	30.8	37.9
No. 480 – Victoria Road bushland, Malaga/Beechboro	15.9	18.2
Total	**129.9**	**188.7**

Note: values may not sum to totals due to rounding error.

Table 6.2 sets out the offset requirements for the significant values impacted by the proposal.

7.3.3 Priority Flora

Consolidated issue 176 (contributing issue 254): Please discuss outcome of additional regional surveys for *Millotia tenuifolia* var. *laevis* and *Meeboldina decipiens* subsp. *decipiens*, including final residual impacts, revised management, monitoring, mitigations and any amendments to offset proposals.

The results of the regional survey are presented in Appendix D, Spring Surveys for *Meeboldina decipiens* subsp. *decipiens* (P3) and *Millotia tenuifolia* var. *laevis* (P2). A summary of the key findings is presented in Chapter 3, Spring Ecological Surveys, Section 3.2 and summarised below.

Millotia tenuifolia* var. *laevis

The survey for Millotia tenuifolia var. laevis recorded a total of 5,222 individuals within eight populations outside the development envelope. This included two populations (1,652 individuals) adjacent to the proposal footprint west of Beechboro Road North in Cullacabardee. Of the 5,222 individuals recorded, 3,345 are in conservation estate (State Forest, Regional Park or MRWA's proposed offset property at Ioppolo Road).

Due to the high number of individuals located nearby (1,652 across two populations) and regionally (3,570 across 6 populations), clearing of *Millotia tenuifolia* var. *laevis* within the proposal footprint (2 populations, 3 individuals) will have a negligible impact on the local and regional population.

Meeboldina decipiens* subsp. *decipiens ms

Material collected from the populations within the development envelope as part of the regional survey, were re-inspected by WAH staff who identified them as *Lepyrodia muirii*. The proposal footprint will not impact *Meeboldina decipiens* subsp. *decipiens* (P3).

As *Millotia tenuifolia* var. *laevis* was found to be abundant in the area and *Meeboldina decipiens* subsp. *decipiens* was determined to not occur in the proposal footprint, impacts on these species are not significant and do not require offset. The revised management relating to flora and vegetation is provided in Chapter 13, Summary of Management Measures.

7.3.4 Study and Survey Adequacy

Consolidated issue 170: Please discuss outcome of additional surveys for TEC SCP02 in development envelope, including final residual impacts, revised management, monitoring, mitigations and any amendments to offset proposals.

Contributing issues:

227: If Offset Proposal 3 proves difficult to implement, alternative offset options for the loss of 0.4 ha of SCP02 should be developed and implemented, in consultation with DPAW.

253: Please discuss outcome of additional surveys for TEC SCP02 in development envelope, including final residual impacts, revised management, monitoring, mitigations and any amendments to offset proposals

273: Please resolve inconsistencies in extent of direct impact to TEC SCP02.

275: It is not clear how the >2:1 ratio for TEC SCP02 was determined. The proponent should use the Commonwealth offsets calculator to determine an appropriate offset if SCP02 is confirmed present in the development envelope.

276: Please provide details of the TEC SCP02 spring survey. The proponent will need to provide a suitable offset for SCP02 and justify the rationale used if SCP02 is confirmed.

A targeted spring survey was undertaken on 17 September 2015 to confirm the presence of TEC SCP02 identified in surveys for the PER.

Surveyed quadrats showed the vegetation community most closely resembled SCP04, which is common on the SCP. The additional quadrats occurred in the same supergroup as SCP02 due to similar dominant taxa, but occur within different subgroups. SCP02 does not occur within the proposal footprint.

There is no residual impact to SCP02 and no offset required. The revised management measures are set out in Chapter 13, Summary of Management Measures.

Further information can be found in Chapter 3, Spring Ecological Surveys. The supporting report is attached as Appendix E, Spring Surveys and Analysis to Investigate SCP02 Presence.

7.4 Terrestrial Fauna

Consolidated issue 97: Study, survey and trapping procedures were inadequate. Richness of extant fauna is not captured in surveys.

Contributing issues:

25: Fauna assessment is inadequate because it does not consider arboreal and bird species, underestimating species diversity. Some species of reptiles, micro bats, invertebrates, birds not properly considered. Local extinctions could result.

27: Study, survey and trapping procedures were likely inadequate. Why were trapping nights not conducted across all four seasons?

194: The timing and duration of the surveys do not adequately represent the richness of fauna that longitudinal studies would have provided.

215: Surveys for flora and fauna, but especially birds, reptiles and invertebrates, was not comprehensive enough. Species have been overlooked because of the limited scope of surveys. How can the real impacts be known?

266: It is unclear if all fauna records from all surveys in the study area have been considered, or if only the results in the Level 2 Targeted Fauna Assessment by Coffey have been considered.

The fauna assemblage of the SCP is well documented with numerous systematic surveys completed in recent history (Government of Western Australia, 2000). The survey method (PER Chapter 9, Terrestrial Fauna, Section 9.2.1) addressed the requirements of the Environmental Scoping Document (ESD) and was approved by the EPA and DPAW.

A total of 97 species were recorded during these surveys, all of which were identified as potentially occurring in the desktop assessment. The number of fauna species recorded during the survey is comparable with other surveys completed in the vicinity and typical of the habitats present within the study area. For example, of the 232 birds identified during the desktop assessment, 62 of these were positively recorded during the surveys (PER Appendix G, Level 2 Targeted Fauna Assessment, Table 5.4).

The term "fauna assemblage" is used throughout the PER to describe the large number of species previously recorded. Fauna assemblage includes birds, arboreal mammals, bats, reptiles and invertebrates.

As the proposal's impacts to the fauna assemblage are expected to be localised, the PER focuses on impacts on conservation significant fauna, particularly those species confirmed to be present during the survey along with any other conservation significant species identified during the desktop assessment which were considered likely to occur within the proposal footprint (see PER Chapter 9, Terrestrial Fauna, Section 9.2.5).

Consolidated issue 168 (contributing issue 267): The incorrect regional scale has been used to assess impacts to fauna. Provide further analysis that addresses the impacts to fauna using the Swan Coastal Plain region as the regional scale.

EPA Guidance Statement 56 recommends a 15 km radius to the proposal to determine the size of remnants and habitat condition in a regional context (EPA, 2004a). However, a 15 km buffer for linear infrastructure would encompass vegetation associations and habitat different to those within the proposal footprint given the diversity of vegetation complexes in the Swan Coastal Plain bioregion. The use of 1 km and 10 km study areas is appropriate to determine local and regional context for linear infrastructure respectively (Appendix M, Technical Advice on Fauna Issues, Issue 168)).

A 10 km buffer to the proposal footprint defined the regional study area for the fauna assessment. A 1 km buffer to the proposal footprint defined the local study area. These areas provided appropriate context for assessing impacts on mapped vegetation associations, TECs, PECs and threatened and priority flora.

Information on the wider distribution of species (PER Chapter 9, Terrestrial Fauna, Section 9.4.1) was provided, where available. For the Western Carpet Python, Southern Brown Bandicoot and Western Brush Wallaby, this discussion provided additional context and was not used in the regional assessment.

Further discussion on the aforementioned species' distribution on the Swan Coastal Plain and the local and regional assessment is provided in Appendix M, Technical Advice on Fauna Issues, Issue 168.

Consolidated issue 169 (contributing issue 265): Provide detail to demonstrate that the EPA's objective for terrestrial fauna can be met for locally or regionally significant species including wetland fauna/ habitats. Is the assessment based on the results from all the surveys in the study area?

Locally and regionally significant species are exposed to the same impacts as listed species including habitat loss, habitat fragmentation, habitat degradation, increased predation and disturbance from noise and light (Appendix M, Technical Advice on Fauna Issues, Issue 169 (locally and regionally significant fauna)). Management of these impacts applies to the entire fauna assemblage not just significant species thereby meeting the EPA's objective.

Changed hydrology is the primary impact on wetland function and health (Appendix M, Technical Advice on Fauna Issues, Issue 169 (wetland fauna and wetland fauna habitats)). An assessment of potential impacts on wetlands is presented in PER Chapter 10, Hydrological Processes and Inland Water Environmental Quality, Section 10. Management measures to maintain hydrological processes are set out in PER Chapter 10, Hydrological Processes and Inland Water Environmental Quality, Table 10.9. The findings of this assessment were that the risk to damplands and wetlands affected by the proposal will be low, as only small portions of wetlands will be affected. The greatest residual impact was the removal of a wetland (Conservation Category Wetland (CCW) 15033) and Bush Forever site 480 at the intersection of Tonkin Highway and Reid Highway.

A desktop assessment of State and Commonwealth databases, regional and local contextual data for the northern SCP and existing biological surveys was undertaken prior to the majority of the field surveys for the fauna study area (see PER Chapter 9, Terrestrial Fauna, Section 9.2.1). The results of this desktop assessment were used to develop a list of fauna expected in the study area. PER Appendix G, Level 2 Targeted Fauna Assessment, Appendix H, Previously recorded fauna list presents the full list of species recorded during the Coffey survey and other surveys undertaken in or adjacent to the fauna study area. All publically available information and previous surveys were considered in the assessment including GHD (2013a) and Appendix M, Technical Advice on Fauna Issues.

7.5 Hydrological Processes and Inland Waters Environmental Quality

Consolidated issue 153 (contributing issue 274): Please resolve inconsistencies in extent of direct impact to CCWs.

Seven CCWs will be directly impacted by the proposal footprint (see PER Chapter 10, Hydrological Processes and Inland Waters Environmental Quality, Table 10.3). The impacted areas are detailed in PER Chapter 10, Hydrological Processes and Inland Waters Environmental Quality, Table 10.6. The total direct impact on the seven CCWs is 14.8 ha.

The proposal will fragment a 1.2 ha area of CCW 15260, this severed portion is unlikely to retain values commensurate with a CCW (see Table 7.2). The offsets proposed in PER Chapter 6, Environmental Offsets

address both the 14.8 ha of direct impacts to seven CCWs and the 1.2 ha fragmentation impact to CCW 15260.

7.6 Environmental Offsets

Consolidated issue 14: The proposal (including offsets) will still result in a net loss of biodiversity. Acquisition does not replace bushland, and MRWA should implement a revegetation offset.

Contributing issues:

10: Can offsets package include purchase of cleared/degraded land for rehabilitation to address net loss of important habitat associated with bushland and wetlands?

82: The net loss of black cockatoo habitat requires habitat replacement in the long term through acquisition and revegetation of degraded habitat to avoid continued cumulative losses. This also applies to all other fauna habitats.

85: While the implementation of Offset 1 is supported, the proposal will still result in a net loss of biodiversity at the species, population and community level.

87: The acquisition of properties does not sufficiently offset the impacts of the proposal. MRWA must be required to undertake a revegetation offset to actually replace lost bushland, even if attempts to do so do not completely succeed.

291: The acquisition of Ioppolo Road protects existing foraging habitat for black cockatoos but does not increase availability of habitat. Losses of habitat in the development envelope are therefore not mitigated.

292: The proponent should take into consideration rehabilitation and revegetation when proposing offsets, particularly regarding the EPA's recent strategic advice for the Perth and Peel regions.

MRWA's offset strategy (see Chapter 6) has been developed in accordance with the Commonwealth Environmental Offsets Policy (Government of Australia, 2012), WA Environmental Offsets Policy (Government of Western Australia, 2011) and WA Environmental Offsets Guideline (Government of Western Australia, 2014).

Land acquisition is recognised as an appropriate form of offset under these policies and guidelines:

- WA Environmental Offsets Policy: "Direct offsets vary... and include acquisition… of natural areas outside the project area."
- WA Environmental Offsets Guideline: "Land acquisition offsets… involve the protection of environmental values through improved security of tenure or restricting the use of the land."
- Commonwealth Environmental Offsets Policy: "The securing of existing unprotected habitat as an offset only provides a conservation gain if that habitat was under some level of threat of being destroyed or degraded, and as a result of offsetting will instead be protected in an enduring way and actively managed to maintain or improve the viability of the protected matter."

As detailed in Chapter 6, Environmental Offsets, MRWA has purchased a parcel of land in the Chittering area (Ioppolo Road) for the purpose of offsetting impacts to Black Cockatoos from the proposal. This offset (Offset proposal 1) protects existing high quality habitat for Black Cockatoo species that was otherwise under threat of clearing and degradation from third party access and exploration and agricultural activities. It is an important ecological linkage to existing reserves to the west. The details of activities and funding arrangements for ongoing management will be included in the Land Acquisition and Management Plan in consultation with DPAW.

MRWA acquired the Ioppolo Road site prior to the release of the OEPA's strategic advice 'Perth and Peel @ 3.5 million Environmental impacts, risks and remedies' (EPA, 2015a). While EPA acknowledged that acquisition of bushland provides immediate value and certainty, it is recommended that in future greater emphasis is placed on rehabilitation and revegetation of degraded areas to achieve a net improvement in habitat and other environmental values.

Offset proposal 1 does not completely satisfy the offset requirement for Black Cockatoos.. The proposal will also require offsets for a variety of other values, including SCP20a, a number of under-represented vegetation and CCWs, as discussed in Chapter 6. MRWA is considering the opportunity to include rehabilitation and revegetation in addressing these other offset requirements.

MRWA are currently developing a restoration offset plan for up to 31.5 ha across several properties adjacent to the alignment. The restoration plan will be aimed at wetlands, under-represented vegetation and Black Cockatoo habitat, as discussed in Chapter 6, Environmental Offsets.

Consolidated issue 15: Should Ioppolo Road not comprise critical habitat for *Caladenia huegelii*, an alternative offset package should focus on the management and protection of existing populations or critical habitat, rather than on translocation options.

Contributing issues:

217: Should Ioppolo Road not comprise critical habitat for *Caladenia huegelii*, an alternative offset package focus on the management and protection of existing populations or critical habitat, rather than on translocation options.

288: Please provide details of the spring survey at Ioppolo Road to determine presence of *Caladenia huegelii* critical habitat. If Ioppolo Road is not suitable, an alternative offset will need to be provided.

The Ioppolo Road offset site does not contain suitable habitat for *Caladenia huegelii*. An alternative offset package has been proposed (see Chapter 6, Offsets). Offset Proposal 3 offsets the loss of 31.9 ha of potential critical habitat for *Caladenia huegelii*.

MRWA is proposing to provide funding for a period of 10 years for the ongoing management of existing reserves 46919, 46875 and Bush Forever site 300 and Whiteman Park, which contain potential critical habitat for *Caladenia huegelii* (see Appendix C, Assessment and Refinement of Potential Critical Habitat for *Caladenia huegelii* (T-DRF) within the Development Envelope, Figure 1).

MRWA is proposing to provide funding for the development and implementation of a management plan in consultation with DPAW in accordance with the Grand Spider Orchid (*Caladenia huegelii*) recovery plan (DEC, 2009).

Consolidated issue 157: Please provide further details relating to the offset for TEC SCP20a.

Contributing issues:

252: Please discuss outcome of additional surveys for TEC SCP20a at Ioppolo Road, including final residual impacts, revised management, monitoring, mitigations and any amendments to offset proposals.

277: Please provide details of the spring survey for TEC SCP20a. If the Ioppolo Road offset site is not suitable then an alternative offset will need to be provided for SCP20a.

278: Please provide details of the rationale behind using a 2:1 offset ratio for TEC SCP20a. The Commonwealth Offsets calculator should be used to determine an appropriate offset for SCP20a.

A spring survey was undertaken on 15 and 16 September 2015 to confirm the presence of TEC SCP20a within the proposed offset site at Ioppolo Road.

The quadrats surveyed in the offset proposal had a close association with SCP28. Two quadrats IR-01 and IR-05 had species in common with SCP20a, but analysis shows they are most closely related to SCP28. Other quadrats had the most species in common with SCP23c and SCP28 in the updated SCP dataset (Keighery et al., 2012). Further information can be found in Chapter 3, Spring Ecological Surveys. The supporting report is attached as Appendix F, Assessment of the Presence of the TEC SCP20a at Ioppolo Road, Chittering. Ioppolo Road is not a suitable offset site for SCP20a.

Up to 4 ha of SCP20a will be impacted by the proposal. The EPBC Act offset assessment guide was used to calculate the likely quantum of offset taking into consideration the existing vegetation condition and threatening processes. The guide identified a need to offset 23 ha, a ratio of 6:1 (see Chapter 6, Offsets). MRWA will fund the acquisition or covenanting of a property or properties to be managed for conservation including restoration where possible to offset the loss of SCP20a.

Consolidated issue 158: Please provide further details relating to the offset for conservation areas.

Contributing issues:

281: It is unclear how the 1:1 ratio of offsets proposed for conservation estate has been determined. It is also likely to be inadequate.

282: The offset for conservation areas should be representative of the values being impacted and the associated attributes that may be lost. There is no consideration of how Offset Proposal 1 addresses this.

283: Class A Nature Reserves are the highest level of conservation reservation and a much higher offset ratio is likely to be required, if approval is granted.

284: Please provide details on the comparison of vegetation quality and composition between Bush Forever sites proposed to be impacted and proposed offsets to Bush Forever.

285: Overlaps between Bush Forever, Class A Nature Reserves and State Forest should be individually quantified. For offsetting purposes, State Forest < Bush Forever < Class A Nature Reserve. Indicate suitability of Offset Proposal 1.

286: A 1:1 offset ratio for State Forest may be appropriate if vegetation quality and values are the same. Please indicate the rationale behind the ratios chosen and the suitability of Offset Proposal 1.

287: A revision of the proposed offsets may be necessary to address residual impacts to conservation areas and should be provided if this is the case.

297: Please provide detailed maps defining boundaries of Class A Nature Reserves 46919 and 46920, the areas impacted by the proposal and the distinction between pine plantations and native vegetation in these reserves.

Conservation areas impacted by the proposal include Class A Nature Reserves, State Forest and Bush Forever sites. Class A Nature Reserves 46919 and 46920 (flora and fauna conservation) and Gnangara-Moore River State Forest No. 65 (timber production) are Crown land with statutory protection. Bush Forever sites 97, 100, 192, 198, 300, 304, 307, 399 and 480 are protected by policy.

The proposal will directly impact values in these conservation areas including vegetation complexes, threatened and priority ecological communities, and threatened species and habitat.

Five vegetation complexes of the SCP are affected by the proposal: Bassendean Complex – Central and North, Bassendean Complex – North Transition, Bassendean Complex – North, Southern River Complex and Yanga Complex. Table 7.4 details the pre-European extent of the complexes compared to the post-construction extent.

Three of these complexes are currently below the retention target of 30%: Bassendean Complex – Central and South, Southern River Complex and Yanga Complex (see Table 7.4) and are also below the 10% Bush Forever protection target (Table 7.7). The proposal's impacts to these vegetation complexes are addressed in Chapter 6, Environmental Offsets.

Table 7.7 Extent of vegetation complexes in Bush Forever sites

Vegetation complex	Pre-European extent (ha)	Extent in Bush Forever	Extent impacted by proposal[1] (ha)	Percentage remaining after proposal
Bassendean Complex – Central and South	87,416	7,980 ha (9.13%)	60.2	9.06%
Southern River Complex	57,163	5,075 ha (8.88%)	18.6	8.85%
Yanga Complex	26,176	706 ha (2.29%)	3.4	2.68%

Source: DOP (2015) and EPA (2015a).
Note:
1. Impacts on intact native vegetation in Bush Forever sites are calculated from the proposal footprint. Intact native vegetation is defined as areas of vegetation where both the vegetation condition is 'Degraded' or better and the vegetation is not mapped as cleared, highly altered or non-native vegetation associations (excluding rehabilitation).

Table 7.8 provides a breakdown of the extent of intact vegetation impacted in nature reserves, State Forest and Bush Forever sites for each vegetation complex below the 30% retention target. The totals are mutually exclusive. Where parts of Bush Forever sites overlap State Forest, the impact has been attributed to State Forest.

Table 7.8 Extent of impact on intact vegetation in vegetation complexes below the 30% retention target with each type of conservation area

Vegetation complex	Extent in Nature Reserve 46919[1] (ha)	Extent in Nature Reserve 49620[1] (ha)	Extent in Gnangara-Moore River State Forest No. 65 [1] (ha)	Extent in Bush Forever sites[2] (ha)	Total extent in conservation areas (ha)
Bassendean Complex – Central and South	–	–	2.1	58.9	61.0
Southern River Complex	–	–	–	18.6	18.6
Yanga Complex	–	–	–	3.4	3.4
Total	**0.0**	**0.0**	**2.1**	**80.9**	**86.4**

Notes:
1. Impacts in nature reserves and state forest are calculated from excision areas.
2. Impacts in Bush Forever sites are calculated from the proposal footprint.

PER Table 15.1 and 15.2 (PER Chapter 15, Amenity (Reserves) have been updated to show the extent of values affected in conservation areas. Table 7.9 (updated PER Table 15.1) shows the extent of impacts on conservation estate (nature reserves and state forest) within the development envelope. Impacts to vegetation associations in Class A Nature Reserves 46919 and 46920 are shown on Figure 7.2 and 7.3 respectively. Table 7.10 (updated PER Table 15.2) shows the extent of impacts on Bush Forever sites within the proposal footprint.

Table 7.9 Updated PER Table 15.1 Impacts to conservation estate

Conservation estate	Area of conservation estate[1]	Area of intact native vegetation	Area of Black Cockatoo habitat	Priority listed flora or area of PEC
Class A Nature Reserve 46919	0.4 ha	0.4 ha	• 0.4 ha of foraging habitat for Carnaby's Black Cockatoo.	• 0.4 ha of SCP21c (P3)
Class A Nature Reserve 46920	9.7 ha	0.5 ha	• 0.3 ha of foraging habitat for Carnaby's Black Cockatoo.	• 1 individual of *Hypolaena robusta* (P4) • 0.8 ha of SCP21c (P3) • 0.2 ha of SCP22 (P3)
Gnangara–Moore River State Forest No. 65	122.1 ha	43.6 ha	• 34.8 ha of foraging habitat for Carnaby's Black Cockatoo, including 3.0 ha of breeding habitat for Carnaby's Black Cockatoo and 3.0 ha of breeding and foraging habitat for Forest Red-tailed Black Cockatoo.	• 13.6 ha of Banksia dominated woodlands on the SCP (P3) • 21.3 ha of SCP21c (P3) • 0.1 ha of SCP22 (P3) • 2.9 ha of SCP24 (P3)

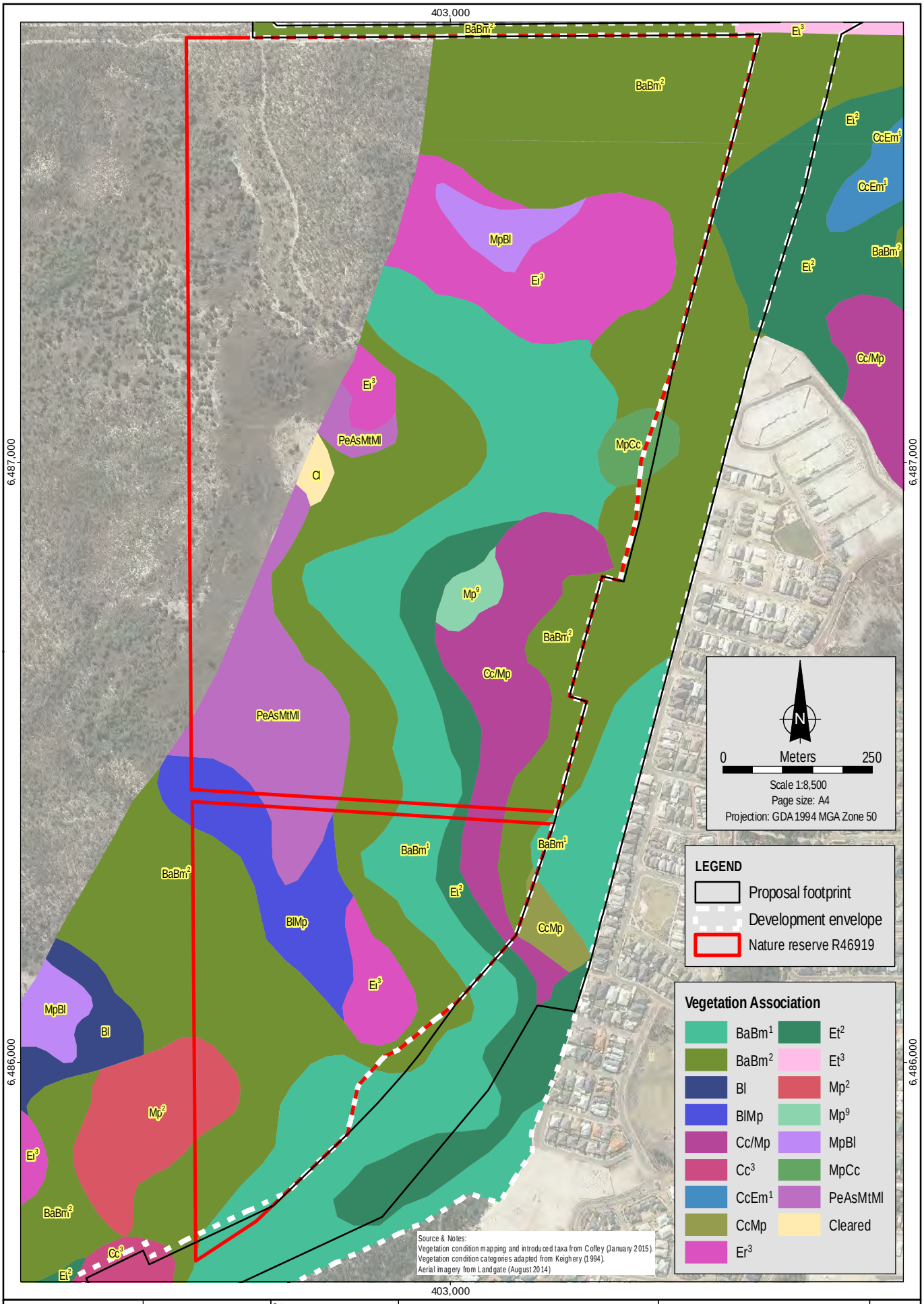
1. Based on the nature reserve and state forest excision areas.

Table 7.10 Updated PER Table 15.2 Impacts to Bush Forever sites

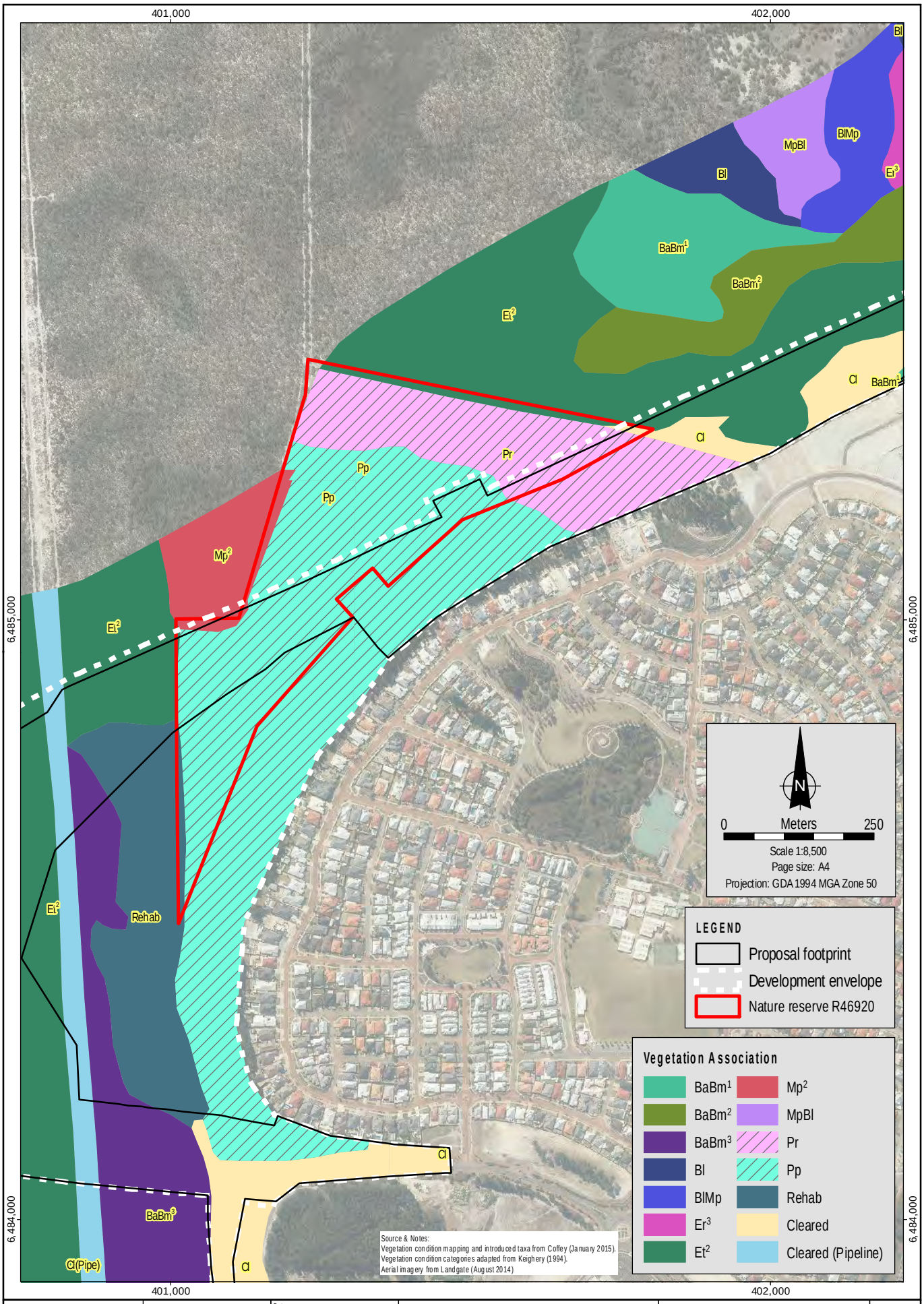
Bush Forever Site	Area of intact native vegetation	Area of Black Cockatoo habitat	Number of Priority listed flora	Area of Priority Ecological Community
97	3.3 ha	• 1.5 ha of foraging and breeding habitat for Carnaby's Black Cockatoo and Forest Red-tailed Black Cockatoo.	–	–
100	0.2 ha	• 1.9 ha of foraging and breeding habitat for Carnaby's Black Cockatoo and Forest Red-tailed Black Cockatoo.	–	–
192	1.3 ha	–	–	• 1.3 ha of SCP24 (P3)

Bush Forever Site	Area of intact native vegetation	Area of Black Cockatoo habitat	Number of Priority listed flora	Area of Priority Ecological Community
198	30.7 ha	• 30.8 ha of foraging habitat for Carnaby's Black Cockatoo, including 15.8 ha of breeding habitat for Carnaby's Black Cockatoo and 15.8 ha of breeding and foraging habitat for Forest Red-tailed Black Cockatoo.	• 3 individuals of *Millotia tenuifolia* var. *laevis* (P2) • 1 individual of *Hypolaena robusta* (P4) • 1 individual of *Anigozanthos humilis* subsp. *chrysanthus* (P4)	• 3.8 ha of SCP20a (En) • 10.6 ha of Banksia dominated woodlands on the SCP (P3) • 9.0 ha of SCP21c (P3) • 7.5 ha of SCP23b (P3)
300	16.9 ha	• 16.8 of foraging habitat for Carnaby's Black Cockatoo, including 1.3 ha of breeding habitat for Carnaby's Black Cockatoo and 1.3 ha of breeding and foraging habitat for Forest Red-tailed Black Cockatoo.	–	• 4.3 ha of Banksia dominated woodlands on the SCP (P3) • 10.4 ha of SCP21c (P3) • 1.9 ha of SCP23b (P3)
304	29.9 ha	• 71.1 ha of foraging and breeding habitat for Carnaby's Black Cockatoo and Forest Red-tailed Black Cockatoo.	–	• 12.0 ha of Banksia dominated woodlands on the SCP (P3) • 1.0 ha of SCP23b (P3)
307	1.0 ha	• 1.0 ha of foraging habitat for Carnaby's Black Cockatoo.	–	–
399	30.8 ha	• 30.5 ha of foraging habitat for Carnaby's Black Cockatoo, including 2.5 ha of breeding habitat for Carnaby's Black Cockatoo and 2.5 ha of breeding and foraging habitat for Forest Red-tailed Black Cockatoo.	–	• 10.6 ha of Banksia dominated woodlands on the SCP (P3) • 19.5 ha of SCP21c (P3) • 0.7 ha of SCP24 (P3)
480	15.9 ha	• 1.6 ha of foraging and breeding habitat for Carnaby's Black Cockatoo and Forest Red-tailed Black Cockatoo.	–	• 0.9 ha of Banksia dominated woodlands on the SCP (P3) • 4.5 ha of SCP24 (P3)

Note: impacts to Bush Forever sites are calculated from the proposal footprint.



NorthLinkWA	coffey	Date: 11.02.2016 MXD: 4483AA_42_GIS009_1 File Name: 4483AA_42_F07.2_GIS	Main Roads WA Response to Submissions Perth-Darwin National Highway	Impacts to Class A Nature Reserve 46919	Figure No: 7.2



NorthLinkWA	coffey	Date: 11.02.2016 MXD: 4483AA_42_GIS010 File Name: 4483AA_42_F07.3_GIS	Main Roads WA Response to Submissions Perth-Darwin National Highway	Impacts to Class A Nature Reserve 46920	Figure No: 7.3

Chapter 6, Environmental Offsets sets out the proposals for offsetting the significant impacts to environmental values within conservation areas (conservation estate and Bush Forever sites) as described above. Impacts on Priority flora species are not significant due to less than 0.2% of known individuals being impacted, as presented in PER Chapter 8, Flora and Vegetation, Table 8.15. The significance of impacts to Priority Ecological Communities (PEC) is difficult to determine as the extent of all known occurrences is undefined. However, on the basis of total known occurrences, the proposal is unlikely to have a significant impact on PECs.

Consolidated issue 160 (contributing issue 293): Please provide details of the rationale behind the ratio of 2:1 for offsetting CCWs.

Chapter 6, Environmental Offsets provides the proposal's revised offset strategy. The rationale for the offset ratio applied to CCWs is provided in Section 6.6.2.2.

Consolidated issue 162: Please provide further details relating to the 1:1 ratio chosen for the *Caladenia huegelii* critical habitat offset

Contributing issues:

251: Please discuss outcome of additional surveys for *Caladenia huegelii* critical habitat at Ioppolo Road, including final residual impacts, revised management, monitoring, mitigations and any amendments to offset proposals.

289: Please provide details of the rationale behind using a 1:1 offset ratio for *Caladenia huegelii* critical habitat. The Commonwealth Offsets calculator should be used to determine an appropriate offset for *Caladenia huegelii* critical habitat.

The Ioppolo Road offset site does not contain suitable habitat for *Caladenia huegelii*. An alternative offset package has been proposed (see Chapter 6, Offsets). Offset Proposal 3 offsets the loss of 31.9 ha of potential critical habitat for *Caladenia huegelii*.

MRWA will provide funding for a period of 10 years for the ongoing management of existing reserves 46919, 46875, Bush Forever site 300 and Whiteman Park, which contain potential critical habitat for *Caladenia huegelii* (see Appendix C, Assessment and Refinement of Potential Critical Habitat for *Caladenia huegelii* (T-DRF) within the Development Envelope, Figure 1).

MRWA will provide funding for the development and implementation of a management plan in consultation with DPAW in accordance with the Grand Spider Orchid (*Caladenia huegelii*) recovery plan (DEC, 2009).

Consolidated issue 163 (contributing issue 280): The EPA will confirm the suitability of Ioppolo Road as an offset for both species of black cockatoos, not the OEPA.

Noted. MRWA is aware that it is the EPA that will make the final decision regarding the suitability of any offsets.

Consolidated issue 164 (contributing issue 279): Please provide evidence that Ioppolo Road is suitable for black cockatoos given that the technical report stated the "entire area was adequately surveyed" while not finding any evidence of cockatoos.

The EPBC Act referral guidelines for three threatened black cockatoo species (DSEWPAC, 2012) states 'the lack of detection should not be taken to mean that black cockatoos do not use the site … due to the mobile nature of these birds'.

Two fauna surveys have been completed at Ioppolo Road, including:

- Level 1 fauna survey, including a Black Cockatoo habitat assessment between 8 and 11 July 2014 (Coffey, 2015d).
- Targeted Black Cockatoo survey 11 June 2015 (Coffey, 2015e).

While no evidence of Black Cockatoos was recorded from the site during these surveys, Carnaby's Black Cockatoos were recorded in a neighbouring property and the presence of suitable habitat within the site was confirmed (see Chapter 6):

- 981 ha of Carnaby's Black Cockatoo foraging habitat (including 673.5 ha within Offset Proposal 1).
- 315 ha of Forest Red-tailed Black Cockatoo habitat (including 279 ha within Offset Proposal 1).
- 315 ha of breeding and roosting habitat, including over 6,300 potential breeding trees for both Black Cockatoo species (including 279 ha and 5,580 trees within Offset Proposal 1).

This habitat is within the current modelled breeding and non-breeding range of Carnaby's Black Cockatoo (DSEWPAC, 2012) and within 16 km of a number of significant roost sites at Gingin town site (Finn et al., 2014).

While this habitat is outside the modelled distribution for the Forest Red-tailed Black Cockatoo (DSEWPAC, 2012), DPAW has recently confirmed that there have been regular sightings of Red-tailed Black Cockatoos in the surrounding area including as far north as Bindoon (Errington, pers. comm.). DPAW is currently arranging for these records to be incorporated into their database, which will extend the known range of this species.

DER and DOTE have acknowledged the new information from DPAW and the suitability of this site as an offset for both species of Black Cockatoos for MRWA's Tonkin Grade Separations Project, which adjoins this proposal to the south.

Consolidated issue 166 (contributing issue 290): Please provide detailed information on the proposed on-going management activities for the Ioppolo Road proposed offset site, including funding arrangements.

MRWA will continue to liaise with DPAW to determine the management required for any offsets that involve land acquisition. An agreement will be reached with DPAW on ongoing management in line with DPAW's Corporate Guideline No. 4 Environmental Offsets (December 2014). The details of these activities and funding arrangements for ongoing management will be included in the Land Acquisition and Management Plan and may include such activities as rubbish removal, prevention of third party access, weed and dieback management.

8 RESPONSE TO DEPARTMENT OF PARKS AND WILDLIFE ISSUES

8.1 Flora and Vegetation

Consolidated issue 120 (contributing issue 232): DPAW request that shape files of confirmed PEC and TEC areas be provided to communities.data@dpaw.wa.gov.au (Parks and Wildlife Species and Communities Branch).

This comment is noted. Shapefiles of confirmed areas of TECs and PECs will be provided to DPAW.

Consolidated issue 127 (contributing issue 197): DPAW supports MRWA's commitments for additional targeted surveys (described in PER Chapter 8, Section 8.5) and recommends the results be presented in the context of protected flora species distributions within and outside secure conservation reserves.

MRWA has fulfilled its commitment to complete additional targeted surveys for Threatened and Priority flora, specifically *Millotia tenuifolia* var. *laevis* (P2) and *Meeboldina decipiens* subsp. *decipiens* ms (P3). The results of the targeted surveys are discussed in Chapter 3, Spring Surveys and the reports are attached as Appendices C, D, E and F.

Consolidated issue 147 (contributing issue 219): Recommends that the EMP incorporates monitoring and performance criteria for Threatened and Priority flora, particularly in relation to *M. tenuifolia* var. *laevis* individuals occurring within 50 m of the proposal footprint.

MRWA notes DPAW support for the operational framework set out in the draft EMP (PER Appendix F, Environmental Management Plan) to protect Threatened and Priority flora from accidental disturbance, and the introduction and spread of weeds and dieback.

MRWA will develop and implement a FVMMP to manage impacts on significant vegetation, including threatened flora, priority flora, TECs and PECs. This will include: establishing baseline condition, undertaking monitoring and implementing contingencies should changes to vegetation health and condition be detected (see PER Chapter 8, Flora and Vegetation, Table 8.16 and PER Appendix F, Environmental Management Plan, Table 4.1).

The plan will be prepared in consultation with DPAW. MRWA will review the proposed monitoring program having regard to DPAW's recommendation for monitoring of priority flora within 50 m of the proposal footprint and establishment of associated performance criteria.

Consolidated issue 148: How will the EPA's objectives be met for Priority taxa *Meeboldina decipiens* subsp. *decipiens* and *Millotia tenuifolia* var. *laevis*? More work should be done on surveying and/or translocating these taxa.

Contributing issues:

72: Likely impacts to *Millotia tenuifolia* var. *laevis* and *Meeboldina decipiens* subsp. *decipiens* are potentially significant. As well as extra surveys proposed, *Meeboldina decipiens* subsp. *decipiens* needs to be translocated e.g. to wetlands. More work needs doing.

78: Clarification is sought on how the successful implementation of the EMP regarding Priority taxa *Meeboldina decipiens* subsp. *decipiens* and *Millotia tenuifolia* var. *laevis* will result in the proposal being likely to meet the EPA's objectives.

206: Targeted survey for *Meeboldina decipiens* subsp. *decipiens* (Priority 3) should include potential habitat within Lightning Swamp Bushland and targeted surveys for *Millotia tenuifolia* var. *laevis* should include potential habitat in Whiteman Park.

A follow-up spring survey for *Meeboldina decipiens* subsp. *decipiens* (P3) and *Millotia tenuifolia* var. *laevis* (P2) was conducted by Woodman Environmental from 6 to 9 October 2015 (see Section 3.2).

The collections of *Meeboldina decipiens* subsp. *decipiens* from the survey were re-identified by WA Herbarium staff as *Lepyrodia muirii*, which is not a conservation significant species. The proposal no longer impacts *Meeboldina decipiens* subsp. *decipiens* (P3).

The survey identified a relatively large number of *Millotia tenuifolia* var. *laevis* individuals outside the proposal footprint. A total of 5,222 *Millotia tenuifolia* var. *laevis* individuals were recorded from eight populations in the area covered by the survey, including 1,652 individuals adjacent to (but not within) the development envelope in Cullacabardee. The proposal will impact two populations of *Millotia tenuifolia* var. *laevis* comprising three individuals (see PER Appendix C, Level 2 Spring Flora and Vegetation Assessment). The impact is not significant at a local or regional scale due to the number of individuals identified outside the proposal footprint in Woodman's 2015 survey (see Appendix D, Spring Surveys for *Meeboldina decipiens* subsp. *decipiens* (P3) and *Millotia tenuifolia* var. *laevis* (P2)).

The draft EMP (PER Appendix F, Environmental Management Plan) contains measures to protect Threatened and Priority flora outside the proposal footprint (including *Millotia tenuifolia* var. *laevis* in Cullacabardee Bushland) from accidental disturbance and prevent the introduction and spread of weeds and dieback.

Consolidated issue 170: Please discuss outcome of additional surveys for TEC SCP02 in development envelope, including final residual impacts, revised management, monitoring, mitigations and any amendments to offset proposals.

Contributing issues:

227: If Offset Proposal 3 proves difficult to implement, alternative offset options for the loss of 0.4 ha of SCP02 should be developed and implemented, in consultation with DPAW.

253: Please discuss outcome of additional surveys for TEC SCP02 in development envelope, including final residual impacts, revised management, monitoring, mitigations and any amendments to offset proposals

273: Please resolve inconsistencies in extent of direct impact to TEC SCP02.

275: It is not clear how the >2:1 ratio for TEC SCP02 was determined. The proponent should use the Commonwealth offsets calculator to determine an appropriate offset if SCP02 is confirmed present in the development envelope.

276: Please provide details of the TEC SCP02 spring survey. The proponent will need to provide a suitable offset for SCP02 and justify the rationale used if SCP02 is confirmed.

A targeted spring survey was undertaken on 17 September 2015 to confirm the presence of TEC SCP02 identified in surveys for the PER.

Surveyed quadrats showed the vegetation community most closely resembled SCP04, which is common on the SCP. The additional quadrats occurred in the same supergroup as SCP02 due to similar dominant taxa, but occur within different subgroups. SCP02 does not occur within the proposal footprint.

There is no residual impact to SCP02 and no offset required. The revised management measures are set out in Chapter 13, Summary of Management Measures.

Further information can be found in Chapter 3, Spring Ecological Surveys. The supporting report is attached as Appendix E, Spring Surveys and Analysis to Investigate SCP02 Presence.

Consolidated issue 185 (contributing issue 295): MRWA should quantify the environmental values of conservation estates and identify the % remaining in each estate.

Presentation of potential impacts as a percentage of remaining vegetation, habitat or individuals within the affected reserves and the entire conservation estate is not possible, as the overall extent of these values in the conservation estate in the Swan Coastal Plain is not known or not publicly available. Vegetation, habitat and individuals have been mapped in the study area. This information and publicly available information on the distribution of ecological communities and species in the bioregion has been used to undertake the assessment. The occurrence or potential for ecological communities and species to exist beyond the study area (which encompasses the development envelope and proposal footprint) informed the assessment of significance of impact that is presented in PER Chapter 8, Flora and Vegetation and PER Chapter 15, Amenity (Reserves). PER Chapter 15, Amenity (Reserves) Tables 15.1 and 15.2, which detail impacts to the conservation estate, have been updated and are presented in the response to consolidated issue 158.

Table 8.1 shows the impact of the proposal on the conservation estate using vegetation complexes. The table compares the extent of vegetation complexes in conservation estate in secure tenure in the Perth-Peel Region pre- and post-construction using the 2015 assessment of remnant vegetation. Table 8.1 shows that in all but one instance, the proposal will impact less than 0.1% of vegetation complexes in the conservation estate. The impact on Bassendean Complex–North Transition results in a 0.4% reduction in that complex within the conservation estate.

Table 8.1 Extent of vegetation complexes in conservation estate in the Perth-Peel Region pre- and post-construction

Vegetation complex	PPR 2015 extent (ha)	PPR Secure for Conservation (ha)	PPR Secure for Conservation	Extent of impact on conservation areas (ha)	PPR Secure for Conservation (post-construction)
Bassendean Complex - Central and South	13,486	733	5.4%	2.1	5.4%
Bassendean Complex - North Transition	3,948	2,200	55.7%	17.7	55.3%
Bassendean Complex - North	23,859	9,092	38.1%	24.7	38.0%
Southern River Complex	6,936	629	9.1%	–	9.1%
Yanga Complex	777	247	31.8%	–	31.8%

Consolidated issue 186 (contributing issue 223): Impacts to GDEs (including Mound Springs SCP TEC) and management of those impacts.

MRWA is committed to preparing and implementing a Wetland and Drainage Management and Monitoring Plan (WDMMP), which includes a groundwater monitoring procedure to detect changes in groundwater levels, to ensure impacts to wetlands (and GDEs and vegetation mapped in association with these wetlands) are being appropriately managed.

Dewatering and abstraction will be temporary and associated with each stage of development. Existing bores will be used where available and where unavailable, new bores may need to be constructed. Groundwater bores will be operated in accordance with existing or new licences (see PER Chapter 10, Hydrological Processes and Inland Water Environmental Quality, Section 10.4.4.2).

Proposed dewatering locations are remote from Mound Springs SCP TECs and any new water abstraction bores will be located to avoid drawdown affecting wetlands and Mound Springs SCP TECs. As the location of existing and new groundwater bores will be identified in each stage of the development, a water balance will be problematic. Groundwater monitoring pre-, during and post-construction will detect changes outside seasonal variation. As wetlands potentially affected by the proposal are dependent on expressions of groundwater, the proposed monitoring program will provide an early indicator of change.

As discussed in PER Chapter 10, Hydrological Processes and Inland Waters Environmental Quality, Section 10.4.8, it is not anticipated that Mound Springs SCP TECs will be impacted by any potential contamination off the highway.

8.2 Terrestrial Fauna

Consolidated issue 117 (contributing issue 235): DPAW should be provided an opportunity to contribute to, and comment on, the planned development of an EMP relating to fauna management.

MRWA is committed to ongoing consultation with DPAW in the development of the construction EMP.

8.3 Hydrological Processes and Inland Waters Environmental Quality

Consolidated issue 76 (contributing issue 237): The estimated loss of wetland values and the extent of wetlands to be monitored should include wetlands that may retain values commensurate with CCWs despite not being mapped as CCWs.

Multiple use wetlands (MUWs) were evaluated against DPAW's Preliminary Evaluation Criteria for determining the potential of a candidate wetland to contain values commensurate with a CCW (DPAW, 2013a). The evaluations were undertaken using information available from investigations conducted for the PER and other publicly available data. The evaluations of MUWs 8464, 15030 and 15200 were inconclusive as to whether these wetlands could contain values commensurate with CCWs. MUW 15732 was unable to be properly assessed due to its large extent, extensive cleared areas and agricultural land uses. The floodplain wetland generally does not contain values commensurate with a CCW. On the basis of the inconclusive evaluations, elevation of these wetlands to a higher classification is not warranted.

A WDMMP will be developed and implemented including groundwater monitoring to ensure impacts to wetlands are appropriately managed and there are no unforeseen impacts (see PER Chapter 10, Hydrological Processes and Inland Waters Environmental Quality, Section 10.5). The WDMMP will consider the conservation status and proximity of wetlands to the proposal. The plan is likely to include monitoring of CCWs 15028 and 15033, which are adjacent to MUWs 8464, 15030 and 15200 and together form an extensive wetland. The Wetland Management and Monitoring Plan will be provided to the OEPA, DOW and DPAW for review/comment.

Consolidated issue 77: Impacts from and management of dewatering and groundwater abstraction.

Contributing issues:

49: How close to wetlands 8800 and 8801 will dewatering take place? What limits will there be on dewatering? How will dewatering impacts to wetlands be managed?

94: Dewatering during construction doesn't mention the impact to local residents that rely on groundwater for domestic/stock water.

145: Wetlands are already dry and construction dewatering, as well as subsurface compaction, must be minimised.

155: How will dewatering and water abstraction be monitored and addressed? In particular: abstraction rates, bore operating regimes, hydrogeology of bores, impacts to environmental values from drawdown, and existing groundwater licences.

204: During construction will there be dewatering near Maralla Road? If so, how will dewatering be managed especially with regard to wetland CCW 8800 and *Caladenia huegelii*?

230: How has construction water allocation been licensed properly? How has existing local over allocation of water been accounted for?

231: Will there be monitoring of the environments likely to be affected by water abstraction during construction?

242: That the potential for indirect impacts on wetlands be minimised by restricting to summer months, the construction of footings for bridges and utility services at locations where dewatering would be likely to lower the water table in CCWs.

243: The potential for indirect impacts on wetlands should be minimised by managing drawdown associated with extraction bores in the vicinity of CCWs to maintain groundwater at depths that will not result in significant impacts on wetlands.

Where practical, construction of bridge footings will be scheduled during summer to avoid or minimise dewatering requirements. If dewatering is required, dewatering methods (e.g. well-point spears) that minimise the radius of influence in confirmed areas of ASS and on sensitive receptors (e.g. wetlands) will be utilised (see PER Chapter 10, Hydrological Processes and Inland Waters Environmental Quality, Section 10.5). A dewatering licence will be obtained from the DOW under the *Rights in Water and Irrigation Act 1914* (RIWI Act) for any dewatering activities undertaken.

If works are undertaken during the wet season construction dewatering will potentially be required at eight locations to enable bridge footing construction. Of these eight locations, only two locations (Reid/Tonkin interchange and Stock Road interchange) have wetlands within the modelled drawdown radius of influence of up to 500 m (see PER Appendix L, Position Paper – Groundwater Level Impact from Construction Dewatering and Groundwater Abstraction, Table 1). Dewatering, if required, is expected to last up to six weeks.

MUW 8785 and MUW 8784 (former EPP Lake 450) are located adjacent to the Stock Road interchange. These wetlands have been degraded by clearing and grazing. Wetlands CCW 15028 and a large part of CCW 15033 will be removed to construct the Reid/Tonkin interchange (see PER Chapter 10, Hydrological Processes and Inland Waters Environmental Quality, Section 10.4.6.3). No bridge structures or dewatering is proposed at Maralla Road in the vicinity of wetlands CCW 8800 and Resource Enhancement Wetland (REW) 8801 or *Caladenia huegelii* habitat.

The requirement for dewatering was determined based on a review of groundwater levels in existing bores (including DOW Gnangara Mound bores) reported over a period of 40 to 50 years, which was undertaken as part of the design groundwater level study for the proposal (Golder, 2015a, b, c). Groundwater data collected over this period indicates the seasonal variation (wet season to dry season) in groundwater ranges between 1.0 m and 2.0 m. Hydrographs of the bores showed two periods of step change in groundwater levels, one associated with development of the Gnangara Mound as a public drinking water source and the other associated with the installation of subsoil drains to enable land development.

Construction of the proposal will require a supply of water for construction purposes at various locations along the alignment. Abstraction will be temporary and associated with each stage of development. While construction water requirements will not be known until detailed final design work has been carried out, construction water is likely to be sourced from existing bores in accordance with existing licences where possible. Should existing bores or licences be unavailable, new bores may need to be constructed and licenced in accordance with DOW requirements (see PER Chapter 10, Hydrological Processes and Inland Waters Environmental Quality, Section 10.4.4.2). The DOW considers existing groundwater user licence allocations during the licence application process.

The location and number of construction water abstraction bores proposed to be used (new and existing) will be assessed against a detailed hydrogeological model. Hydrogeological modelling will account for the proposed parameters of the bore as well as the hydrogeology of the proposed bore site. Preferentially, each construction water bore required will be sited such that no wetlands are located within the modelled drawdown radius of influence for the bore, thereby avoiding indirect hydrological impacts to wetlands as a result of drawdown. Where it is not possible to site a bore such that no wetlands occur within its drawdown radius of influence, the operating parameters of bores will be limited such that modelled changes to groundwater levels at wetlands remain within usual seasonal variations for those wetlands (see PER Chapter 10, Hydrological Processes and Inland Waters Environmental Quality, Section 10.4.6.3). Any impact to wetlands from drawdown is expected to be short-term and localised.

Step changes in groundwater levels as a result of construction (including dewatering and water abstraction) will be detected by a groundwater monitoring program as part of a WDMMP to protect public drinking water supply and to protect wetlands. The information presented in Golder (2015a, b, c) will be used to set

trigger levels for the target aquifers and wetlands. The WDMMP will be prepared in consultation with DPAW and the OEPA.

A dewatering management plan (including ASS management) will also be developed and implemented in support of any application for dewatering and a groundwater licence operating strategy will be developed and implemented as necessary to support the supply of construction water. These plans will include monitoring of abstraction rates. Opportunities for alternative construction water sources will also be investigated during project delivery.

8.4 Amenity (Reserves) and European Heritage

Consolidated issue 34 (contributing issue 244): MRWA should continue to work with the Swan Coastal District office of DPAW regarding the translocation of heritage cork trees and the reestablishment of fencing and access ways associated with DPAW managed lands.

MRWA will continue to work with DPAW on the preparation of detailed site plans and specifications to minimise impacts on Dick Perry Reserve. The plans and specifications will document:

- MRWA's commitment to retain and translocate heritage cork trees.
- Maintenance of access through connections to the PSP which forms part of the proposal.
- Fencing, the designs for which will reflect the requirements of bordering properties.

8.5 Environmental Offsets

Consolidated issue 15: Should Ioppolo Road not comprise critical habitat for *Caladenia huegelii*, an alternative offset package should focus on the management and protection of existing populations or critical habitat, rather than on translocation options.

Contributing issues:

217: Should Ioppolo Road not comprise critical habitat for *Caladenia huegelii*, an alternative offset package focus on the management and protection of existing populations or critical habitat, rather than on translocation options.

288: Please provide details of the spring survey at Ioppolo Road to determine presence of *Caladenia huegelii* critical habitat. If Ioppolo Road is not suitable, an alternative offset will need to be provided.

(Repeated from Section 7.6)

The Ioppolo Road offset site does not contain suitable habitat for *Caladenia huegelii*. An alternative offset package has been proposed (see Chapter 6, Offsets). Offset Proposal 3 offsets the loss of 31.9 ha of potential critical habitat for *Caladenia huegelii*.

MRWA is proposing to provide funding for a period of 10 years for the ongoing management of existing reserves 46919, 46875, Bush Forever site 300 and Whiteman Park, which contain potential critical habitat for *Caladenia huegelii* (see Appendix C, Assessment and Refinement of Potential Critical Habitat for *Caladenia huegelii* (T-DRF) within the Development Envelope, Figure 1).

MRWA is proposing to provide funding for the development and implementation of a management plan in consultation with DPAW in accordance with the Grand Spider Orchid (*Caladenia huegelii*) recovery plan (DEC, 2009).

Consolidated issue 17 (contributing issue 240): Offset Proposal 2 'Conservation of Land Comprising CCWs' should be refined to align as far as practicable with the types of impacted wetlands within each consanguineous suite.

Chapter 6, Environmental Offsets presents the proposal's revised offset strategy. Where possible offset sites will be selected that:

1. Protect and/or restore values to a commensurate or greater value than those impacted.
2. Are located as close to the proposal as possible, unless it can be demonstrated that an offset site achieves item one above (e.g. wetland offsets within the same consanguineous suite).

9 RESPONSE TO DEPARTMENT OF WATER ISSUES

Consolidated issue 69: Location of bio-retention basins with respect to production bores.

Contributing issues:

93: The Drainage Management Plan should commit to future consultation with DoW on bio-retention basin locations and other water quality mitigation measures.

246: A minimum of 100 m distance should separate production bores and bio-retention basins.

The proposal intercepts 12 wellhead protection zones (WHPZs) and comes within 15 to 30 m of the associated drinking water production bores (see PER Chapter 10, Hydrological Processes and Inland Waters Environmental Quality, Section 10.4.5). The proximity of the proposal to these wells makes it impractical to locate all water quality mitigation measures (e.g. bio-retention swales) 100 m from all production bores or outside the WHPZs. The Drainage Strategy's primary objective within the P1 zone is the protection of the Gnangara Groundwater Mound. Within WHPZs, water quality will be addressed by the provision of bio-retention swales, sized to treat the common rainfall event, with excess runoff directed away from the bores. All proposed infiltration basins (including bio-retention basins) will be at least 100 m from production bores.

The current Drainage Strategy (PER Appendix H) has been developed in consultation with the DOW and in accordance with the DOW's principles of water resource management, as detailed in the Stormwater Management Manual for Western Australia (DOW, 2004a) and the Decision Process for Stormwater Management in Western Australia (DOW, 2009). MRWA is committed to ongoing liaison with the DOW through the proposal's development and construction to ensure protection of the production bores. A detailed infrastructure plan will be prepared for each stage of the development prior to construction to ensure that the proposal is designed and constructed in accordance with the Drainage Strategy. This will include details of key elements including the location and dimensions of culverts, bio-retention swales and infiltration basins.

Consolidated issue 79: Consideration of Gnangara UWPCA and how potential impacts and management are addressed in EMP.

Contributing issues:

90: The EMP does not clearly state the importance of the Gnangara UWPCA. It should be revised to do so and also to refer to the appropriate policies and Water Quality Protection Notes (WQPNs).

91: The EMP omits details on the quality of water used for dust suppression. The water should be of the highest quality.

92: The EMP should commit to working closely with Water Corporation in the P1 and P3 areas. Regular joint inspections between Water Corp and MRWA should be included. Accidental spills should be reported to Water Corp.

MRWA will ensure that bores and associated infrastructure installed for the proposal are available for inspection by Water Corporation representatives at all stages of the construction. MRWA will undertake joint inspections with Water Corporation on a quarterly basis during construction. The construction EMP will be revised to include a commitment to work closely with Water Corporation during construction. MRWA will report accidental spills of fuel and chemicals greater than 5L within the P1 and P3 area to the Water Corporation.

The construction EMP will emphasise the importance of the Gnangara Underground Water Pollution Control Area (UWPCA) and refer to the appropriate policies and Water Quality Protection Notes. The temporary storage of fuel and other chemicals in the P1 area is allowed under SPP 2.2 for the purposes of construction with appropriate conditions. MRWA proposes that all fuel and chemicals be stored in a double skin tank and placed in bunds capable of storing 125% of the capacity of the largest tank. Spill response kits will be available during refuelling which will be conducted outside WHPZs. Individual fuel storage tanks will not exceed 5,000 L capacity within the P1 area.

MRWA intends to use groundwater or scheme water for compaction and dust suppression. Existing bores will be used where possible and subject to licence conditions. Where unavailable, new bores will be installed and operated in accordance with the licence conditions.

Consolidated issue 80 (contributing issue 89): Impacts to the P1 UWPCA have not been properly considered. Construction impacts need to be considered further in consultation with the DOW, and approval may be required.

Several state planning policies and DOW guidelines (e.g., Water Quality Protection Note No. 25 (DOW, 2004b)) identify activities that are potentially incompatible with UWPCAs. Aspects of the proposal that are potentially incompatible with UWPCAs include construction laydown areas, stockpiles, hazardous materials storage and refuelling.

Locations of construction infrastructure and activities have not yet been determined. MRWA met with the DOW in November 2015 to discuss the types of activities that may be conducted in the Gnangara UWPCA Priority 1 areas. The meeting identified management measures that will be requirements of an approval including specification of doubled-lined bunded fuel storage tanks in the Priority 1 area, with maximum individual tank capacity of 5,000 L.

A construction EMP will be prepared and include relevant policies, guidelines and management measures to be employed to manage impacts to the P1 UWPCA. DOW approval will be required for any activities proposed within the UWPCA that are considered incompatible activities under the relevant policies.

10 RESPONSE TO DEPARTMENT OF ENVIRONMENT REGULATION ISSUES

Consolidated issue 11 (contributing issue 239): Contaminated sites do not appear to have been addressed in the PER. However, the contaminated sites register suggests one or more possibly contaminated sites may be in close proximity to, or within, the proposed alignment.

The form, content and public review period of the PER document was determined by the EPA as set out in the proposal's ESD dated March 2014 (PER Appendix B, Environmental Scoping Document). Land contamination was not identified as a preliminary key environmental factor in the ESD and so was not assessed in the PER.

MRWA will comply with its obligations under the *Contaminated Sites Act 2003* (CS Act) regarding the identification and management of contamination within the proposal footprint. A number of studies have already been undertaken and further consultation with the DER (Contaminated Sites Branch) will be conducted.

Consolidated issue 53 (contributing issue 241): The noise modelling calibration value is not appropriate and likely results in an underestimation of the traffic noise impact.

The technical issues raised with regard to noise model calibration have been resolved in the revised transportation noise report (Appendix I, Revised Transportation Noise Assessment). A calibration factor of -0.6 dB was adopted for the revised assessment based on monitoring undertaken on the GNH and consultation with DER. The description of the calculation of the calibration factor and the results of the revised assessment are presented in Chapter 4, Amenity (Noise and Vibration), sections 4.1.1 and 4.2, respectively.

Consolidated issue 62: Management of acid sulfate soils (ASS).

Contributing issues:

154: How will ASS be managed?

238: Recommendations in the PER regarding further investigations to inform specific management of ASS are generally consistent with DER guidelines as applicable to large-scale linear projects.

DER noted "recommendations in the PER regarding further investigations to inform specific management of acid sulfate soils are generally consistent with DER guidelines as applicable to large scale linear projects."

Following final design and the definition of likely soil disturbance, a detailed ASS investigation will be undertaken to inform the development of an ASS Management Plan. PER Chapter 10, Hydrological Processes and Inland Waters Environmental Quality, Table 10.9 outlines proposed management strategies including the use of spread footings in final design where sands are deemed suitable to support structures at raised interchanges, to minimise the extent of any anticipated disturbance to ASS.

This page is intentionally blank.

11 RESPONSE TO OTHER GOVERNMENT AGENCY ISSUES

11.1 Department of Aboriginal Affairs

Consolidated issue 43: Aboriginal heritage sites with significance should be avoided and protected in a manner acceptable to the local Nyungah people.

Contributing issues:

160: Aboriginal heritage sites with significance should be avoided and protected in a manner acceptable to the local Nyungah people.

179: Any potential impacts to Aboriginal heritage from the proposal can be addressed through the proposed Aboriginal Heritage management Plan and the provisions of the *Aboriginal Heritage Act 1972* (e.g. Section 18 consent).

Where possible, Aboriginal heritage sites will be avoided and protected. However where disturbance of Aboriginal heritage sites is required consent to disturb an Aboriginal site under Section 18 of the *Aboriginal Heritage Act 1972* (AH Act) will be obtained.

Members of the Nyungah (Noongar) community were involved in field surveys for Aboriginal cultural heritage (see PER Appendix Q, Ethnographical Aboriginal Heritage Survey and PER Appendix R, Aboriginal Archaeological Assessment).

The management process developed to monitor and minimise impacts to Aboriginal archaeological records is supported by the Noongar people (see PER Appendix R, Aboriginal Archaeological Assessment).

PER Chapter 13, Aboriginal Heritage, Section 13.4 sets out the measures to be incorporated in an Aboriginal Heritage Management Plan. The measures incorporate the recommendations set out in PER Appendix R, Aboriginal Archaeological Assessment.

11.2 Department of Lands

Consolidated issue 21 (contributing issue 59): Proponent must seek approval to develop within Dampier to Bunbury Natural Gas Pipeline (DBNGP) corridor. Registration of new interests in corridor is not allowed.

MRWA is currently negotiating with DBP Transmission in relation to the approvals required to construct the proposal within the Dampier–Bunbury Natural Gas Pipeline (DBNGP) corridor.

Consolidated issue 63 (contributing issue 60): Proponent must ensure major water flows do not impact the DBNGP corridor.

Through the implementation of the proposal's Drainage Strategy (PER Appendix H) Main Roads will ensure that major water flows do not impact the DBNGP corridor. Main Roads will continue to liaise with the DOL and other stakeholders during design and construction to ensure that impacts on the DBNGP corridor are avoided or mitigated.

Without management and control measures, the proposal has the potential to alter surface water flow from earthworks (e.g., cut and fill) and crossing/impounding of waterways and wetlands. The assessment of impacts associated with altered surface water flow is outlined in PER Chapter 10, Hydrological Processes and inland Waters Environmental Quality, specifically Section 10.4.2. One of the main controls in the

management of hydrological impacts associated with the proposal is the implementation of the proposal's drainage strategy during design and construction. The objective of the drainage strategy is to maintain drainage across the site to as close as practicable to the pre-development condition. This strategy has influenced the design of the proposal and informed a number of the hydrological mitigation and management strategies, including the provision of sufficient drainage structures to maintain surface water flows in watercourses, drainage lines and to wetlands (see PER Chapter 10, Hydrological Processes and inland Waters Environmental Quality, Section 10.4.2 and Section 10.5).

11.3 Department of Planning

Consolidated issue 4 (consolidated issue 192): During the MRS and subsequent planning phases, the DOP will work with MRWA and Department of Transport to address the public transport network, zoning changes and noise mitigation measures.

The DOP's support for the proposed alignment is noted. MRWA will work with DOP and Department of Transport (DOT) during the MRS and subsequent planning phases.

Consolidated issue 39: The proposal is supported.

Contributing issues:

3: General support for the proposal.

57: Submission supports PDNH and believes it will reduce traffic congestion on GNH.

190: The proposal is supported.

The comment is noted.

12 RESPONSE TO ISSUES RAISED BY THE PUBLIC

12.1 Proposal Background and Justification

Consolidated issue 37 (contributing issue 181): What evidence shows that PDNH will significantly decrease traffic through the Swan Valley?

Extensive traffic modelling has been undertaken for the proposal. NorthLink WA has utilised MRWA's strategic traffic model, the Regional Operations Model (ROM). The ROM is a 24-hour multi-modal model of the Perth Metropolitan road network, which uses information on existing and forecast population and employment statistics obtained from DOP and Local Government authorities. It has been calibrated against existing traffic volumes. The proposed highway has been incorporated into the model and a number of different scenarios modelled including different forecast years and different options for the future road network.

ROM has been used to understand the traffic implications on surrounding routes such as Lord Street, West Swan Road and GNH. The model shows a significant shift in demand from GNH to the proposed highway, particularly for freight and regional traffic. It also shows a decrease in demand along Lord Street and West Swan Road compared to a scenario where the proposal is not constructed.

The proposal will be constructed as a high capacity, free-flowing (no traffic signals), high speed route. Travel times will be faster than competing routes such as GNH, which are generally lower speed and have traffic signals. ROM has shown that a trip along Tonkin Highway and this proposal from Kewdale to Muchea will be 10 to 15 minutes faster than the current route along Roe Highway and GNH. Signage (including electronic message signs) will show the reduced travel times along PDNH reinforcing the benefits of using this route.

Consolidated issue 38 (contributing issue 186): Do the benefits of this proposal outweigh the costs?

The financial costs and benefits of road projects are evaluated through cost benefit analysis process. The cost benefit analysis is documented in the business case for the proposal which confirms that the benefits greatly outweigh the costs.

Consolidated issue 39: The proposal is supported.

Contributing issues:

3: General support for the proposal

57: Submission supports PDNH and believes it will reduce traffic congestion on GNH.

190: The proposal is supported.

(Repeated from Section 11.3)

The comment is noted.

Consolidated issue 40 (contributing issue 182): The upgrading of GNH has been overlooked although it presents fewer environmental constraints.

A comprehensive upgrade of GNH was considered at a number of stages during the development of the proposal. The upgrade of GNH was deemed an unsuitable option due to the following:

- The intensity of land development along the section of GNH through the Swan Valley means there are several access locations which are not conducive to the operation of a safe and efficient freight route.
- There are numerous constraints including interfaces with existing rail tracks and corridors.
- There is considerable community concern with the current high level of freight traffic on the route including speed limits at a school in the southern section of the GNH.

Freight efficiency along this route could not be achieved due to the inability to upgrade GNH to a controlled access highway with appropriate grade separations.

12.2 Route Selection Development

Consolidated issue 41: Mapping and surveying of vegetation associations and good quality vegetation should have occurred at an earlier stage so it could be avoided during route selection.

Contributing issues:

183: Number of vegetation associations to be lost is too great. Mapping should have occurred at an earlier stage so they could be avoided during route selection.

185: Earlier surveys would have resulted in avoiding areas of native vegetation good and above to the west of Ellenbrook.

The availability of the detailed vegetation association mapping acquired and presented in PER Chapter 8, Flora and Vegetation, Figure 8.6 has influenced refinement of the alignment within the development envelope but would not have influenced the location of the development envelope or highway corridor. Corridor options to the west would have fragmented Bush Forever sites 300 and 399, both large contiguous tracts of remnant vegetation in very good to pristine condition. The proposed alignment of the highway avoids the majority of pristine, pristine to excellent and excellent to very good vegetation in the development envelope. Located adjacent to Ellenbrook residential area, the proposed alignment minimises impacts on the conservation estate and known location of *Caladenia huegelii*.

PER Chapter 3, Route Selection and Development, Section 3.3 presents details of the environmental constraints assessment that was undertaken on potential alignments. This assessment considered factors such as Bush Forever sites and conservation and ecologically sensitive areas. The survey effort and assessments completed were proportional to the stages of the proposal's development.

PER Chapter 4, Detailed Description of Proposal, Section 4.2.3 discusses changes to the design as a result of studies undertaken as part of the PER and PER Chapter 8, Flora and vegetation, specifically Section 8.5, discusses how changes to the proposal have reduced the proposal's overall impact to flora and vegetation values. Nearly 80% of the proposal footprint occurs within vegetation mapped as degraded or worse condition.

12.3 Detailed Description of Proposal

12.3.1 Footprint Minimisation

Consolidated issue 27: Clearing footprint should be minimised further through placement of proposal components such that fragmentation of vegetation and habitats is minimised.

Contributing issues:

61: Clearing of vegetation needs to be minimised especially in areas such as the interchange at The Promenade and behind Ellenbrook. Width of fragmented vegetation is excessive. Noise walls and wire rope barriers should be used to reduce highway width.

64: Which side of the PDNH will the PSP be? It should be located so as to minimise fragmentation.

75: Clearing footprint can be further reduced through use of wire rope barriers, increasing batter slopes, following natural contours, not clearing all vegetation, reducing table drain sizes, reducing fire track requirement, routing PSP through cleared area.

The Promenade interchange and section of highway adjacent to Ellenbrook have been designed to reduce fragmentation of conservation estate (Bush Forever site 300), avoid *Caladenia huegelii* habitat and minimise impacts to Black Cockatoo foraging and roosting habitat. Protection of the threatened species and habitat results in fragmentation of the Bush Forever site. The fragment also arises from community feedback requesting the highway be aligned adjacent to the western boundary of the development envelope to reduce noise impacts on residences (see PER Chapter 4, Detailed Description of Proposal, Table 4.1).

The PSP (pedestrian/cycle path) will be on the west side of the proposed highway south of Baal Street, Cullacabardee and east of the proposed highway north of Baal Street. The path will be located adjacent to the southbound carriageway adjacent to Ellenbrook to avoid *Caladenia huegelii* and minimise impacts to Black Cockatoo foraging and roosting habitat.

Wire rope barriers are proposed for the full extent of the proposal. They facilitate embankment slopes at 1 (V):3(H) but do not reduce the footprint significantly due to the relatively flat terrain. The width of the highway will be minimised by the installation of road safety barriers between the northbound and southbound carriageways. Vegetation will be cleared from the back slopes of drains to facilitate construction and maintenance. Table drain size is dependent on the catchment and expected runoff. The drains are designed to avoid flooding of the highway carriageways. Fire tracks will be designed to minimise clearing of significant vegetation.

Consolidated issue 42 (contributing issue 184): There is an opportunity in Beechboro Road to move the alignment into some degraded vegetation instead of through excellent/very good vegetation.

The degraded vegetation adjacent to Beechboro Road (PER Chapter 8, Flora and Vegetation, Figure 8.6A) is an easement for a 330 kV transmission line. Western Power has identified land adjacent to the easement as a state significant corridor for future expansion of the electricity network. Locating the highway on or adjacent to Beechboro Road would constrain this corridor.

12.3.2 Interchanges

Consolidated issue 28 (contributing issue 99): The Whiteman to Yanchep Highway bifurcation should be relocated immediately north of Gnangara Rd to avoid unnecessary excision of 8 ha from Whiteman Park and reduce number of interchanges from 2 to 1.

The Whiteman to Yanchep Highway bifurcation was designed to ensure the most direct routes and to avoid a large freeway to freeway interchange that would have increased the overall proposal footprint. The configuration of the interchange enables vehicles to maintain speed through the intersection, improving traffic flow and the efficiency of the highway. Moving the interchange north of Gnangara Road would reduce impacts on Whiteman Park but would make connection to Gnangara Road more complex and increase the proposal footprint and impact on State Forest. The existing 330 kV transmission line easement adjacent to Beechboro Road precludes using this road for the proposed highway.

Consolidated issue 29: There should/shouldn't be an interchange at Maralla Road.

Contributing issues:

58: Maralla Road interchange should be added to reduce distance between interchanges at The Promenade and Neaves Road. It would also enable future development north of Ellenbrook.

50: Maralla Road interchange is opposed. If interchange is required between Promenade and Stock Road, it should be located at Warbrook Road.

213: The proposed interchanges are supported, however any suggestion by developers to include an interchange at Maralla Road should be refused on grounds of Maralla Road's environmental and heritage values.

No interchange is proposed at Maralla Road. Interchange locations for the proposal have been selected based upon current land use planning, including the current Perth to Peel @ 3.5 million strategy (WAPC, 2015). Current land use planning does not require an interchange at Maralla Road. The assessment process required for any future proposals including new interchanges will be subject to determination by the relevant statutory authority at the time of referral.

12.3.3 Local Roads

Consolidated issue 30 (contributing issue 53): Will Maralla Road west of PDNH alignment retain its name?

No change to the naming of Maralla Road is proposed as a result of the proposal. Emergency services will be notified of the changed access arrangements.

Consolidated issue 31: When will Halden Road extension begin construction? Will it be sealed bitumen?

Contributing issues:

52: Will Halden Road extension to Maralla Road be sealed bitumen?

54: When will Halden Road extension begin construction?

Halden Road will be constructed ahead of part of Maralla Road being closed for construction of the proposal. Construction of the proposal is planned to start in 2016–17 and will proceed in a staged approach. The exact timing of construction of the Halden Road extension is to be determined. It is proposed that Halden Road be a sealed road.

Consolidated issue 32 (contributing issue 63): Why are Maralla Road and Halden Road being upgraded and to what extent? Good quality vegetation will be damaged.

Maralla Road and Halden Road are being upgraded to maintain access to properties along Maralla Road whose access to the east will be cut off by construction of the proposed highway. Maralla Road will be upgraded to a two lane 7-m-wide road and sealed. Emergency access gates will be installed in the highway reserve fence at the Maralla Road cul-de-sacs to enable emergency vehicle access and a secondary evacuation route for residents.

12.3.4 Other Issues

Consolidated issue 25: Accuracy of information used in decision-making processes and surveying for clearing.

Contributing issues:

148: How is the correct surveying of construction/clearing footprint assured, given inaccuracies in spatial data for EPP lakes?

233: Previous decisions and discussions have been made on the basis of incorrect information.

The location and extent of Environmental Protection (Swan Coastal Plain Lakes) Policy 1992 lakes (EPP lakes) were wetlands with surface water at 1 December 1991. Geomorphic wetland mapping started in 1992 was based on digitised 1:25,000 scale maps held in the Wetlands of the Swan Coastal Plain Volume 2B Wetland mapping, Classification and Evaluation: Wetland Atlas (Hill et al., 1996). Discrepancies in the boundaries of wetlands maintained in Western Australia Government spatial data libraries reflects the different map bases used to map the extents of EPP lakes and geomorphic wetlands. Satellite imagery shows the proposal footprint avoids wetland vegetation associated with CCW 8800 and REW 8801, as reported in PER Chapter 10, Hydrological Processes and Inland Water Environmental Quality, Table 10.3. Note that the EPP Lakes Policy was revoked on 20 November 2015, as a result EPP lakes are no longer recognised.

MRWA is committed to delineating the proposal footprint ahead of clearing to ensure disturbance is restricted to the proposal footprint.

MRWA will be responsible for auditing the proposal during construction to ensure compliance with conditions. The OEPA and DOTE may conduct audits on implementation of approval conditions, including compliance with nominated buffers and clearance boundaries. Where required by the OEPA or the DOTE, MRWA will commission an independent auditor.

Consolidated issue 26 (contributing issue 65): An intermodal road/rail transfer hub near Muchea is required to reduce road freight. This planning failure needs to be rectified as part of this proposal.

An objective of the proposal is to improve the capacity, efficiency and productivity of the road network including freight movements. The proposal is not contingent on the provision of freight logistics facilities. The concept design includes provision for a road train assembly area and traveller's rest area in the vicinity of the GNH and Brand Highway at Muchea (PER Chapter 4, Detailed Description of Proposal, Section 4.8).

The Western Australia Planning Commission (WAPC) has prepared Amendment 1219/41 to the MRS. The amendment proposes rezoning land south of RAAF Pearce for the proposed South Bullsbrook Industrial Precinct which includes land set aside for an intermodal freight terminal. The freight terminal, if built, would be accessed from the Stock Road interchange.

12.4 Regulatory Context

Consolidated issue 22 (contributing issue 18): What impact could Department of Defence (DOD) lack of endorsement for the final alignment have on the proposal?

MRWA will continue to work with the Department of Defence (DOD) with the regard to the negotiation and transfer of this land under the Commonwealth Property's Disposal Policy. It is anticipated that the Defence Land required for the proposal will be available prior to the proposal's scheduled commencement date.

The development envelope is zoned as a Primary regional road in the MRS (Metropolitan Region Scheme, Map Sheet 8).

Consolidated issue 23 (contributing issue 66): Principle 4 (improved valuation, pricing and incentive mechanisms) under Section 4A of EP Act has not been properly addressed. Sections on Infrastructure Sustainability Council of Australia (ISCA) are light on detail and are inadequate.

The proposal design, scoping of environmental investigations and development of management measures has taken into account the value of social and environmental resources and impacts. Part of the alignment definition study included an assessment of potential physical constraints on the alignment including topography, development, major infrastructure, DOD facilities, watercourses, wetlands, rare flora, indigenous and non-indigenous heritage sites. Impacts on the following were avoided where possible or minimised:

- Wetlands, Bush Forever sites, rare flora and trees.
- Indigenous and non-indigenous heritage sites.
- Property severance, access and water supply.

The development and design of the proposal captures environmental and socio-economic aspects through the up-front alignment definition study, stakeholder and community consultation and expert technical advice.

In addition, MRWA has ensured that the proposal follows the principles relating to improved valuation, pricing and incentive mechanisms through use of the Infrastructure Sustainability Council of Australia (ISCA) rating tool. The ISCA rating tool provides a framework for focusing on sustainability and driving performance, and a method for capturing good practices in project delivery and measuring improvements in performance over time.

The proposal was registered with ISCA to receive a Design and an As-Built Rating, with planning towards this rating commencing during project development. While the ISCA rating tool is designed for application through the design and construction stages, MRWA and ISCA have used the proposal to explore its use at these earlier stages as a means of maximising project sustainability, the first time this has been done by MWRA.

Consolidated issue 24 (contributing issue 67): Principle 5 (waste minimisation) under Section 4A of EP Act has not been addressed. Waste minimisation does not appear to have been thought about at all.

Environmental Principle 5, Waste minimisation is discussed in PER Chapter 5, Regulatory Context, Waste. In a road construction project context, waste includes clearing residue, excess spoil requiring disposal, acid sulphate soils requiring treatment and/or disposal, wastewater discharge (e.g., trench and foundation seepage), waste road surfacing material, waste concrete, packaging, waste oil filters and rags etc. from vehicle, plant and equipment servicing, and general and domestic waste from site offices and amenities..

MRWA will ensure that all construction activities are carried out in accordance with the principles of cleaner production and waste minimisation in accordance with its Environmental Policy (MRWA, 2004).

A construction EMP (CEMP) will incorporate waste management measures and conditions of approval relevant to construction. The measures will need to demonstrate management in accordance with the waste hierarchy, giving preference to avoidance and recovery.

Examples of waste management strategies that will be employed for the proposal include:

- Balance cut and fill material to minimise spoil disposal. Fill material will be required for construction of the highway.
- Minimise dewatering and wastewater discharge requirements.
- Use of Recycled Asphalt Planings (RAP).
- Implementing the use of energy efficient measures where practicable (e.g., low-level lighting).
- The CEMP will include an Emergency Response Plan which will be prepared and implemented to reduce impacts associated with any release of contaminants, fire and other emergency situations.

As fly-tipping is known to occur in the Gnangara Park area and other areas of bushland near the proposal the detailed design will take into consideration opportunities to reduce access to bushland areas. Uncontrolled access and illegal dumping of rubbish within the proposal area will also be monitored during construction.

12.5 Stakeholder Consultation

Consolidated issue 3 (contributing issue 88): Stakeholder issues have only been addressed generally in the PER and should be addressed more directly.

Stakeholder issues are addressed in more detail in Table 12.1.

Table 12.1 Stakeholder issues

Area of interest	Key issues raised	Response
Proposal planning		
Proposal support and timing	• Support for the proposal. • Doubt that the proposal will proceed. • Timing of the proposal. • Concern at the time to completion (by 2019).	The proposal has been identified as a priority project by the Western Australia Government. Construction of the proposal is scheduled to commence in 2016. Procurement activities have commenced, award of contracts will be subject to environmental approval. The proposal is funded by the Western Australia Government (20%) and Australian Government (80%). The community has been made aware of the commitment to commence construction in 2016 and complete the proposal by 2019.
Proposal alignment, footprint and design issues	• The extent of the resultant proposal footprint. • Use of the former PDNH reservation along Lord St and Drumpellier Drive and potential to return it to public use at Whiteman Park. • Suggested realignment of the PDNH corridor further west to avoid the direct interface with residents of Ellenbrook.	The proposal footprint is nominally 746 ha as outlined in PER Chapter 4, Detailed description of proposal, Section 4.2. PER Chapter 3, Route Selection Development, Section 3.3 presents details of the environmental constraints assessment that was undertaken on potential alignments. The current alignment was selected over the Lord Street/Drumpellier Drive alignment, as it facilitated a more direct link between the proposal and Tonkin Highway and provided more significant transport benefits, while reducing impacts on existing and future residential areas. A number of changes to the design of the proposal were made as a result of studies undertaken as part of the PER and issues raised by stakeholders during the consultation process (see PER Chapter 3, Route selection and development). Positioning of the Ellenbrook interchange and highway along the western side of the road reserve was developed in consultation with the community through the Community Reference Group process and feedback from consultation activities. The proposed interchange location was determined by balancing impacts on the community with the impacts on the environment, including avoiding the newly recorded location of *Caladenia huegelii.*

Area of interest	Key issues raised	Response
Flora		
Flora (vegetation clearing)	• Impacts on remnant native vegetation. • Loss of vegetation and trees within the road reserve. • Identification and protection of TEC and other ecological communities along the corridor.	PER Chapter 8, Flora and vegetation, specifically Section 8.5, discusses how changes to the proposal have reduced the proposal's overall impact to flora and vegetation values. The alignment and width of the development envelope was reviewed to identify a proposal footprint that minimises clearing in areas with very good to pristine condition vegetation. Nearly 80% of the proposal footprint occurs within vegetation mapped as degraded or worse condition, and reduces the clearing of TECs and PECs. This includes the avoidance of the Mound Springs SCP and Claypans of the SCP TECs (see PER Chapter 4, Detailed description of the proposal). The proposal will impact: • 206 ha of intact native vegetation. • 4.0 ha of the state-listed TEC SCP20a. • 145.5 ha of PECs (64 ha of SCP21c, 0.1 ha of SCP22, 11.6 ha of SCP23b, 7.8 ha of SCP24 and 62.0 ha of Banksia dominated woodlands on the SCP). The following management measures have been proposed to mitigate the impact of native vegetation clearing: • Disturbance will be restricted to the proposal footprint. • Delineation of the proposal footprint ahead of clearing. • Staged clearing and revegetation (where applicable) in accordance with the detailed infrastructure plan. • Preparation and implementation of a construction EMP and a Flora and Vegetation Monitoring and Management Plan. • Revegetation and rehabilitation of roadside vegetation (PER Chapter 12, Rehabilitation and Decommissioning, Section 12.5).

Area of interest	Key issues raised	Response
Flora (weeds)	• Measures to identify and assess areas impacted by dieback. • Topsoil management and use of degraded topsoil or topsoil containing dieback as base level fill and covered.	Management of the introduction and spread of weeds and dieback will be addressed through the preparation and implementation of a weed and dieback hygiene management plan (see PER Chapter 8, Flora and Vegetation, Section 8.5). The weed and dieback management plan will set out the control and hygiene measures to avoid and manage the introduction and/or spread of weeds and dieback including: • A risk assessment of potential sources and activities. • The identification of 'protectable' areas adjacent to the proposal footprint. • Soils within the proposal footprint will not be moved between dieback occurrence categories. • Requirements for hygiene washdown locations that consider risk in the surrounding landscape. • A program to monitor and report on compliance and corrective actions where non-compliance has occurred. • Quarterly auditing of washdown sites to identify weed incursions. • Regular walk-overs at strategic locations along the proposal footprint (i.e. in association with native vegetation) to identify and ameliorate weed incursions. • An auditable hygiene inspection form will be prepared to detail inspection results at the hygiene locations. The Weed and Dieback Management Plan will include management of WONS and declared pests known to be present within the proposal footprint (as listed in PER Chapter 8, Flora and Vegetation, Section 8.2.13) along with weeds ranked as high priority for eradication and control within the DPAW (2013b) weed prioritisation process (WPP).

Area of interest	Key issues raised	Response
Flora (rehabilitation)	• Revegetation strategies. • Expand offsets to include rehabilitation of degraded land.	PER Chapter 12, Rehabilitation and Decommissioning details the revegetation strategies for the proposal. The strategies will be supported by a Detailed Revegetation Plan (PER Chapter 12, Rehabilitation and Decommissioning, Section 12.5). Revegetation will focus on using local native provenance species in each of the revegetation zones (urban, transition and rural) that are suited to the surrounding land use and landscape characteristics, including the floristic formation of adjacent vegetation and so will contribute to maintaining biodiversity. Rehabilitation and habitat restoration opportunities are being considered as part of this proposal's offset strategy (Chapter 6, Environmental Offsets).
Fauna		
Fauna (movement)	• Impacts on fauna movement corridors for terrestrial fauna and birds.	PER Chapter 9, Terrestrial Fauna, specifically Section 9.4.8 discusses the loss of ecological connectivity on terrestrial fauna with particular regard to three ecological linkage networks, Maralla Road Bushland, Whiteman Park/Cullacabardee Bushland and Micro Gardens Park (PER Chapter 9, Terrestrial Fauna, Figure 9.4). Fragmentation of ecological linkages has been avoided where possible, although road design constraints limit the extent to which all vegetation can be avoided. Installation of fauna underpasses (PER Chapter 9, Terrestrial Fauna, Section 9.5.8) and revegetation and rehabilitation of roadside vegetation (PER Chapter 12, Rehabilitation and Decommissioning, Section 12.5) will assist in the maintenance of ecological connectivity.
Fauna (reptiles)	• Impacts on reptiles in the proposal area.	A desktop assessment of State and Commonwealth databases, regional and local contextual data and existing biological surveys identified approximately 360 species of fauna previously recorded in the vicinity of the alignment. This included 64 reptile species, 19 of which were recorded during the Level 1 and Level 2 field surveys, including two conservation significant reptiles, the Jewelled Sandplain Ctenotus (*Ctenotus gemmula*) and Black-striped Snake (*Neelaps calonotos*), both listed as Priority 3 species. The assessment of potential impacts on fauna, including specific consideration of these two species is outlined in PER Chapter 9, Terrestrial Fauna, Table 9.4.

Area of interest	Key issues raised	Response
Fauna (Black Cockatoos)	• Impacts on Black Cockatoos.	PER Chapter 9, Terrestrial Fauna, Section 9.5, discusses how changes to the proposal have reduced the overall impact to fauna values, including Black Cockatoos. For example: • To avoid an area containing a high concentration of Black Cockatoo breeding trees, the width of the proposal footprint was reduced between Baal Street and Gnangara Road (see PER Chapter 9, Terrestrial Fauna, Figure 4.3). The revised proposal footprint reduced the number of breeding trees cleared from 410 to 342 (conserving 68 breeding trees). • The proposal alignment predominantly follows existing infrastructure, cleared areas or secondary habitats, which reduces impacts to existing fauna habitats. A total of 586 ha or 78.6% of the proposal footprint occurs in disturbed areas that offer little or no habitat for fauna. • The proposal alignment was moved to the western boundary of the development envelope in the vicinity of Gulf Cove, Ellenbrook to minimise impacts to high value habitat, avoid a known location of *Caladenia huegelii* and to minimise noise impacts on residents. Impacts on Black Cockatoos are assessed in PER Chapter 9, Terrestrial Fauna, Section 9.4.1.1 and include the loss of habitat and possible temporary displacement of birds during construction. Management measures have been proposed to reduce the impact on fauna and habitat as far as practicable (see PER Chapter 9, Terrestrial Fauna, Section 9.5). This includes restricting disturbance to the proposal footprint and delineation of the proposal footprint ahead of clearing. Additional management measures include the installation of rope wire barriers to reduce the proposal's overall footprint and impact on remnant vegetation.
Fauna (bird strike)	• Bird strikes as a result of vehicle collisions during flyover or as a result of road foraging.	The use of Banksia and other Black Cockatoo foraging resources will be limited as part of revegetation activities within 10 m of the highway, in order to manage the risk of bird strike. Proposed 1.8-m-high fauna fences to be installed on both sides of the highway in areas north of Hepburn Avenue to a minimum of 100 m north of Maralla Road will assist in deterring birds from foraging and roosting in roadside vegetation. Higher fences are not practical. Other measures for reducing fauna mortalities are presented in PER Chapter 9, Terrestrial Fauna, Section 9.5.4.

Area of interest	Key issues raised	Response
Hydrology		
Flooding and stormwater management	• Proposals for managing an extreme flood event. • Seek local infiltration solutions generally and manage flows locally without piping it to other areas or main drains. • Protect potable water quality by understanding and diverting stormwater away from production bores – spillage, hydrocarbons, weed management spraying etc. with provision for emergency response to allow for effective clean up. • Maintain sheet flow characteristics in the northern section to avoid local flooding and inundation outcomes resulting from the proposal.	PER Appendix H, Drainage Strategy, Section 10.4 sets out the strategy for managing flooding and stormwater runoff. Drainage will be designed to integrate with natural drainage lines to maintain existing hydrology/surface flow to watercourses and wetlands. In the northern section on the palusplain, runoff will be allowed to sheet flow across the road reserve to adjacent land where it will disperse via the existing drainage network of ephemeral watercourses and drainage lines. Bio-retention swales will be used within 100 m of wetlands to allow infiltration of normal rainfall events (see PER Appendix H, Drainage Strategy, Section 10.4). South of the palusplain, runoff will be directed as close to source as possible for treatment in bio-retention swales and basins before discharge to existing watercourses and drainage lines. Piped drainage systems will only be required at kerbed sections of the proposed highway in the urban drainage zone. Water quality within the WHPZ will be managed through the provision of bio-retention swales and basins, sized to treat average rainfall events, with excess runoff directed away from the bores. All proposed bio-retention/infiltration basins will be located as far as possible from WHPZs. All but one of the bio-retention basins are located at least 100 m from production bores. Provision has also been made for the preparation of a proposal specific An Emergency Spill Response Plan will be prepared and implemented to manage spills in the Gnangara UWPCA. Closed Circuit Television (CCTV) will be installed in the Priority 1 UWPCA to detect any incidents.
Management of drainage structures	• Recognise the long-term maintenance impacts and costs. • Adopting the appropriate technologies and treatment options.	The drainage strategy (PER Appendix H, Drainage Strategy) incorporates features that mimic existing hydrological conditions. Culverts and bridges will maintain flow in watercourses and drainage lines. Bio-retention swales and basins will use infiltration to settle, treat and filter contaminants in a similar manner to the predominantly sandy substrate of the proposal footprint. Graded verges in the palusplain will allow sheet flow across the road reserve, mimicking natural sheet flow. These features will be low maintenance.

Area of interest	Key issues raised	Response
Water supply to Cyrenian House	• Impacts for water self-sufficiency of Cyrenian House.	The proposal is not anticipated to impact the water self-sufficiency of Cyrenian House. Dewatering and water abstraction will be managed to avoid impacts on water supplies. A WDMMP will include groundwater monitoring to ensure impacts to the Gnangara Mound (public water supplies) are appropriately managed and there are no unforeseen impacts (see PER Chapter 10, Hydrological Processes and Inland Waters Environmental Quality, Section 10.5). Groundwater abstraction will be undertaken in accordance with approved licences under the RIWI Act (see PER Chapter 10, Hydrological Processes and Inland Water Environmental Quality, Section 10.5).
Impacts on the P1 water mound	• Impact on the Priority One water mound. • Ensure compliance with relevant water quality guidelines and standards and be informed by the Gnangara Water and Land Management Strategy.	The drainage strategy (PER Appendix H, Drainage Strategy) has been developed in consultation with the DOW and in accordance with the DOW's principles of water resource management, as detailed in the Stormwater Management Manual for Western Australia (DOW, 2004) and the Decision Process for Stormwater Management in Western Australia (DOW, 2009). MRWA is committed to ongoing liaison with the DOW to ensure protection of the Gnangara Mound production bores. All reasonable measures have been implemented to protect the Priority 1 water mound during construction and operation of the Highway. These include: • Water quality within the WHPZ will be managed through the provision of bio-retention swales, sized to treat the common rainfall event, with excess runoff directed away from the bores. All proposed infiltration basins (including bio-retention basins) have been located as far from the WHPZs as possible and all but one are located at least 100 m from production bores. • Preparation of a proposal specific Emergency Spill Response Plan. • Provision of CCTV throughout the Priority 1 UWPCA to detect any incidents. • MRWA is committed to ongoing liaison with the DOW through the proposal's development and construction to ensure protection of the production bores. A detailed infrastructure plan will be prepared for each stage of the development prior to construction to ensure that the proposal is designed and constructed in accordance with the drainage strategy. • Commitment for joint inspections with Water Corporation. • The EMP will be revised to emphasise the importance of the Gnangara UWPCA and to refer to

Area of interest	Key issues raised	Response
		the appropriate policies and Water Quality Protection Notes. • All fuel and chemicals be stored in a double skin tank and placed in a bunded enclosure capable of storing 125% of the full capacity of the largest tank. The capacity of any single tank will not exceed 5000 L in the Priority 1 area of the Gnangara UWPCA. • Refuelling activities will be carried out at least 50 m from WHPZ. Spill kits will be maintained on refuelling tankers. • Approval will be sought from DOW for any activities that are to be located in the Gnangara UWPCA and are considered incompatible activities under the relevant policies. See PER Chapter 10, Hydrological Processes and Inland Water Environmental Quality, Section 10.4.5 and 10.5 and responses to Consolidated issue 69, 79 and 80.
Impacts to Muchea residents	• Impacts to Muchea residents and others reliant upon groundwater as a potable water supply source. • Protect existing bores from spills and other impacts.	The proposal is not anticipated to impact water supply to Muchea residents. Dewatering and water abstraction will be managed to avoid impacts on domestic water supplies. A WDMMP will include groundwater monitoring to ensure impacts to aquifers are appropriately managed and there are no unforeseen impacts (see PER Chapter 10, Hydrological Processes and Inland Waters Environmental Quality, Section 10.5). Groundwater abstraction will be undertaken in accordance with approved licences under the RIWI Act (see PER Chapter 10, Hydrological Processes and Inland Water Environmental Quality, Section 10.5). Management measures for spills and runoff during construction and when the highway is operational are set out in PER Chapter 10, Hydrological Processes and Inland Waters Environmental Quality, Section 10.5 and Table 10.9. They include measures relating to the generation, storage, handling and release of pollutants, surface water management and a spill response procedure, which will be incorporated in the Emergency Response Plan developed in consultation with emergency services.

Area of interest	Key issues raised	Response
Impacts to fauna and flora	• Impacts for flora and fauna from changing surface water, runoff and drainage regimes.	The proposal has the potential to disrupt the surface flow of water which could affect groundwater-dependent vegetation particularly around Wetland and Dampland habitats, in turn causing habitat degradation and reducing the ability of these habitats to support fauna such as the Great Egret, Cattle Egret and Southern Brown Bandicoot. PER Appendix H, Drainage Strategy, Section 10.4 sets out the strategy for managing flooding and stormwater runoff. Drainage will be designed to direct runoff to close as source as possible for infiltration and discharge to natural drainage lines to maintain existing hydrology/surface flow to watercourses and wetlands. In the northern section on the palusplain, runoff will be allowed to sheet flow across the road reserve to adjacent land where it will disperse via the existing drainage network of ephemeral watercourses and drainage lines. Bio-retention swales will be used within 100 m of wetlands to allow infiltration of normal rainfall events (see PER Appendix H, Drainage Strategy, Section 10.4). A WDMMP will be developed and implemented including groundwater monitoring to ensure impacts to wetlands (and Ellen Brook) are appropriately managed and there are no unforeseen impacts (see PER Chapter 10, Hydrological Processes and Inland Waters Environmental Quality, Section 10.5). The Wetland Management and Monitoring Plan will consider the conservation status and proximity of wetlands to the proposal.
Wetlands		
Wetland rehabilitation	• Impacts on historic and planned wetland rehabilitation work undertaken by volunteers. • The potential role for community groups to play a part in identifying, restoring or even potentially managing rehabilitated wetlands.	The proposal has been aligned to avoid and where not possible, minimise impacts to wetlands, particularly CCWs and REWs north of Maralla Road where the proposal is less constrained with regard to existing development (see PER Chapter 10, Hydrological Processes and Inland Waters Environmental Quality, Figure 10.2). Chittering Landcare/Ellen Brockman Catchment Council and Perth Region RNM were involved in the Environmental Reference Group and Drainage Reference Group. The proposal may impact some existing areas of rehabilitation along watercourses near Muchea. MRWA will continue to consult with the Chittering Landcare/Ellen Brockman Catchment Council to identify opportunities to offset any loss of rehabilitation. MRWA is considering opportunities to involve community groups in the delivery/management of the proposal's rehabilitation and offsets.

Area of interest	Key issues raised	Response
Wetland connectivity	• Need for wetland connectivity to maintain the integrity of the existing wetland network.	Hydrological connectivity and the maintenance of surface water flows between areas of wetland intersected/fragmented by the proposal will be maintained through the installation of culverts in accordance with the Drainage Strategy (PER Appendix H).
Protection of wetlands	• Long-term protection and management of wetlands is a critical catchment management task for the future. • Wetland protection should be a priority wherever possible.	PER Appendix H, Drainage Strategy, Section 10 sets out the strategy for managing stormwater runoff from the highway to wetlands, including maintenance of water quality and hydrological connectivity through the installation of culverts and infiltration systems, e.g., bio-retention swales and basins. A Wetland Management and Monitoring Plan will be developed and implemented including groundwater monitoring to ensure impacts to wetlands are appropriately managed and there are no unforeseen impacts (see PER Chapter 10, Hydrological Processes and Inland Waters Environmental Quality, Section 10.5).
Aboriginal and European Heritage		
Aboriginal and European heritage	• Identification and protection and/or recognition of sites of Aboriginal or European heritage value.	Where possible, Aboriginal heritage sites will be avoided and protected. Where Aboriginal heritage sites are unavoidable and disturbance is required, a consent to disturb under Section 18 of the AH Act will be obtained. Members of the Noongar community were involved in field surveys for Aboriginal cultural heritage (see PER Appendix Q, Ethnographical Aboriginal Heritage Survey and PER Appendix R, Aboriginal Archaeological Assessment). The process developed to monitor and manage impacts to Aboriginal archaeological records is supported by the Noongar people (see PER Appendix R, Aboriginal Archaeological Assessment). PER Chapter 13, Aboriginal Heritage, Section 13.4 sets out the measures to be incorporated in an Aboriginal Heritage Management Plan. The measures incorporate the recommendations set out in PER Appendix R, Aboriginal Archaeological Assessment.

Area of interest	Key issues raised	Response
Noise		
Impacts on the community	• Noise impact for the communities of Beechboro, Noranda, Bennett Springs, Ballajura, Ellenbrook and rural properties. • Residential noise impacts.	Predicted noise impacts on residential and rural properties are detailed in the revised transportation noise assessment (Appendix I, Revised Transportation Noise Assessment) and summarised in Chapter 4, Amenity (Noise and Vibration), Table 4.3. The SPP 5.4 noise limit (60 dB $L_{Aeq\ (Day)}$) will be achieved at all noise sensitive properties south of Maralla Road including residences in Ellenbrook, Noranda and Ballajura. It is not practicable to achieve the noise target (55 dB $L_{Aeq\ (Day)}$) at some residences in Ellenbrook due to the limitation on noise wall height of 5 m. Noise levels at sixteen rural properties north of Ellenbrook will exceed the SPP 5.4 noise limit (60 dB $L_{Aeq\ (Day)}$). Indoor noise levels at these properties will be reduced by application of noise mitigation set out in the Implementation Guidelines for SPP 5.4 (WAPC, 2014), as discussed and agreed with the affected property owner.
Noise mitigation	• Concern about the already high noise levels and the lack of existing noise mitigation measures. • Noise mitigation measures.	PER Chapter 11, Amenity (Noise and Vibration), Table 11.3 lists proposed noise management measures. Updates to these management measures are detailed in Chapter 4, Amenity (Noise), Table 4.2. Proposed noise mitigation includes noise walls up to 5 m high adjacent to residential areas and screening walls to 2.4 m at appropriate locations in rural areas. Where noise levels at rural properties north of Maralla Road exceed the SPP 5.4 noise limit (60 dB $L_{Aeq\ (Day)}$) indoor noise levels at these properties will be reduced by application of noise mitigation set out in the Implementation Guidelines for SPP 5.4 (WAPC, 2014), as discussed and agreed with the affected property owner.

Area of interest	Key issues raised	Response
Amenity		
Amenity (Gnangara Park Management Plan)	• Impact on the recreational area under the Gnangara Park Management Plan.	Potential impacts on Gnangara Park and Dick Perry Reserve are discussed in PER Chapter 15, Amenity. The proposal footprint and overlap with the Gnangara Park recreational master plan are outlined in Figure 15.1. Management measures to address the continued use and viability of the reserve have been addressed through the design of the proposal and include: • Re-establishment of a barrier fence along the western side of the proposal to ensure access to the reserve is controlled. Gates for access for fire suppression will be established at regular intervals, in locations to be agreed with DPAW. • Linking of walking trails with the PSP at the interchanges on Gnangara Road and at Ellenbrook to ensure continuity of the trails. • Avoidance of, and translocation where necessary, of heritage cork trees. MRWA will continue to work with DPAW in the preparation of an agreement, including detailed site plans and specifications, for construction of the length of the proposed highway through Dick Perry Reserve. The agreement may include removal and provision of an alternative water source for Black Cockatoos.
Amenity (Cyrenian House)	• Concern that the sensitivities and importance of Cyrenian House facility (Rick Hamersley Centre) may not be recognised. • Retention of kangaroos, birds and wildlife and other fauna as a valued and positive benefit of the current location of Cyrenian House with fauna movement through the site.	Consultation with Cyrenian House representatives has included three individual meetings and their attendance at the Central Community Reference Group meetings. MRWA has agreed to address the concerns of Cyrenian House representatives which included emergency access. MWRA is also committed to providing additional planting in the vicinity of Cyrenian House for screening and amenity. MRWA has committed to install fauna underpasses along the alignment within Cullacabardee Bushland and Whiteman Park to ensure maintenance of fauna movement and ecological connectivity. PER Chapter 9, Terrestrial Fauna, Section 9.5.8 describes underpass design and includes a summary of design considerations.

Area of interest	Key issues raised	Response
Amenity (Whiteman Park)	• Concern at the severance and other impacts for Whiteman Park.	A working group was formed with representatives of City of Swan, Whiteman Park management and stakeholders from the existing sporting clubs to discuss potential impacts on Whiteman Park. This group met on two occasions to discuss and agree the proposed strategy to minimise any access impacts. The agreed proposal includes upgrade and construction of roads within Whiteman Park and the provision of improved security and access control. Potential impacts on Whiteman Park and associated mitigation are discussed in PER Chapter 15, Amenity, Section 15.3.2.
Amenity (rural)	• Concern at the introduction of a highway/freeway standard road in a rural area in the northern section.	The impact of severance of the local road network has been addressed by the proposed construction and/or upgrade of roads to ensure that access to all properties is maintained. As a result, routes and travel times to some properties may be longer. The new highway will improve travel times in the region. Access arrangements were discussed with the City of Swan and affected property owners. Invitations were sent to the occupiers and owners of all affected properties to attend facilitated public information sessions in Muchea and Bullsbrook. These were well attended by affected residents. Consultation with Department of Fire and Emergency Services (DFES) has resulted in the provision of regular emergency vehicle crossings/access points along the proposed highway. Noise levels at sixteen rural properties north of Ellenbrook will exceed the SPP 5.4 noise limit (60 dB $L_{Aeq\ (Day)}$). It is not practicable to construct noise walls in rural areas. Where practicable, 2.4-m-high screening walls have been incorporated into the design. Indoor noise levels at these properties will be reduced by application of noise mitigation set out in the Implementation Guidelines for SPP 5.4 (WAPC, 2014), as discussed and agreed with the affected property owner.
Amenity (visual)	• Visual and proximity impacts.	Visual screening will be achieved through the construction of screen walls and revegetation of the road reserve. Where practicable, screen walls will be constructed adjacent to rural residences north of Maralla Road. Planting may also be provided to affected private properties, subject to discussion and consent with individual property owners. Noise walls installed adjacent to residential areas south of Maralla Road will screen the highway from adjacent residences. Road reserve revegetation will reflect the existing environment as detailed in PER Chapter 12, Rehabilitation and Decommissioning. Revegetation strategies for the urban, transition and rural zones will focus on using local native provenance species that are suited to the surrounding land use and landscape characteristics, including the floristic formation of adjacent vegetation.

Area of interest	Key issues raised	Response
Social		
Social (housing)	• The distance of the new highway from existing homes.	The road reserve for the proposed highway has been gazetted and shown in the Perth MRS for many years, and pre-dates some residential development. Refinement of the alignment of the proposed highway within the gazetted road reserve to increase separation to residential developments has been considered in conceptual design. A number of changes to the design of the proposal were made as a result of studies undertaken as part of the PER and issues raised by stakeholders during the consultation process (refer to PER Chapter 3, Route selection and development). Where possible the proposal alignment has been moved away from adjacent residents (see PER Chapter 4, Detailed description of proposal, Table 4.1). Positioning of the Ellenbrook interchange and highway along the western side of the road reserve (ensuring no traffic lanes within 60 m of any residence) was developed in consultation with the community through the Community Reference Group process and feedback from consultation activities. The proposed interchange location was determined by balancing impacts on the community with the impacts on the environment, including avoiding the newly recorded location of *Caladenia huegelii.*
Social (crime)	• Crime and anti-social behaviour in residual land between noise walls and property boundaries – use of residual space.	Crime prevention has been considered in designing the highway and addressed by minimising the area of land behind noise walls within the road reserve. The exception is at Ellenbrook, where through the community consultation process (northern Community Reference Group); the community's desire to retain the vegetation close to properties and have any noise mitigation structures closer to the highway was adopted.
Social (business)	• Concern at the loss of passing trade and commercial opportunities for Muchea businesses and in particular the IGA store. • Impacts for business access to GNH at the northern reconnection point near Muchea.	The GNH/Brand Highway interchange located east of Muchea provides access to Muchea via the Brand Highway. The interchange will maintain access to the Muchea IGA and other Muchea business. Access to the GNH at this location is being considered through the provision of a parallel service road that will provide safe access to the regional road network while also allowing large vehicle access to these businesses to ensure minimal impacts.

Consolidated issue 5 (contributing issue 234): Any future interchanges must be done with more consultation with local landholders and residents as consultation has been substandard in the past.

Stakeholder engagement was undertaken with numerous groups (see PER Chapter 6, Stakeholder Consultation) throughout the preparation of the PER including with Members of Parliament, landowners, residents, business owners and operators, environmental interest groups, community members, the freight industry, highway users and cyclists. A number of changes to the design and proposal alignment options for the PDNH were undertaken in response to issues raised by stakeholders. These are listed in PER Chapter 4, Detailed Description of Proposal, Section 4.2.3 and include the construction of interchanges at selected existing roads to enable access to suburbs and key transport routes along the alignment.

Any future interchanges will be subject to necessary assessment as determined by relevant statutory at the time which will dictate the level of consultation required.

12.6 EIA Framework

Consolidated issue 1: PER review period was too short.

Contributing issues:

19: Public review period was too short and didn't allow proper time to read and respond to PER.

100: PER review period was too short.

188: Four weeks is not long enough for the public review period. Quality of feedback is compromised as a result.

214: Future public review period length should be commensurate with the size and detail of the PER so it can be responded to in full.

The length of the public review period of the PER document was determined by the EPA as set out in their decision (6 January 2014) to assess the Perth Darwin National Highway (Swan Valley Section) with a four-week public comment period.

Consolidated issue 2 (contributing issue 11): Future projects should consider cumulative impacts.

The PER presents the assessment of direct and indirect impacts of the proposal at a local, regional and State level.

Western Australian Ministers for Planning and Environment and the Commonwealth Minister for the Environment agreed to undertake a Strategic Assessment of the Perth and Peel regions (Strategic Assessment) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) for impacts on matters of national environmental significance (MNES). The assessment will provide a framework for the assessment of direct, indirect and cumulative impacts of future projects on MNES. The assessment is in progress. More information on the Strategic Assessment can be found at https://www.dpc.wa.gov.au/Consultation/StrategicAssessment/Pages/Default.aspx.

The PER presents the assessment of impacts (habitat loss and fragmentation) on Black Cockatoos at local, regional and bioregional scales (see PER Chapter 9, Terrestrial Fauna, Table 9.4). The local scale is defined as a 1 km buffer to the proposal footprint. The regional scale is defined as all Bush Forever sites within a 10 km buffer to the proposal footprint. The bioregional scale is the Swan Coastal Plain bioregion. The loss of foraging habitat for Carnaby's Black Cockatoo is expected to be 0.2% at the regional scale and 0.04% at the

bioregional scale. The loss of foraging habitat for the Forest Red-tailed Black Cockatoo is expected to be 0.1% at the regional scale and 0.03% at the bioregional scale.

Avoidance and mitigation measures associated with Black Cockatoo habitat are discussed in response to consolidated issue 88 (see Section 12.8.1).

12.7 Flora and Vegetation

12.7.1 Threatened Flora

Consolidated issue 130: Confidentiality of threatened flora locations.

Contributing issues:

108: Why has the location of declared rare flora been published in the PER despite DPAW requesting it to be kept in confidence?

112: Should Threatened and Priority listed flora locations be kept confidential?

189: *Caladenia huegelii* should have been discussed in more detail without revealing its location. The importance at [address redacted] Maralla Road as stated may be misleading.

MRWA is aware of the DPAW's policy regarding the confidentiality of Threatened and Priority flora. Where feasible the general location is only shown but if it is necessary for the assessment of impacts to the species and disclosure provides benefits for the assessment, then the locations are provided.

MRWA was requested to clearly show the locations of *Caladenia huegelii* and *Grevillea curviloba* subsp. *incurva* identified in surveys for the proposal relative to the development envelope and proposal footprint. DOTE requested more general information regarding *C. huegelii*, *G. curviloba* subsp. *incurva* and *Darwinia foetida* that required the known locations of these species to be shown. The locations of these species are shown on PER Chapter 8, Flora and Vegetation, Figure 8.1 along with historical records. Historical records shown on this figure identify the record source and the conservation status but do not identify the species.

Consolidated issue 131 (contributing issue 103): Further surveys for *Caladenia huegelii.*

In addition to the three flora surveys described in the PER (PER Chapter 8, Flora and Vegetation, Section 8.2), a further targeted survey for *Caladenia huegelii* was undertaken on 18 September 2015, following release of the PER (see Appendix C, Assessment & Refinement of Potential Critical Habitat for *Caladenia huegelii* (T-DR) within the Development Envelope). The survey by Woodman Environmental was conducted in the area west of Ellenbrook previously identified as critical habitat for *C. huegelii*. The area of critical habitat in the proposal footprint was reduced from 39.2 ha to 30.0 ha. The flowering period for *C. huegelii* in 2015 commenced approximately two weeks earlier than its normal mid-September start time. The 18 September survey date is therefore considered appropriate.

The survey did not record any *C. huegelii* plants in the area. The survey commented on the relatively good condition of the vegetation in the critical habitat area and indicated that given the level of existing public access to the area, the long-term persistence of the orchid in this area will require appropriate management to protect the habitat's viability.

Consolidated issue 132: Impacts to known *Caladenia huegelii* from construction.

Contributing issues:

22: *Caladenia huegelii* on a private property is not identified in PER. Will monitoring during construction and operation focus include *Caladenia huegelii*, and who will be responsible for identifying it correctly?

109: Why has declared rare flora at Maralla Road been disregarded in planning the PDNH?

191: A *Caladenia huegelii* orchid [address redacted, but assumed to be on private property] exists within 50 m of the study boundary and will be subject to the impacts of highway construction and ongoing operation.

As detailed in the Level 2 Flora and Vegetation Assessment (PER Appendix C), a search of the DPAW database provided all known records of conservation significant flora that occur on the WAH database Florabase or otherwise recorded by DPAW.

The location of the private property on which *Caladenia huegelii* is located is not specified in the submission. It is therefore difficult to comment on the location of the site relative to the flora study area. If the occurrence is outside the study area it will not be directly impacted by the proposal. There are many instances where populations of *Caladenia huegelii* have existed for many years within 50 m or less of roads including the busy Roe Highway (Stage 7). The potential for impacts to *Caladenia huegelii* resulting from highway construction and operation will be mitigated by establishing a 50 m buffer between the known locations of *Caladenia huegelii* and the proposal footprint (see PER Chapter 8, Flora and Vegetation, Section 8.4.5).

Consolidated issue 133: Impacts to known *Caladenia huegelii* from construction.

Contributing issues:

104: How can the proponent guarantee that *Caladenia huegelii* will be fully protected?

106: The statement that 'there are no direct impacts to [*Caladenia huegelii*]' is wrong. How is the impact on unknown populations of *C. huegelii* considered?

The individual plant of *Caladenia huegelii* is located on land that is unprotected from public access and is very close to existing houses. Construction of the proposal will include fencing either side of the road reserve which will reduce public access, provide a management boundary for weeds and thereby better protect the plant. Current unrestricted public access into areas of critical habitat for *C. huegelii* west of the proposal will be further limited following the installation of fencing.

While it is acknowledged that *C. huegelii* plants do not necessarily flower every year there have now been four flora surveys undertaken in the spring-flowering period of *C. huegelii* in 2012, 2014 and 2015 (see PER Chapter 8, Flora and Vegetation, Section 8.2 and Appendix C, Assessment & Refinement of Potential Critical Habitat for *Caladenia huegelii* (T-DR) within the Development Envelope). The likelihood that unknown populations of *C. huegelii* occur in the survey area and will be impacted by the proposal is considered to be very low.

Consolidated issue 134 (contributing issue 216): Accuracy and completeness of survey information for *Caladenia huegelii*.

There have been three flora surveys undertaken in the optimal spring flowering period of *Caladenia huegelii* including 24 to 27 September 2012 (GHD, 2013b), 15 September to 26 November (360 Environmental, 2014), and 15 to 19 September and 22 to 26 September 2014 (Coffey, 2015b) (see PER

Chapter 8, Flora and Vegetation, Section 8.2 and Appendix C, Assessment & Refinement of Potential Critical Habitat for *Caladenia huegelii* (T-DR) within the Development Envelope). Only one individual has been identified from these surveys. In 2015, Woodman Environmental undertook a survey for *C. huegelii* critical habitat. The survey was undertaken by experienced botanists (see Appendix C, Assessment & Refinement of Potential Critical Habitat for *Caladenia huegelii* (T-DR) within the Development Envelope). The likelihood that unknown populations of *C. huegelii* occur in the survey area is considered to be low. However, the provision of an offset for the residual impact of the proposal on areas deemed suitable for *Caladenia huegelii* (i.e., critical habitat) recognises the cryptic nature of the species and the inherent uncertainty around numbers of individuals.

Consolidated issue 135: Commentary on fungi and *Zaspilothynnus* wasp supporting *Caladenia huegelii* are omitted.

Contributing issues:

105: *Caladenia huegelii* habitat loss is completely unacceptable, especially given vehicular impacts to the wasp *Zaspilothynnus* sp. that pollinates this species.

193: The impacts to the *Zaspilothyunnus* wasp responsible for pollinating *Caladenia huegelii* are unclear.

218: Why have no surveys been done for fungi and invertebrates that support *Caladenia huegelii* given their essential role in its survival?

Food plants used by the male Thynnid wasp responsible for pollinating *Caladenia huegelii* include *Dasypogon bromeliifolius*, *Hakea prostrata*, *Hibbertia hypericoides*, *Kunzea ericifolia* and *Pericalymma ellipticum* (A. Batty, cited in Roe Highway Stage 7 *Caladenia huegelii* Conservation and Management Plan 2004) (Batty cited in Roe 7 Alliance, 2004). These are all common species occurring in the *Caladenia huegelii* critical habitat defined in the PER and revised in Woodman Environmental (2015a) (see Appendix C, Assessment & Refinement of Potential Critical Habitat for *Caladenia huegelii* (T-DRF) within the Development Envelope), a large extent of which is to the west of the proposal and will not be impacted by the highway construction.

It is acknowledged that construction of the highway may introduce a barrier to the movement of wasps from the western side of the highway to the pocket of bushland east of the proposal containing the individual of *Caladenia huegelii*. In the Ellenbrook area, incorporating species used by Thynnid wasps as food sources in revegetation of the road reserve adjacent to *Caladenia huegelii* critical habitat will reduce the barrier effect of the highway.

Surveys to determine the extent of the mychorrizal fungi required in the lifecycle of *Caladenia huegelii* were considered but were not undertaken, as they are not typically required for vascular plant surveys and as they require seed from *Caladenia huegelii* to determine the presence of the specific mychorrizia. A fungi survey would have required more *Caladenia huegelii* seed than is currently available from the known individual plant.

Consolidated issue 136 (contributing issue 77): Clarification is sought on how the mitigation measures for Threatened flora will result in the proposal being likely to meet the EPA's objectives.

The EPA's objective for flora and vegetation is "to maintain representation, diversity, viability, and ecological function at the species, population and community level" (EPA, 2015b). As discussed in PER Chapter 8, Flora and Vegetation, Section 8.4.5, direct impacts to the three Threatened flora species *Caladenia huegelii, Grevillea curviloba* subsp. *incurva* and *Darwinia foetida* have been avoided. Impacts to critical habitat have been minimised for *Caladenia huegelii* and *Grevillea curviloba* subsp. *incurva*, .The EPA's objectives with respect to Threatened flora will therefore be met.

Consolidated issue 138 (contributing issue 70): *Caladenia huegelii* is even more threatened than it was previously, and hasn't been found in some regional locations listed. Every effort needs to be taken to protect/re-introduce *Caladenia huegelii* in its critical habitat area.

Three surveys in separate spring flowering seasons have identified only one individual of *Caladenia huegelii*, or Grand Spider Orchid, in the development envelope (see PER Chapter 8, Flora and Vegetation, Section 8.2). The PER assessed the impacts of the proposal on this known location and concluded that there are no direct impacts to the Grand Spider Orchid as it is outside the proposal footprint. Indirect impacts will be managed through the retention of a vegetated buffer around this location.

The Grand spider orchid (*Caladenia huegelii*) recovery plan (DEC, 2009) defines critical habitat as additional occurrences of similar habitat that may contain important populations of the species or be suitable sites for future translocations or other recovery actions intended to create important populations. Mapping conducted for the PER identified 39.2 ha of critical habitat for the Grand Spider Orchid within the proposal footprint. Subsequent detailed mapping refined this area to 30.0 ha (see Appendix C, Assessment & Refinement of Potential Critical Habitat for *Caladenia Huegelli* (T-DRF) within the Development Envelope).

Indirect impacts to critical habitat including impacts associated with uncontrolled access, fires, spread of introduced weeds and Phytophthora dieback will be managed through the management measures proposed in the PER (see PER Chapter 8, Flora and Vegetation, Section 8.5).

Unavoidable loss of Grand Spider Orchid critical habitat will be offset (see Chapter 6, Environmental Offsets).

12.7.2 Impact Assessment

Consolidated issue 122: Clearing of remnant intact native vegetation on the Swan Coastal Plain, particularly good to pristine native vegetation and vegetation in association with a Bush Forever site is unacceptable.

Contributing issues:

115: It is difficult to justify clearing yet another 205 ha of native vegetation. When will the continued clearing of native vegetation on the Swan Coastal Plain stop?

117: Clearing of good to pristine native vegetation is completely unacceptable. Clearing of Bush Forever is unacceptable. Does 'forever' mean only if it suits development proposals?

The proposal will impact 206 ha of intact native vegetation, including 149.1 ha in good to pristine condition, 129.9 ha of which is associated with a Bush Forever Site. Three of the five vegetation complexes impacted by the proposal within the Perth-Peel Region of the SCP are below the retention target of 30%: Bassendean Complex – Central and South (21.3%), Southern River (16.8%) and Yanga Complex (13.5%) (EPA, 2015a).

The proposed alignment avoids the majority of pristine, pristine to excellent and excellent to very good vegetation in the development envelope and was realigned to avoid Bush Forever Site 13 (PER Chapter 8, Flora and Vegetation, Figure 8.6 and 15.3). The Promenade interchange and the section of highway adjacent to Ellenbrook have been designed to reduce fragmentation of conservation areas (e.g., Bush Forever Site 300), avoid known location of *Caladenia huegelii* and minimise impacts to Black Cockatoo foraging and roosting habitat, whilst reducing noise impacts on residences.

PER Chapter 8, Flora and vegetation, specifically Section 8.5, discusses how changes to the proposal have reduced the proposal's overall impact to flora and vegetation values. Nearly 80% of the proposal footprint occurs within vegetation mapped as degraded or worse condition. PER Chapter 3, Route Selection and Development, Section 3.3 presents details of the environmental constraints assessment that was

undertaken on potential alignments. This assessment considered conservation and ecologically sensitive areas including Bush Forever sites.

While native vegetation clearing is required for the construction of the proposal, clearing has been minimised to as low as practicable. The alignment and width of the development envelope has been reviewed to identify a proposal footprint that minimises clearing in very good to pristine vegetation and reduces the clearing of TECs and PECs. The following management is proposed to minimise clearing and mitigate the impact of fragmentation:

- Disturbance will be restricted to the proposal footprint.
- Delineation of the proposal footprint ahead of clearing.
- Staged clearing and revegetation (where applicable) in accordance with the detailed infrastructure plan.
- Preparation and implementation of a construction EMP, including management and monitoring of intact native vegetation.
- Revegetation and rehabilitation of roadside vegetation (PER Chapter 12, Rehabilitation and Decommissioning, Section 12.5).
- Installation of fauna underpasses (PER Chapter 9, Terrestrial Fauna, Section 9.5.8 and Figure 9.5).

The response to consolidated issue 27 (see Section 12.3.1) provides further details on how the proposal has minimised impacts to native vegetation (e.g. reduction in the width of the highway through the installation of a concrete barrier between the northbound and southbound carriageways and wire rope barriers).

Consolidated issue 124 (contributing issue 69): Discussion on SCP21c is confusing and internally inconsistent.

The inconsistencies in the discussion of SCP21c arise from varying estimates of the number of sites (quadrats), occurrences and mapped extent. The areal extent of SCP21c has not been determined at the regional scale, as the extent of vegetation associations with SCP21c (occurrences) have not been mapped for all sites. The following discussion outlines the current understanding of the distribution and areal extent of SCP21c and forms the basis for the revised impact assessment.

SCP21c is known from at least 43 sites between Gelorup (near Bunbury) and Breera (near Muchea). Existing records of SCP21c include:

- 27 sites from the DPAW 2005 Swan Coastal Plain dataset (Keighery et al., 2012).
- 17 sites from a custom search of DPAW's databases for existing records of SCP21c within 10 km of the proposal. Nine of these records correspond to records from Keighery et al. (2012) and eight are unique.
- 53 records provided by DPAW's Species and Communities Branch, of which 41 are sites and 12 are occurrences (i.e., mapped areas). It is not known if the 41 sites are unique from the other DPAW records listed above. The 12 occurrences are 231 ha in extent.

The Level 2 Spring Flora and Vegetation Assessment (PER Appendix C) sampled new quadrats and previous quadrats from earlier studies of the study area. The floristic analysis grouped 23 of these quadrats with SCP21c (see PER Appendix C, Level 2 Spring Flora and Vegetation Assessment, Appendix F, Floristic analysis of vegetation site data from the Swan Valley Bypass proposal area). The flora and vegetation assessment combined the floristic analysis with the vegetation association mapping (see PER Appendix C, Level 2 Spring Flora and Vegetation Assessment, Chapter 5 Results, Table 18 and Figure 10) to generate mapping for

SCP21c and other FCTs. The 23 quadrats identified as SCP21c were mapped as 10 occurrences of SCP21c, as shown in PER Figure 8.3. These occurrences total 177.9 ha in extent.

Combining existing records of SCP21c with those from PER Appendix C, Level 2 Spring Flora and Vegetation Assessment, SCP21c is known from at least 65 and possibly over 100 sites and has a mapped extent of 408.9 ha.

Assessment of the proposal's impacts on SCP21c at a regional scale is complicated by the available data. The number of SCP21c sites within the proposal footprint is a coarse measure of the proposal's impact on SCP21c, as the impact is proportional to the survey intensity. Impacts to SCP21c are better assessed by area impacted; however, many records held by DPAW are of SCP21c sites only without spatial extent included.

Fourteen sites of SCP21c will be impacted by the proposal, representing 14% to 21% of existing sites of SCP21c in the region. The significance of this impact is low in a regional context given the distribution of existing sites and the limitations with using this measure as discussed above. At a local scale, the proposal will result in the removal of 64.0 ha of SCP21c, which is 36% of its 177.9 ha extent in the study area.

Consolidated issue 137 (contributing issue 107): What endangered and priority species other than *Caladenia huegelii* have their impact understated or denied?

The impact on *Caladenia huegelii* has been assessed with further information provided in this document (see response to consolidated issue 132 (Section 12.7.1)). PER Chapter 8, Flora and Vegetation, Table 8.1 lists the threatened and priority flora occurring in or proximate to the development envelope. The likelihood of occurrence is based on an assessment of suitable habitat or records.

Potential impacts to listed threatened and priority flora are assessed in PER Chapter 8, Flora and Vegetation, Section 8.4.5, specifically Tables 8.15 and 8.16. Table 8.16 lists the management measures to reduce impacts to these species.

12.7.3 Management

Consolidated issue 123 (contributing issue 225): Given that fire management is essential for conservation, what fire management measures will be put in place during and after construction?

Fire management measures to be implemented during construction will be set out in a fire management plan prepared in accordance with Main Roads Operational Guideline 94 (see PER Appendix F, Environmental Management Plan, Table 4.1 (Increase in wildfires) and Table 4.2 (Altered fire regimes)).

The plan is "likely to include hot works permits; obeying total fire bans; ensuring the serviceability of all equipment and plant (including spark arrestors on exhausts); induction of personnel; prevention of unauthorised access to the construction area and ensuring the work site is kept clean". Burning off will not be permitted under any circumstances in any part of the site or other land used for the purpose of construction.

Fire fighting equipment and trained personnel will be available during construction to suppress any fires that may arise from construction activities.

Gates will be installed in the road reserve boundary fence at closed roads and other places to enable emergency vehicle access and an evacuation route for residents during operation.

Consolidated issue 139 (contributing issue 180): Areas proposed to be cleared should be independently audited and local landowners should be allowed to check it before construction begins.

MRWA will complete land excision prior to commencing work, therefore no clearing will be occurring on local landowner's property. MRWA as the land manager will be responsible for auditing the proposal during construction to ensure compliance with conditions.

The OEPA and DOTE may conduct audits on implementation of approval conditions, including compliance with nominated buffers and clearance boundaries. Where required by the OEPA or DOTE, MRWA will commission an independent auditor to undertake these audits.

Consolidated issue 140: How will weeds and dieback be managed?

Contributing issues:

23: What procedures will be in place to reduce dieback risk? Will effective spraying and treatment regimes be implemented prior to construction to control dieback?

24: What controls will be in place to limit weeds? Will weed control be ongoing?

116: Will MRWA conduct a phosphorus acid spraying program in the proposal footprint to protect healthy vegetation from the likely spread of dieback?

153: How will the weeds Victorian Tea Tree (*Leptospermum laevigatum*), Arum Lily (*Zantedeschia aethiopica*) and Bridal Creeper (*Asparagus asparagoides*) be managed?

162: How will uncontrolled access, rubbish dumping, weeds, dieback and the degradation of vegetation through off-road activities be managed?

222: How will dieback be managed during construction so it does not worsen? Will phosphite treatments be used and, if so, how? Will relevant landowners be consulted?

Management of the introduction and spread of weeds and dieback will be addressed through the preparation and implementation of a weed and dieback hygiene management plan (see PER Chapter 8, Flora and Vegetation, Section 8.5). PER Chapter 8, Flora and Vegetation, Sections 8.4.6 and 8.4.7 assess the potential risk to native vegetation located adjacent to the proposal footprint associated with the introduction and spread of weeds and dieback.

The weed and dieback management plan will set out the control and hygiene measures to manage weeds and dieback and to avoid the introduction and/or spread of weeds and dieback including:

- A risk assessment of potential sources and activities.
- The identification of 'protectable' areas adjacent to the proposal footprint.
- Soils within the proposal footprint will not be moved between dieback occurrence categories.
- Requirements for hygiene washdown locations that consider risk in the surrounding landscape.
- A program to monitor and report on compliance and corrective actions where non-compliance has occurred.
- Quarterly auditing of washdown sites to identify weed incursions.
- Regular walk-overs at strategic locations along the proposal footprint (i.e. in association with native vegetation) to identify and ameliorate weed incursions.
- An auditable hygiene inspection form will be prepared to detail inspection results at the hygiene locations.

The weed and dieback management plan will take particular consideration into the management of WONS and declared pests known to be present within the proposal footprint (as listed in PER Chapter 8, Flora and Vegetation, Section 8.2.13) along with weeds ranked as high priority for eradication and control within the DPAW (2013b) WPP.

The management plan will also consider the effects of weed management on neighbouring tenure, to ensure any adverse impacts on neighbouring properties are minimised, including any need for notification and consultation. MRWA will not be responsible for conducting weed control on land managed by others.

There is no intention to implement a phosphite treatment program for managing dieback. Soil management measures within the weed and dieback management plan will minimise the risk of transporting or using dieback infested or uninterpretable soils into uninfested/protectable areas. Phosphite treatment may be considered if dieback is introduced to uninfested/protectable areas due to proposal activities and where the phosphite treatment will be effective in controlling the new infestation.

Consolidated issue 142 (contributing issue 118): The removal of 280 ha of TECs and PECs should be avoided. What measures will be put in place to protect TECs and PECs impacted by the proposal?

The proposed highway alignment is the product of numerous investigations over a long period of time. It seeks to balance impacts on remnant vegetation, wetlands, public drinking water supplies (Priority 1 and 3 areas of Gnangara UWPCA), amenity and existing and future land use (see PER Chapter 3, Route Selection and Development and Chapter 4 Detailed Description of Proposal).

The proposal has avoided all direct impact on Commonwealth-listed TECs and will only impact 4.0 ha of the state-listed TEC SCP20a and 145.5 ha of PECs (64 ha of SCP21c, 0.1 ha of SCP22, 11.6 ha of SCP23b, 7.8 ha of SCP24 and 62.0 ha of Banksia dominated woodlands on the SCP) as documented in PER Chapter 8, Flora and Vegetation, Table 8.13. The proposal will no longer impact the stated-listed TEC SCP02 following the additional surveys described in Chapter 3.

MRWA will offset unavoidable impacts to TECs. PER Chapter 17, Offsets, presents MRWA's proposal for environmental offsets. This report updates MRWA's offset strategy (Chapter 6, Environmental Offset) which incorporates the results of the spring surveys (Chapter 3) and addresses requests for further information set out in submissions on the PER.

Consolidated issue 143 (contributing issue 163): Which recommendations made by botanical environmental consultants will be implemented?

The majority of recommendations provided in the flora and vegetation report (PER Appendix C, Level 2 Spring Flora and Vegetation Assessment, Section 8 Recommendations) have been adopted for the proposal and are listed in PER Chapter 8, Flora and Vegetation, Section 8.5, including a discussion of flora and vegetation avoidance through design and the following management strategies:

- The avoidance or minimisation of vegetation clearing consistent with the three State TECs located within and adjacent to the proposal footprint.
- Additional targeted surveys for *Millotia tenuifolia* var. *laevis* to clearly define populations (currently underway).
- Demarcation of Threatened and Priority flora adjacent to the proposal footprint.
- Preparation and implementation of a construction EMP, including a monitoring program, to monitor impacts on environmentally significant vegetation adjacent to the proposal.
- Preparation and implementation of a weed and dieback management plan.

The proposal has successfully avoided direct impacts to both federally listed TECs and so no further studies are deemed necessary, as recommended in PER Appendix C, Level 2 Spring Flora and Vegetation Assessment.

Consolidated issue 144: There are no measures described regarding how to prevent, reduce or restore fragmentation.

Contributing issues:

79: There are no measures described regarding how to prevent, reduce or restore fragmentation.

249: Proposal should include measures to create/restore ecological linkages in Figure 8.5.

Fragmentation of remnant vegetation/ecological linkages has been avoided or minimised where possible. For example the proposal alignment was relocated around Bush Forever site 13 in order to avoid fragmenting the site (PER Chapter 8, Flora and Vegetation, Section 8.5). Linear road design constraints limit the extent to which fragmentation of patches of remnant vegetation can be avoided.

The development envelope is located adjacent to Ellenbrook residential area to minimise fragmentation impacts on conservation estate. It also avoids the known location of Caladenia huegelii and minimises noise impacts on residents, which results in a small area of fragmentation.

The following management has been proposed to mitigate the impact of fragmentation on ecological linkage networks:

- Disturbance will be restricted to the proposal footprint.
- Delineation of the proposal footprint ahead of clearing.
- Staged clearing and revegetation (where applicable) in accordance with infrastructure plan.
- Preparation and implementation of a construction EMP, including management and monitoring of intact native vegetation.
- Revegetation and rehabilitation of roadside vegetation (PER Chapter 12, Rehabilitation and Decommissioning, Section 12.5).
- Installation of fauna underpasses to maintain connectivity between patches (PER Chapter 9, Terrestrial Fauna, Section 9.5.8 and Figure 9.5).

PER Chapter 8, Flora and Vegetation, specifically Section 8.4.8 discusses the risks of fragmentation of native vegetation with particular regard to the six regional ecological linkage networks that traverse the proposal footprint (PER Chapter 8, Flora and Vegetation, Figure 8.5). PER Chapter 9, Terrestrial Fauna, specifically Section 9.4.8 discusses the loss of ecological connectivity on terrestrial fauna with particular regard to three ecological linkage networks, Maralla Road Bushland, Whiteman Park/Cullacabardee Bushland and Micro Gardens Park (PER Chapter 9, Terrestrial Fauna, Figure 9.4).

The selection of offset sites will consider the protection and enhancement of ecological linkages (see Chapter 6, Environmental Offsets).

12.7.4 Priority Flora

Consolidated issue 145 (contributing issue 73): Statement in Section 8.4.5 regarding clearing/removal of *Cyathochaeta teretifolia* (P3) is confusing.

PER Chapter 8, Flora and Vegetation, Table 8.1 provides results from a desktop search of relevant government databases to determine threatened and priority flora occurring within or in proximity to the proposal footprint. The desktop search identified a historical record of *Cyathochaeta teretifolia* within the proposal footprint, recorded during a survey conducted in 2013 by 360 Environmental (as cited in PER Appendix C, Level 2 Spring Flora and Vegetation Assessment).

This previously recorded population was not identified during the September 2014 survey (PER Appendix C, Level 2 Targeted Flora and Vegetation Assessment) The previously known location of *Cyathochaeta teretifolia* is in a cleared area. It is assumed that the clearing has resulted in the loss of this population.

The 2014 survey did however identify two new locations of *Cyathochaeta teretifolia* within the study area (see PER Chapter 8, Flora and Vegetation, Figure 8.1) however neither of these locations are within the proposal footprint and so no direct impact on this species is anticipated. This information is presented in PER Chapter 8, Flora and Vegetation, Table 8.15 and Section 8.4.5.

Four priority species will be impacted by the proposal: *Millotia tenuifolia* var. *laevis* (P2), *Poranthera moorokatta* (P2), *Anigozanthos humilis* subsp. *chrysanthus* (P4) and *Hypolaena robusta* (P4), as a subsequent study in 2015 has determined *Meeboldina decipiens* subsp. *decipiens ms* (P3) is no longer considered to be present within the proposal footprint (see Chapter 3, Spring Ecological Surveys, Section 3.2).

Consolidated issue 146 (contributing issue 113): Protection and management of Priority flora species.

Four priority-listed flora – *Millotia tenuifolia* var. *laevis, Poranthera moorokatta*, *Anigozanthos humilis* subsp. *Chrysanthus* and *Hypolaena robusta* – are located within the proposal footprint. Those within the footprint will be cleared during construction.

Individuals located adjacent of the proposal footprint will be protected through demarcation (based on a 50 m buffer) ahead of clearing as well as preparation and implementation of an EMP (see PER Chapter 8, Flora and Vegetation, Table 8.16).

Consolidated issue 148: How will the EPA's objectives be met for Priority taxa *Meeboldina decipiens* subsp. *decipiens* and *Millotia tenuifolia* var. *laevis*? More work should be done on surveying and/or translocating these taxa.

Contributing issues:

72: Likely impacts to *Millotia tenuifolia* var. *laevis* and *Meeboldina decipiens* subsp. *decipiens* are potentially significant. As well as extra surveys proposed, *Meeboldina decipiens* subsp. *decipiens* needs to be translocated e.g. to wetlands. More work needs doing.

78: Clarification is sought on how the successful implementation of the EMP regarding Priority taxa *Meeboldina decipiens* subsp. *decipiens* and *Millotia tenuifolia* var. *laevis* will result in the proposal being likely to meet the EPA's objectives.

206: Targeted survey for *Meeboldina decipiens* subsp. *decipiens* (Priority 3) should include potential habitat within Lightning Swamp Bushland and targeted surveys for *Millotia tenuifolia* var. *laevis* should include potential habitat in Whiteman Park.

(Repeated from Section 8.1)

A follow-up spring survey for *Meeboldina decipiens* subsp. *decipiens* (P3) and *Millotia tenuifolia* var. *laevis* (P2) was conducted by Woodman Environmental from 6 to 9 October 2015 (see Section 3.2).

The collections of *Meeboldina decipiens* subsp. *decipiens* from the survey were re-identified by WA Herbarium staff as *Lepyrodia muirii*, which is not a conservation significant species. The proposal no longer impacts *Meeboldina decipiens* subsp. *decipiens* (P3).

The survey identified a relatively large number of *Millotia tenuifolia* var. *laevis* individuals outside the proposal footprint. A total of 5,222 *Millotia tenuifolia* var. *laevis* individuals were recorded from eight populations in the area covered by the survey, including 1,652 individuals adjacent to (but not within) the development envelope in Cullacabardee. The proposal will impact two populations of *Millotia tenuifolia*

var. *laevis* comprising three individuals (see PER Appendix C, Level 2 Spring Flora and Vegetation Assessment). The impact is not significant at a local or regional scale due to the number of individuals identified outside the proposal footprint in Woodman's 2015 survey (see Appendix D, Spring Surveys for *Meeboldina decipiens* subsp. *decipiens* (P3) and *Millotia tenuifolia* var. *laevis* (P2)).

The draft EMP (PER Appendix F, Environmental Management Plan) contains measures to protect Threatened and Priority flora outside the proposal footprint (including *Millotia tenuifolia* var. *laevis* in Cullacabardee Bushland) from accidental disturbance and prevent the introduction and spread of weeds and dieback.

Consolidated issue 149 (contributing issue 114): The starflower species *Calytrix fraseri* Ellenbrook Form is a special form of the species and should be protected.

The *Calytrix fraseri* Ellenbrook Form is described in PER Appendix C, Level 2 Flora and Vegetation Assessment as being an unusual or unique species. This is due to its variation comprising up to 25 subspecies or variants. This taxon is not formally recognised as a Threatened or Priority species, and has been recorded from a number of survey quadrants within and outside of the proposal footprint. The *Calytrix fraseri* Ellenbrook Form was recorded in two vegetation associations (see PER Chapter 8, Flora and Vegetation, Table 8.3):

- Banksia sparse low woodland or BaBm[2], which comprises 4.9% or 147.6 ha of the study area.
- Corymbia sparse mid woodland or CcEm[2], which comprises 3.1% or 92.5 ha of the study area.

PER Chapter 8, Flora and Vegetation, Table 8.10 outlines the clearing impact of the proposal on the vegetation associations present in the study area. It is estimated that 82.2% of BaBm[2] and 70.7% of CcEm[2] will remain within the study area following clearing for the proposal. It is likely that some individuals of *Calytrix fraseri* Ellenbrook Form found within these vegetation associations will be impacted. MRWA will ensure the impact of vegetation clearance is reduced to as low as reasonably practicable and is restricted to the proposal footprint. As a large extent of both vegetation associations containing *Calytrix fraseri* Ellenbrook Form will remain, the impact on this species is not locally significant.

Consolidated issue 152: Risk from proposal to *Grevillea curviloba* subsp. *incurva* is understated. The PDNH needs to be moved further from individuals. Every effort needs to be taken to protect, and if possible re-introduce, this species in its critical habitat area.

Contributing issues:

71: Risk from proposal to *Grevillea curviloba* subsp. *incurva* is understated. The PDNH needs to be moved further from individuals. Every effort needs to be taken to protect, and if possible re-introduce, this species in its critical habitat area.

263: Please provide justification as to why a 10 m buffer is sufficient for avoiding indirect impacts to *Grevillea curviloba* subsp. *incurva* given that a 50 m buffer is proposed for *Caladenia huegelii*.

(Repeated from Section 7.3.1)

The population of *Grevillea curviloba* subsp. *incurva* is located in a 20-m-wide strip of degraded, weedy vegetation located between Brand Highway and the Midland–Geraldton railway line. The populations in this location are already confined with the distance of individuals from current active transport corridors a maximum of 10 m away.

Direct impacts to this population have been avoided through the construction of a bridge over the railway, Brand Highway and the railway/road reserve, which spans the location of this population. No section of the proposed highway will be positioned closer to individuals than the current Brand Highway.

The draft EMP (PER Appendix F, Environmental Management Plan) contains measures to protect Threatened and Priority flora from accidental disturbance and prevent the introduction and spread of weeds and dieback. The implementation of weed control measures may lead to an improvement in the condition of the *Grevillea curviloba* subsp. *incurva* critical habitat in the road reserve.

12.7.5 Study and Survey Adequacy

Consolidated issue 125: Will future/recommended surveys be conducted at Maralla Road and Halden Road?

Contributing issues:

4: Additional flora and vegetation surveys for Maralla Road. Were additional surveys undertaken? How will results be incorporated into project management documentation?

111: Will the spring surveys recommended for TECs, PECs, Threatened and Priority flora focusing on annual species at Maralla Road and Halden Road be conducted? When and by whom?

Prior to construction, a qualified ecologist will undertake a Level 2 targeted flora and vegetation survey of Maralla and Halden roads. The survey will confirm the presence/absence of TECs, PECs and Threatened or Priority flora in the area to be cleared in the road reserves. The results of the surveys will inform the detailed infrastructure plan prepared for this stage of the development (see PER Appendix F, Environmental Management Plan, Table 4.1).

Consolidated issue 126 (contributing issue 5): Timing of flora surveys for spring means flora surveys are limited.

The surveys were carried out in accordance with the ESD and EPA Guidance Statements 10 and 51. Guidance Statement No. 51 Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA, 2004b) states that surveys should be conducted following the season which normally contributes the most rainfall in the bioregion. This timing "ensures that the majority of the plant species in an area are flowering, fruiting and have foliage that allows identification. This is particularly important where ephemeral or cryptic species of interest may occur (e.g. geophytes, orchids)" (EPA, 2004b). For the proposal, located in the South-West Province, the main rain occurs in winter. The timing of the surveys in spring is consistent with this advice.

Consolidated issue 128: Clarifications regarding flora and vegetation surveys and results.

Contributing issues:

68: *Eryngium pinnatifidum* subsp. *palustre* (G.J. Keighery 13459) PN (P3) and *Verticordia serrata* var. *linearis* are not listed despite occurring in/near the area.

101: Our property was not surveyed for flora/vegetation. How can we be sure more significant species weren't missed?

102: 357 species of vascular flora taxa is probably an underestimation. Will MRWA fund additional surveys to characterise diversity of non-vascular plants and fungi, especially in the Maralla Road nature reserve?

110: *Millotia tenuifolia* var. *laevis* (P2), *Meeboldina decipiens* subsp. *decipiens* ms (P3), *Ornduffia submersa* (P4) and *Stylidium striatum* (P4) aren't mentioned in Table 8.1. Have they not been previously found? Or are they name changes?

Flora and vegetation surveys for the proposal were carried out in accordance with the proposal's ESD and EPA Guidance Statements 10 and 51 (EPA, 2004b).

The 2014 survey completed by Coffey (2015b) (see PER Appendix C, Level 2 Flora and Vegetation Assessment) covered an area of approximately 3,074 ha (the 'flora study area'), which is approximately four times larger than the proposal footprint (746 ha), to provide a broader floristic context. The flora study area followed the alignment of the proposal footprint and extended approximately 500 m from the edge of the proposal footprint in several locations south of Maralla Road. North of Maralla Road, the flora study area extended to the boundaries of the properties that the proposal footprint traverses (where access was granted).

PER Chapter 8, Flora and Vegetation, Section 8.2.1 states that the 2014 survey (Coffey, 2015b) identified a total of 456 vascular flora species from 73 families and 234 genera, while the total number of vascular taxa recorded from the three main surveys along the proposal footprint was 485 native taxa. This represents a high diversity of flora on the SCP and is higher than comparable surveys carried out in proximity to the proposal.

PER Chapter 8, Flora and Vegetation, Table 8.1 provides a list of potential Threatened and Priority flora occurring within or in proximity to the proposal footprint, based on a desktop search of relevant government databases. PER Chapter 8, Flora and Vegetation, Section 8.2.3 lists additional conservation significant species that were not identified in the desktop search but recorded during the 2014 survey including *Millotia tenuifolia* var. *laevis* (P2), *Meeboldina decipiens* subsp. *decipiens* ms (P3), *Ornduffia submersa* (P4) and *Stylidium striatum* (P4).

The desktop search identified 25 Threatened and 45 Priority-listed (two Priority 1, nine Priority 2, 21 Priority 3 and 13 Priority 4) taxa as occurring within and in proximity to the proposal footprint, including *Eryngium pinnatifidum* subsp. Palustre (G.J. Keighery 13459) PN. The known locations of *Eryngium pinnatifidum* subsp. Palustre (G.J. Keighery 13459) PN were visited during the 2014 survey but no plants were found, possibly due to it not flowering at the time of survey or becoming locally extinct. Notwithstanding, this species is considered to be present (PER Chapter 8, Flora and Vegetation, Table 8.1). *Verticordia serrata* var. *linearis* which is considered likely to be present was not recorded in surveys for the proposal which did not include private property.

No flora and vegetation surveys to characterise the diversity of non-vascular plants and fungi are proposed.

Consolidated issue 129 (contributing issue 236): Any future interchanges must be subject to thorough environmental review with surveys for flora/fauna to be more in depth than was done for PDNH.

The assessment process and the requirement for any further investigations to support future proposals including new interchanges will be subject to determination by the relevant statutory authority at the time of referral.

Flora and vegetation survey for the proposal was carried out in accordance with the ESD and EPA Guidance Statement Nos. 10 (EPA, 2006) and 51 (EPA, 2004b). The findings of this survey are presented in PER Appendix C, Level 2 Spring Flora and Vegetation Assessment. The Terrestrial fauna survey for the proposal was carried out in accordance with the ESD and the survey method was approved by the EPA and the DPAW. The findings of this survey are presented in PER Appendix G, Level 2 Targeted Fauna Assessment. The assessment of potential impacts on flora and fauna is presented in PER Chapter 8, Flora and Vegetation and Chapter 9, Terrestrial Fauna, respectively.

12.7.6 Weeds and Dieback

Consolidated issue 141 (contributing issue 74): MRWA weed control should be less procedural and more focused on outcomes, e.g. preventing weed incursion into adjacent vegetation and/or removing weeds from adjacent vegetation.

PER Chapter 8, Flora and Vegetation, Section 8.4.6 assesses the risk of introduction and spread of weeds to native vegetation located adjacent to the proposal footprint. Management of this risk during construction will be addressed through the preparation and implementation of a Weed and Dieback Hygiene Management Plan (see PER Chapter 8, Flora and Vegetation, Section 8.5). The management plan will include key objectives/outcomes and performance criteria and will be the responsibility of the contractor. During operations, MRWA will be responsible for weed control in the road reserve of the proposal.

12.8 Terrestrial Fauna

12.8.1 Black Cockatoos

Consolidated issue 85 (contributing issue 136): Black cockatoo watering sites within Dick Perry Reserve near PDNH needs to be replaced with new sites away from PDNH to lessen chance of mortalities.

MRWA will continue to work with DPAW in the preparation of an agreement, including detailed site plans and specifications, for construction of the length of the proposed highway through Dick Perry Reserve. The agreement may include removal and provision of an alternative water source for Black Cockatoos.

Consolidated issue 86: Black cockatoo surveys may have underestimated numbers due to timing and not asking local landholders.

Contributing issues:

134: Have field surveys been done during breeding season to determine black cockatoo roosting sites? Were landowners asked for local information?

226: Black Cockatoos have been sighted in increasing numbers very close to the proposal footprint. Given the PER surveys don't reflect this, the surveys appear not to have provided an accurate assessment of the species' presence. The impact may be greater.

The survey method described in PER Chapter 9, Terrestrial Fauna, Section 9.2.1 addressed the requirements of the ESD prepared by the EPA and the Referral Guidelines for Black Cockatoos (DSEWPAC, 2012) and was approved by the EPA and the DPAW.

The fauna study area was assessed and mapped to record the level of Black Cockatoo foraging, roosting and breeding habitat. The survey was conducted in September which coincides with the breeding season for Carnaby's Black Cockatoo (Johnstone and Storr, 1998). None of the species of Black Cockatoo are known to breed within the fauna study area. Their preferred breeding sites occur further to the southwest of Western Australia or in the Wheatbelt.

Consolidated issue 87 (contributing issue 133): Other options for reducing occurrences of black cockatoos at highway height.

PER Chapter 9, Terrestrial Fauna, Section 9.5.4 describes the management measures to reduce Black Cockatoo mortalities on the highway including limiting the use of Banksia and other Black Cockatoo foraging resources in revegetation planting within 10 m of the highway.

Proposed 1.8-metre-high fauna fences to be installed on both sides of the highway in areas north of Hepburn Avenue to a minimum of 100 m north of Maralla Road will also be a limited deterrent to the canopy foraging and roosting birds. Higher fences are not practical.

Consolidated issue 88: Minimisation of clearing of black cockatoo habitat.

Contributing issues:

32: Black cockatoo habitat preservation is of utmost importance. The removal of 13 breeding trees should absolutely be avoided.

62: Clearing of black cockatoo habit needs to be minimised especially in areas such as the interchange at The Promenade and behind Ellenbrook. Width of fragmented habitat is excessive. Noise walls and wire rope barriers should be used to reduce highway width.

81: The loss of 737 trees with a DBH over 500 mm and associated habitats is of considerable concern, highly significant and is not acceptable.

187: Approximately 10 large trees slightly northwest of the end of Gulf Cove in Ellenbrook should be retained. The alignment can be moved around these trees.

The proposal will not result in the removal of any known breeding trees. Impacts to Black Cockatoo habitat are addressed in PER Chapter 9, Terrestrial Fauna, Section 9.4.1.1.

PER Chapter 4, Detailed Description of Proposal, Section 4.2.3 discusses changes to the design as a result of studies undertaken as part of the PER and PER Chapter 9, Terrestrial Fauna, Section 9.5, discusses how changes to the proposal have reduced the proposal's overall impact to fauna values, including Black Cockatoos, for example:

- To avoid ecologically sensitive areas, the proposal alignment and design has been altered throughout the planning of the proposal.
- To avoid an area containing a high concentration of Black Cockatoo breeding trees, the width of the proposal footprint was reduced between Baal Street and Gnangara Road (see PER Chapter 9, Terrestrial Fauna, Figure 4.3). The updated proposal footprint design reduced the number of breeding trees cleared from 410 to 342 (a saving of 68 breeding trees).
- The proposal alignment predominantly follows existing infrastructure, cleared areas or secondary habitats, which reduces impacts to existing fauna habitats. A total of 586.4 ha or 78.6% of the proposal footprint occurs on these disturbed areas that offer little or no habitat for fauna. The proposal alignment was also moved to the western boundary of the development envelope in the vicinity of Gulf Cove, Ellenbrook to minimise impacts to high value habitat, avoid a known location of *Caladenia huegelii* and to minimise noise impacts on residents.

Where removal of habitat cannot be avoided, management measures have been proposed to reduce the impact on fauna and habitat as far as practicable (see PER Chapter 9, Terrestrial Fauna, Section 9.5). This includes restricting disturbance to the proposal footprint and delineation of the proposal footprint ahead of clearing.

Additional management measures, including the installation of rope wire barriers to reduce the proposal's overall footprint, are discussed in response to Issue 27. PER Appendix F, Environmental Management Plan includes measures to reduce impact to Black Cockatoo habitat through the development and implementation of detailed infrastructure plans for each stage of work to ensure Black Cockatoo habitat to be retained is clearly identified and demarcated before work commences.

Following revisions to the proposal described in Chapter 2, Proposal Update and reworking of spatial data, a maximum of 207.2 ha of Carnaby's Black Cockatoo foraging habitat, 120.5 ha of Forest Red-tailed Black Cockatoo foraging habitat, and 120.5 ha of breeding habitat (inclusive of 763 potential breeding trees) and 56.5 ha of roosting habitat for both species will be removed.

Offsets will address residual impacts where impacts cannot be avoided or minimised. Cleared Black Cockatoo habitat will be offset as discussed in Chapter 6, Environmental Offsets.

Consolidated issue 89 (contributing issue 33): What measures will be put in place to assess the extent of impact to Black Cockatoos?

Impacts on Black Cockatoos have been assessed in PER Chapter 9, Terrestrial Fauna, Section 9.4.1.1 and include the loss of habitat and possible temporary displacement of birds during construction.

PER Appendix F, Environmental Management Plan includes measures to reduce impact to Black Cockatoo habitat through the development and implementation of detailed infrastructure plans for each stage of work to ensure Black Cockatoo habitat to be retained is clearly identified and demarcated before work commences.

MRWA will be responsible for auditing the proposal during construction to ensure compliance with conditions. The OEPA and DOTE may conduct audits on implementation of approval conditions, including compliance with nominated buffers and clearance boundaries. Where required by the OEPA or the DOTE, MRWA will commission an independent auditor.

12.8.2 Fauna Underpasses

Consolidated issue 91: Effectiveness of fauna underpasses.

Contributing issues:

35: What is the likelihood that 100% of target species will use fauna underpasses?

202: Are fauna underpasses successful? Would all species in the area use them?

209: Is there any evidence that wildlife will use an underpass subject to noise and vibration from a highway being used by heavy traffic like the PDNH?

PER Chapter 9, Terrestrial Fauna, Section 9.5.8 describes underpass design and includes a summary of design considerations. Underpasses for this proposal were designed in line with MRWA Design of Fauna Underpass guideline (MRWA, 2010) and in consultation with a fauna underpass expert from UWA (Chambers, pers. comm.). The underpasses are designed for use by all ground dwelling fauna likely to occur in the study area.

Factors that influence the success of a fauna underpass that were considered in the design include presence of "furniture" such as logs and branches, vegetation at the openings, length, dry passage and natural flooring i.e., dirt or sediments. Limiting human access to underpasses is key to ensuring their use by fauna (Bamford, 2011).

Fauna underpasses have been successfully implemented on similar projects in the Perth region such as the Roe Highway, Kwinana Freeway and Mandjoogoordap Drive (UWA, 2013). A fauna underpass monitoring program will be developed as part of the proposal to assess their effectiveness (see PER Chapter 9, Terrestrial Fauna, Section 9.5.8).

Consolidated issue 92: Suitability of design of underpasses relative to target species.

Contributing issues:

34: Fauna underpass size may be limiting to larger animals. Can they be used by large kangaroos? Are there previous examples of successful implementation?

35: What is the likelihood that 100% of target species will use fauna underpasses?

36: Will all fauna underpasses include natural lighting throughout to ensure use by diurnal species?

126: What evidence demonstrates that 1.2 m x 3 m x 70 m fauna underpasses work for Western Grey Kangaroos, which can be 2 m tall?

203: Will there be natural lighting in fauna underpasses for daytime migrating species? If underpasses are in darkness they may not be used by all species.

PER Chapter 9, Terrestrial Fauna, Section 9.5.8 describes underpass design and includes a summary of design considerations. The underpasses were designed in line with MRWA requirements and in consultation with a fauna underpass expert. The design considers use by all ground-dwelling fauna likely to occur in the study area and natural lighting including sky lights will be used where practicable.

The results of a monitoring of existing underpasses has shown that adult Western Grey Kangaroos are able to use structures with a height of 1.2 m (Chambers, pers. comm.) and slowly move through the underpass on their haunches.

Fauna underpasses have been successfully implemented by MRWA on similar projects in the Perth region such as the Roe Highway, Kwinana Freeway and Mandjoogoordap Drive (UWA, 2013). A fauna underpass monitoring program will be developed as part of the proposal to proposal to assess their effectiveness (see PER Chapter 9, Terrestrial Fauna, Section 9.5.8).

The program will focus on underpasses on the Maralla Road Bushland and Whiteman Park/Cullacabardee ecological linkages.

Consolidated issue 93: Unauthorised uses of fauna underpasses such as rubbish dumping and illegal motorbike riding.

Contributing issues:

37: Will fauna underpasses be monitored for illegal use such as trail bikes and rubbish dumping?

38: Will fauna underpasses restrict access for motorbikes while allowing access for fauna?

196: Bollards or other devices should be installed in fauna underpasses to limit unauthorised access, e.g. from motorbikes.

199: Rubbish dumping is a problem around Maralla Road. Fauna underpasses will attract more dumping. Who will be responsible for cleaning up rubbish?

201: Underpasses will create additional problems for residents due to motorbikes using them and rubbish being dumped in them.

229: How will unauthorised human access into fauna underpasses be prevented to avoid discouraging use by fauna?

Limiting human access to underpasses is key to ensuring their use by fauna (Bamford, 2011) and has been considered in the design. PER Chapter 9, Terrestrial Fauna, Section 9.5.8 provides details of underpass design including features that encourage use by fauna.

The maximum height of underpasses for the proposal is 1.2 m, which will limit unauthorised access (e.g., trail bike riders). Fauna underpasses have been successfully implemented on similar projects in the Perth region such as Roe Highway, Kwinana Freeway and Mandjoogoordap Drive (UWA, 2013). A fauna underpass monitoring program will be developed to assess their effectiveness (see PER Chapter 9, Terrestrial Fauna, Table 15.3).

Uncontrolled access and illegal dumping of rubbish within the proposal footprint will be monitored during construction. Temporary fencing during construction and permanent fencing post construction (see PER Chapter 9, Terrestrial Fauna, Figure 9.5) will restrict access to the underpasses from the highway.

Illegal dumping of rubbish on public land including road reserves is regulated under the *Litter Act 1979*.

MRWA is also considering the installation of bollards at fauna underpass entries to further deter access.

Consolidated issue 94 (contributing issue 16): Can fauna underpasses also be placed in cleared areas?

Fauna underpasses are most effective in areas where there is vegetation in proximity to the opening (Bamford, 2011; QDMR, 2000). Fauna will be less likely to use an underpass in a cleared or open area as they will be at a higher risk of predation.

PER Chapter 9, Terrestrial Fauna, Section 9.5.8 describes underpass design and includes a summary of design considerations. Underpasses for this proposal were designed in line with MRWA requirements and in consultation with a fauna underpass expert. The final underpass designs will include revegetation close to the underpass openings using local species. A fauna underpass monitoring program will be developed as part of the proposal to assess the effectiveness (see PER Chapter 9, Terrestrial Fauna, Section 9.5.8).

Consolidated issue 184 (contributing issue 294): What monitoring and maintenance during operations will exist for revegetation? What will the measures of success be?

PER Chapter 9, Terrestrial Fauna, Section 9.5.8 describes underpass design and monitoring to be undertaken post construction. The monitoring program will assess the size of fauna populations prior to construction and continue for a minimum of one year post construction to determine the effectiveness of the underpasses. If fauna underpasses are deemed to be ineffective, remedial actions including extended rehabilitation of surrounding vegetation and installation of additional underpass furniture will be considered.

Following the completion of this monitoring program, Main Roads will conduct periodic inspections of the road and associated infrastructure. Where any damage is found, either through these inspections or other reports, the damage will be repaired as soon as practicable.

12.8.3 Impact Assessment

Consolidated issue 105: [address redacted] Maralla Road should be included in the ecological linkage corridor.

Contributing issues:

140: [address redacted] Maralla Rd should be included in the ecological linkage corridor.

198: Our land is an important contributor to the ecological linkages described in the PER. It should have been considered even though it is outside the study area.

Maralla Road Bushland is one of six ecological linkages identified in the Regional Ecological Linkage Network (see PER Chapter 8, Flora and Vegetation, Section 8.2.9 and Figure 8.5A). PER Chapter 9, Terrestrial Fauna, Section 9.2.8 and Figure 9.4A describe the importance of this link for wildlife movement. While the assessment focused on nature reserves and Bush Forever sites, it is acknowledged that remnant

vegetation along the north side of Maralla Road will contribute to ecological connectivity and support wildlife movement.

Consolidated issue 106 (contributing issue 20): Why is habitat at Lot 9 Maralla Road classified as 'modified' when it hasn't been used for agricultural or residential purposes?

Aerial photography shows that the vegetation at Lot 9 Maralla Road was cleared sometime between 1965 and 1974. This would have caused a significant modification to the original vegetation community. During ecological surveys, it was noted that the vegetation type differed significantly from adjacent native vegetation.

PER Appendix G, Level 2 Targeted Fauna Assessment, Section 5.1.5 provides a description of the 'modified vegetation' classification. Modified vegetation is classified as secondary fauna habitat i.e., it provides limited habitat for some species. Secondary fauna habitat acts as ecological linkage between areas of more suitable habitat. Modified vegetation occurs where there is disruption of original vegetation structure of the habitat due to removal of either the lower-, mid- or over-storey. Modified vegetation may occur in areas such as along roads where there has been some revegetation or may have been impacted by clearing, weeds or tracks or other evidence of human disturbance.

Consolidated issue 107 (contributing issue 28): What is the impact to species already noted as in decline?

Development of the proposal will result in loss of habitat for some fauna (mammals and birds). Fauna habitat is largely protected by minimising impacts to vegetation, avoiding Bush Forever sites and nature reserves and ecological connectivity is preserved through use of underpasses for fauna and revegetation. Some fauna will be permanently displaced by the proposal footprint and seek refuge or relocate to adjacent native vegetation. Some fauna such as birds will be temporarily displaced but will recolonise areas adjacent to the highway following construction.

The significance of impacts on fauna is assessed in PER Chapter 9, Terrestrial Fauna, Section 9.4. Impacts from the proposal are restricted to the local scale and are not expected to be significant; as such the proposal is not anticipated to alter the conservation status of any locally and regionally significant fauna.

Consolidated issue 108 (contributing issue 130): In Appendix G, column 9 in the previously recorded fauna list doesn't seem to match the location and results of trap sites list.

The results of the Level 2 Targeted Fauna Assessment are presented in Appendix E and Appendix H of PER Appendix G, Level 2 Targeted Fauna Assessment. Appendix E presents the fauna records from the six trap sites including opportunistic sightings. It does not include records from elsewhere during the fauna survey (e.g., those recorded during the Level 1 survey, fauna movement survey or targeted Black Cockatoo survey). Appendix H column 9 presents the full list of species recorded during the fauna survey (at trap sites and in other surveys). All species listed in Appendix E are recorded as 'present' in Appendix H. The only exception is the Spotted Pardalote, which was inadvertently omitted from the list in Appendix H.

Consolidated issue 118: How is it possible to justify the removal of 159 ha of natural fauna habitat?

Contributing issues:

21: Fauna habitats should be preserved as much as possible.

120: How is it possible to justify the removal of 159 ha of natural fauna habitat?

An environmental constraints assessment was undertaken on potential alignments (see PER Chapter 3, Route Selection Development, Section 3.3) and considered factors such as Bush Forever sites and conservation/ecologically sensitive areas. PER Chapter 4, Detailed Description of Proposal, Section 4.2.3

discusses changes to the design made as a result of studies undertaken as part of the PER and issues raised by stakeholders during consultation.

PER Chapter 9, Terrestrial Fauna, Section 9.5 discusses how changes to the proposal have reduced the proposal's overall impact to fauna values in particular, for example:

- To avoid ecologically sensitive areas, the proposal alignment and design has been altered throughout the planning of the proposal.
- To avoid impacts to habitat for the Critically Endangered Western Swamp Tortoise at Twin Swamps Nature Reserve, the interchange at Warbrook Road was relocated to Stock Road.
- To avoid an area containing a high concentration of Black Cockatoo breeding trees, the width of the proposal footprint was reduced between Baal Street and Gnangara Road (see PER Chapter 9, Terrestrial Fauna, Figure 4.3). The updated proposal footprint design reduced the number of breeding trees cleared from 410 to 342 (a reduction of 68 breeding trees).
- The proposal alignment predominantly follows existing infrastructure, cleared areas or secondary habitats, which reduces impacts to existing fauna habitats. A total of 586.4 ha or 78.6% of the proposal footprint occurs on these disturbed areas that offer little or no habitat for fauna.

Where removal of habitat cannot be avoided, management measures have been proposed to reduce the impact on fauna and habitat as far as practicable (see PER Chapter 9, Terrestrial Fauna, Section 9.5), including restricting disturbance to the proposal footprint, delineation of the proposal footprint ahead of clearing, the installation of fauna underpasses to assist in preserving ecological connectivity and revegetation using local native species. Offsets will address residual impacts where impacts cannot be avoided or minimised. Refer to Chapter 6, Environmental Offsets.

Following revisions to the proposal described in Chapter 2, Proposal Update and reworking of spatial data, the area of fauna habitat impacted by the proposal has been revised from 159.3 ha to 160.1 ha.

12.8.4 Impacts from Light, Noise and Vibration

Consolidated issue 95: Impacts and management of noise and vibration on fauna.

Contributing issues:

40: How will the impact of light and noise emissions on fauna be managed? Has the potential impact to wildlife in the area been assessed?

80: Potential impacts of noise and vibration on fauna has been dismissed. Many fauna are sensitive and the impact could be greater than thought.

172: Façade treatment will not reduce exterior noise and will impact fauna. Can thick vegetative buffers be considered?

210: It is not clear what impact ground vibration will have on wildlife in the area.

The impacts of light and noise on fauna are discussed in PER Chapter 9, Terrestrial Fauna, Section 9.4.6.

Studies of the impacts of light, noise and vibration on fauna are not extensive. Noise, vibration and light may result in disturbance or displacement of fauna and disrupt their natural behaviour. For example, noise (and vibration) can disturb roosting bats and birds and affect bats, birds and frogs which use noise to communicate and/or hunt. Artificial lighting can affect the behaviour of nocturnal fauna and will attract insects that are a food source for some fauna.

Construction will cause temporary displacement of fauna until some species assimilate to the changed acoustic environment and return to habitat adjacent to the highway. More sensitive and reclusive fauna

may be permanently displaced from the area adjacent to the highway, as they seek refuge in larger tracts of remnant vegetation.

Vibration impacts will be higher during construction due to piling activities and vibratory rollers. Vibration impacts during operation will be insignificant.

Measures to manage the impacts of light on fauna have been discussed in PER Chapter 9, Terrestrial Fauna, Section 9.5.6 and noise and vibration measures are presented in PER Chapter 11, Amenity (Noise and Vibration), Section 11.7 and Table 11.3. During construction, all works will be carried out in accordance with AS 2436:2010 Guide to Noise and Vibration control on Construction, Demolition and Maintenance Sites.

12.8.5 Management During Construction Only

Consolidated issue 109 (contributing issue 121): Clearing should be able to avoid mortalities in local vertebrates. Clearing should be done slowly and carefully to prevent mortalities.

MRWA is committed to minimising the number of fauna mortalities associated with vegetation clearing (see PER Chapter 9, Terrestrial Fauna, Section 9.5). A construction EMP will be developed and implemented to manage impacts during clearing and reduce the potential for fauna mortalities. The plan will include measures such as clearing outside of spring wherever possible, implementing a fauna trapping and relocation program prior to clearing activities, using fauna spotters during clearing activities and carrying out clearing progressively and in a way that directs escaping fauna away from clearing activities to adjacent vegetation.

Consolidated issue 110 (contributing issue 127): What staging measures will be put in place during construction to prevent the halting of fauna movements at all times?

Construction activities including vegetation clearing, road reserve fencing, road work and noise will displace fauna from the proposal footprint. The linear nature of construction activities precludes providing temporary access for fauna. Notwithstanding this, some fauna will cross the proposal footprint during construction. As revegetation establishes following construction, fauna are expected to explore and commence using underpasses.

The proposal is likely to be constructed in stages which will reduce the length of the proposal footprint and duration of time fauna is excluded from a particular area (see PER Chapter 4, Detailed Description of Proposal, Section 4.1). The typical construction timeframe for a stage is 2 to 3 years.

Consolidated issue 111 (contributing issue 137): *Merops ornatus* (Rainbow Bee-eater) is likely to occur but the nests will be at risk from construction. Will construction cease if nesting birds are noticed along or near Maralla Road?

A construction EMP will be developed and implemented to manage impacts to fauna (including the Rainbow Bee-eater) during construction (see PER Chapter 9, Terrestrial Fauna, Section 9.5).

The construction EMP will include a requirement to clear outside spring wherever possible to minimise impacts on to the breeding cycle of resident fauna (including nesting birds). It will also include a requirement for a fauna spotter to be on site during clearing activities (see PER Appendix F, Environmental Management Plan, Table 4.2). Any evidence of nesting Rainbow Bee-eaters will be recorded, demarcated and temporarily avoided until the birds have left the nest.

12.8.6 Management During Construction and Operation

Consolidated issue 112 (contributing issue 122): Will MRWA erect warning signs along the roadside about wildlife crossing, and provide wildlife rescue contact details?

MRWA will erect warning signs about wildlife crossing where there is a road safety issue. Fauna fencing and underpasses will reduce the potential for fauna to enter the road reserve and hence fauna warning signs are unlikely to be required.

MRWA has published the following information on its website to facilitate the recovery and care of fauna injured on its road network: "Call the Wildcare Helpline on 9474 9055 for sick, injured or orphaned native wildlife."

Consolidated issue 113: Roadside fencing.

Contributing issues:

128: Will the roadside fencing be kangaroo proof?

164: Will roadside fences be built into the ground and at a height of 1.8 m as recommended?

228: Roadside fencing height of 1.2 m is inadequate to prevent kangaroos and other animals getting past. Fencing should be 1.8 m minimum in all areas along bushland and wetlands. Fencing repair and monitoring must be ongoing.

PER Chapter 9, Terrestrial Fauna, Section 9.5.4 and Figure 9.5 provide details and shows the location of fauna fencing designed to restrict medium to large ground-dwelling fauna (including kangaroos) from accessing the highway. The fauna fence design is consistent with MRWA Drawing No. 200331-110; i.e., 1,800 mm high and 500 mm below ground level. The fence is designed to guide fauna to safe crossing points at the fauna underpass locations.

Where any damage is found, either through MRWA inspections or other reports, the damage will be assessed and repaired as soon as practicable.

Consolidated issue 114 (contributing issue 83): Are the proposed fauna escape ramps better than one-way fauna gates as found on some other projects?

Fauna escape ramps or gates (one-way devices that allow trapped animals safe egress from the road) will be installed every 200 m in sections of the alignment with fauna fencing to allow trapped animals egress from the road reserve (see Chapter 13). The ramps or gates are designed to prevent fauna access in the wrong direction i.e., to prevent fauna from entering the road reserve.

The effectiveness of ramps and one-way gates as escape strategies from road reserves depends on the design. One-way gates need to be large enough to accommodate the largest animal to use them and some fauna are known to be able to bypass the one-way design of the gates. Escape ramps resemble natural topography and can be vegetated with native plants to encourage use by fauna. In a study on the effectiveness of escape ramps and one-way gates in the United States of America, earthen ramps were found to be 8 to 11 times more effective than steel gates for large-hooved mammals (Bissonette and Hammer, 2000).

Consolidated issue 115 (contributing issue 147): The indirect impacts to fauna habitats discussed in Section 9.3 are unacceptable. Alterations to hydrology resulting in habitat destruction should be mitigated to prevent damage to wetlands.

Impacts to hydrology are predicted to be localised and temporary in nature during construction due to management measures aimed at maintaining hydrological connectivity across the proposed highway.

Culverts and bridges will be constructed on existing drainage lines to maintain flow during operation in watercourses and to wetlands fed by the watercourses.

Potential impacts to habitat from changes to hydrological conditions is described in PER Chapter 9, Terrestrial Fauna, Section 9.4.7, and in more detail (specifically with regard to wetlands) in PER Chapter 10, Hydrological Processes and Inland Waters Environmental Quality. Proposed management measures are detailed in PER Chapter 10, Hydrological Processes and Inland Waters Environmental Quality, Section 10.5. A Wetland Management and Monitoring Plan will be developed and implemented including groundwater monitoring to ensure impacts to wetlands (and Ellen Brook) are being appropriately managed and there are no unforeseen impacts (see PER Chapter 10, Hydrological Processes and Inland Waters Environmental Quality, Section 10.5). Edge effects could extend up to 10 m into remnant vegetation from the cleared area. The extent of edge effects will be ameliorated by revegetation and weed control in the road reserve. The Weed and Dieback Management Plan will control the introduction and spread of weeds and dieback during construction (see also response to consolidated issue 153). Ongoing maintenance of the road reserve will include inspection for, and control of weeds, during operation.

Uncontrolled access within the proposal area will be monitored during construction to reduce the risk of fire and illegal dumping of rubbish. Temporary fencing during construction and permanent fencing post construction (see PER Chapter 9, Terrestrial Fauna, Figure 9.5) will restrict access from the highway. Fauna underpasses have also been designed to limit human use (see PER Chapter 9, Terrestrial Fauna, Section 9.5.8).

Consolidated issue 116 (contributing issue 132): Will MRWA be proactive in removing animal carcasses from the PDNH to prevent impacts to carrion predators such as the Wedge-tailed Eagle?

Animal carcasses will be removed where they pose a road safety issue.

12.8.7 Monitoring

Consolidated issue 101 (contributing issue 125): What maintenance during operations will exist for underpasses, escape ramps, fences, logs, furniture and revegetation?

A fauna underpass monitoring program will be developed as part of the proposal to assess their effectiveness (see PER Chapter 9, Terrestrial Fauna, Section 9.5.8). The program will focus on underpasses on the Maralla Road Bushland and Whiteman Park/Cullacabardee ecological linkages.

During operation, MRWA will conduct periodic inspections of the highway and associated infrastructure in accordance with their maintenance program. Where any damage is found, either through these inspections or other reports, the damage will be assessed and repaired as soon as practicable.

12.8.8 Study and Survey Adequacy

Consolidated issue 96: Surveys for invertebrates were not extensive enough.

Contributing issues:

26: Desktop fauna survey records only 4 invertebrate species. Invertebrates should have been considered properly.

139: Invertebrates have not been surveyed extensively enough in the proposal footprint. Will MRWA help fund an extensive invertebrate survey?

195: Extent of invertebrate studies was non-existent or extremely limited. Invertebrates have a role in other processes, e.g. pollination. The view that insects are unimportant is unacceptable and outdated.

The fauna survey method (PER Chapter 9, Terrestrial Fauna, Section 9.2.1) addresses the requirements of the ESD prepared by the Environmental Protection Authority (EPA). The OEPA and the DPAW were consulted on the survey method.

PER Chapter 9, Terrestrial Fauna, Section 9.2.4 states:

> *Conservation significant invertebrates and fish species identified in the desktop assessment were assessed on their likelihood of occurrence in the fauna study area based on the habitats present, current distribution and relevance of previous records. The* [former] *DEC conducted a terrestrial invertebrate biodiversity assessment for the GSS* [Gnangara Sustainability Strategy]*, which identified three conservation significant invertebrates as currently occurring on the northern SCP (Wilson and Valentine, 2009). Of these, only the Priority 4 listed Graceful Sun Moth (*Synemon gratiosa*) occurs in close proximity (within 10 km) of the proposal footprint.*

Potential short-range endemic (SRE) habitat (predominantly associated with invertebrates) was identified at the Mound Springs SCP TEC. The proposal avoided this site and there will be no impact on this community and habitat. No specific SRE survey was required to comply with the ESD.

The role of the thynnid wasps in pollinating *Caladenia huegelii* is understood and addressed in the discussion of potential impacts on this species (see response to consolidated issue 135 in Chapter 12, Response to Issues Raised by the Public, Section 12.7.1).

Consolidated issue 97: Study, survey and trapping procedures were inadequate. Richness of extant fauna is not captured in surveys.

Contributing issues:

25: Fauna assessment is inadequate because it does not consider arboreal and bird species, underestimating species diversity. Some species of reptiles, micro bats, invertebrates, birds not properly considered. Local extinctions could result.

27: Study, survey and trapping procedures were likely inadequate. Why were trapping nights not conducted across all four seasons?

194: The timing and duration of the surveys do not adequately represent the richness of fauna that longitudinal studies would have provided.

215: Surveys for flora and fauna, but especially birds, reptiles and invertebrates, was not comprehensive enough. Species have been overlooked because of the limited scope of surveys. How can the real impacts be known?

266: It is unclear if all fauna records from all surveys in the study area have been considered, or if only the results in the Level 2 Targeted Fauna Assessment by Coffey have been considered.

(Repeated from Section 7.4)

The fauna assemblage of the SCP is well documented with numerous systematic surveys completed in recent history (Government of Western Australia, 2000). The survey method (PER Chapter 9, Terrestrial Fauna, Section 9.2.1) addressed the requirements of the ESD and was approved by the EPA and DPAW.

A total of 97 species were recorded during these surveys, all of which were identified as potentially occurring in the desktop assessment. The number of fauna species recorded during the survey is comparable with other surveys completed in the vicinity and typical of the habitats present within the study area. For example, of the 232 birds identified during the desktop assessment, 62 of these were positively recorded during the surveys (PER Appendix G, Level 2 Targeted Fauna Assessment, Table 5.4).

The term ‘fauna assemblage’ is used throughout the PER to describe the large number of species previously recorded. Fauna assemblage includes birds, arboreal mammals, bats, reptiles and invertebrates.

As the proposal’s impacts to the fauna assemblage are expected to be localised, the PER focuses on impacts on conservation significant fauna, particularly those species confirmed to be present during the survey along with any other conservation significant species identified during the desktop assessment which were considered likely to occur within the proposal footprint (see PER Chapter 9, Terrestrial Fauna, Section 9.2.5).

12.8.9 Study and Survey Scope

Consolidated issue 98 (contributing issue 131): There are no comprehensive lists of birds in the survey site. Some species are not mentioned. Will MRWA fund bird surveys in the proposal area?

The fauna survey method (PER Chapter 9, Terrestrial Fauna, Section 9.2.1) addresses the requirements of the ESD prepared by the Environmental Protection Authority (EPA). The OEPA and the DPAW were consulted on the survey method.

The desktop assessment of State and Commonwealth databases, regional and local contextual data and existing biological surveys identified approximately 360 species of fauna (including 232 birds) previously recorded in the vicinity of the proposal footprint. The Red-winged Fairy-wren (*Malurus elegans*) was previously recorded in the study area by Birdlife Australia but has not been recorded in any recent surveys including those conducted for the PER. The list of birds previously recorded in the study area is provided in PER Appendix G, Level 2 Targeted Fauna Assessment, Appendix H. The Level 1 opportunistic survey and Level 2 targeted survey conducted as part of the PER recorded 62 birds including three conservation significant birds, Carnaby's Black Cockatoo, Forest Red-tailed Black Cockatoo and the Australian Bustard.

No additional bird surveys are proposed.

Consolidated issue 99 (contributing issue 138): Jewelled Sandplain Ctenotus (*Ctenotus gemmula*), Black striped snake (*Neelaps calonotos*) and Western Brush Wallaby (*Macropus irma*) do occur within the proposal footprint, despite being stated as 'likely' to occur.

The nominated species were identified as ‘likely’ to occur in the study area based on the availability of suitable habitat and records close to the study area (see PER Appendix G, Level 2 Targeted Fauna Assessment, Section 5.5). Despite not being recorded in surveys conducted for the PER, they were assumed to be present and potential impacts on these species were assessed (see PER Chapter 9, Terrestrial Fauna, Section 9.4, specifically Sections 9.4.1.9 (Jewelled Sandplain Ctenotus), 9.4.1.10 (Black striped snake) and 9.4.1.12 (Western Brush Wallaby).

Consolidated issue 100 (contributing issue 39): Why were properties outside the study area not surveyed?

PER Appendix B, Environmental Scoping Document states that the PER should identify the values and significance of fauna, fauna habitat and habitat connectivity within the development envelope and immediate adjacent area. Properties not directly impacted by the proposal were not included in the terrestrial fauna survey. The search of historical records done as part of the Level 2 fauna survey informed the areas targeted for trapping. These areas included corridors that were important for the maintenance of ecological connectivity. OEPA and DPAW were consulted on the survey method.

12.8.10 Translocations

Consolidated issue 102: Fauna translocations during the construction phase.

Contributing issues:

15: Will funds be available to support wildlife carers with animals injured as a result of the construction of the proposal?

29: Provide details on fauna translocations prior to construction, viz. who will do it, where will animals be relocated to, what is the minimum distance, what about other animals, what about injured fauna?

123: What measures will be adopted during construction to monitor and remove species that can be relocated? What support will MRWA provide for ongoing monitoring of relocated fauna to determine relocation success?

124: What support will MRWA give to wildlife carers who have to care for injured and orphaned animals that result from extensive habitat destruction and relocation of adult females?

Fauna spotters (qualified zoologists) will be present during vegetation clearing. Ground-dwelling fauna will be trapped, other fauna will be captured. Trapped and captured fauna will be relocated to adjacent comparable habitat outside the proposal footprint (see PER Chapter 9, Terrestrial Fauna, Section 9.5.4), in accordance with a *Wildlife Conservation Act 1950* (WC Act) Regulation 15 Licence to take fauna for education or public purposes (fauna relocation and/or education). Injured fauna will be taken to an authorised veterinarian or wildlife carer.

Consolidated issue 103 (contributing issue 31): Will the relocation of fauna account for breeding patterns, e.g. the monogamous nature of the lizard *Tiliqua rugosa*?

The Bobtail Skink (*Tiliqua rugosa*) was recorded in multiple surveys in the vicinity of the proposal (see PER Appendix G, Level 2 Targeted Fauna Assessment, Appendix H) and is assumed widely distributed in adjacent areas such as Whiteman Park. Translocation of particular species (e.g., *Tiliqua rugosa*) will target suitable adjacent habitat avoiding segregation of individuals trapped or captured in the vicinity.

Consolidated issue 104 (contributing issue 30): Who is responsible for detecting and reducing disease in fauna? Will trapping personnel identify diseased animals and prevent its spread?

Injured (ill or diseased) fauna trapped or captured by fauna spotters during construction will be taken to an authorised veterinarian or wildlife carer who will be able to identify infectious diseases and recommend appropriate treatment.

12.9 Hydrological Processes and Inland Waters Environmental Quality

12.9.1 Acid Sulfate Soils

Consolidated issue 62: Management of acid sulfate soils (ASS).

Contributing issues:

154: How will ASS be managed?

238: Recommendations in the PER regarding further investigations to inform specific management of ASS are generally consistent with DER guidelines as applicable to large-scale linear projects.

(Repeated from Chapter 10)

DER noted "recommendations in the PER regarding further investigations to inform specific management of acid sulfate soils are generally consistent with DER guidelines as applicable to large scale linear projects."

Following final design and the definition of likely soil disturbance, a detailed ASS investigation will be undertaken to inform the development of an ASS Management Plan. PER Chapter 10, Hydrological Processes and Inland Waters Environmental Quality, Table 10.9 outlines proposed management strategies including the use of spread footings in final design where sands are deemed suitable to support structures at raised interchanges, to minimise the extent of any anticipated disturbance to ASS.

12.9.2 Dewatering and Water Abstraction

Consolidated issue 66 (contributing issue 144): The Water Corporation bores impacted by PDNH should be decommissioned.

MRWA will continue to liaise with the Water Corporation and DOW in relation to impacts to production bores and well head protection zones. The establishing and decommissioning of groundwater production bores is the responsibility of the Water Corporation. The licensing of groundwater bores and allocation of groundwater is the responsibility of the DOW.

Consolidated issue 77: Impacts from and management of dewatering and groundwater abstraction.

Contributing issues:

49: How close to wetlands 8800 and 8801 will dewatering take place? What limits will there be on dewatering? How will dewatering impacts to wetlands be managed?

94: Dewatering during construction doesn't mention the impact to local residents that rely on groundwater for domestic/stock water.

145: Wetlands are already dry and construction dewatering, as well as subsurface compaction, must be minimised.

155: How will dewatering and water abstraction be monitored and addressed? In particular: abstraction rates, bore operating regimes, hydrogeology of bores, impacts to environmental values from drawdown, and existing groundwater licences.

204: During construction will there be dewatering near Maralla Road? If so, how will dewatering be managed especially with regard to wetland CCW 8800 and *Caladenia huegelii*?

230: How has construction water allocation been licensed properly? How has existing local overallocation of water been accounted for?

231: Will there be monitoring of the environments likely to be affected by water abstraction during construction?

242: That the potential for indirect impacts on wetlands be minimised by restricting to summer months, the construction of footings for bridges and utility services at locations where dewatering would be likely to lower the water table in CCWs.

243: The potential for indirect impacts on wetlands should be minimised by managing drawdown associated with extraction bores in the vicinity of CCWs to maintain groundwater at depths that will not result in significant impacts on wetlands.

(Repeated from Section 8.3)

Where practical, construction of bridge footings will be scheduled during summer to avoid or minimise dewatering requirements. If dewatering is required, dewatering methods (e.g. well-point spears) that

minimise the radius of influence in confirmed areas of ASS and on sensitive receptors (e.g. wetlands) will be utilised (see PER Chapter 10, Hydrological Processes and Inland Waters Environmental Quality, Section 10.5). A dewatering licence will be obtained from the DOW under the RIWI Act for any dewatering activities undertaken.

If works are undertaken during the wet season construction dewatering will potentially be required at eight locations to enable bridge footing construction. Of these eight locations, only two locations (Reid/Tonkin interchange and Stock Road interchange) have wetlands within the modelled drawdown radius of influence of up to 500 m (see PER Appendix L, Position Paper – Groundwater Level Impact from Construction Dewatering and Groundwater Abstraction, Table 1). Dewatering, if required, is expected to last up to six weeks.

MUW 8785 and MUW 8784 (former EPP Lake 450) are located adjacent to the Stock Road interchange. These wetlands have been degraded by clearing and grazing. Wetlands CCW 15028 and a large part of CCW 15033 will be removed to construct the Reid/Tonkin interchange (see PER Chapter 10, Hydrological Processes and Inland Waters Environmental Quality, Section 10.4.6.3). No bridge structures or dewatering is proposed at Maralla Road in the vicinity of wetlands CCW 8800 and Resource Enhancement Wetland (REW) 8801 or *Caladenia huegelii* habitat.

The requirement for dewatering was determined based on a review of groundwater levels in existing bores (including DOW Gnangara Mound bores) reported over a period of 40 to 50 years, which was undertaken as part of the design groundwater level study for the proposal (Golder, 2015a, b, c). Groundwater data collected over this period indicates the seasonal variation (wet season to dry season) in groundwater ranges between 1.0 m and 2.0 m. Hydrographs of the bores showed two periods of step change in groundwater levels, one associated with development of the Gnangara Mound as a public drinking water source and the other associated with the installation of subsoil drains to enable land development.

Construction of the proposal will require a supply of water for construction purposes at various locations along the alignment. Abstraction will be temporary and associated with each stage of development. While construction water requirements will not be known until detailed final design work has been carried out, construction water is likely to be sourced from existing bores in accordance with existing licences where possible. Should existing bores or licences be unavailable, new bores may need to be constructed and licenced in accordance with DOW requirements (see PER Chapter 10, Hydrological Processes and Inland Waters Environmental Quality, Section 10.4.4.2). The DOW considers existing groundwater user licence allocations during the licence application process.

The location and number of construction water abstraction bores proposed to be used (new and existing) will be assessed against a detailed hydrogeological model. Hydrogeological modelling will account for the proposed parameters of the bore as well as the hydrogeology of the proposed bore site. Preferentially, each construction water bore required will be sited such that no wetlands are located within the modelled drawdown radius of influence for the bore, thereby avoiding indirect hydrological impacts to wetlands as a result of drawdown. Where it is not possible to site a bore such that no wetlands occur within its drawdown radius of influence, the operating parameters of bores will be limited such that modelled changes to groundwater levels at wetlands remain within usual seasonal variations for those wetlands (see PER Chapter 10, Hydrological Processes and Inland Waters Environmental Quality, Section 10.4.6.3). Any impact to wetlands from drawdown is expected to be short-term and localised.

Step changes in groundwater levels as a result of construction (including dewatering and water abstraction) will be detected by a groundwater monitoring program as part of a WDMMP to protect public drinking water supply and to protect wetlands. The information presented in Golder (2015a, b, c) will be used to set trigger levels for the target aquifers and wetlands. The WDMMP will be prepared in consultation with DPAW and the OEPA.

A dewatering management plan (including ASS management) will also be developed and implemented in support of any application for dewatering and a groundwater licence operating strategy will be developed and implemented as necessary to support the supply of construction water. These plans will include monitoring of abstraction rates. Opportunities for alternative construction water sources will also be investigated during project delivery.

12.9.3 Drainage Strategy

Consolidated issue 67: Will Saw Pit Gully definitely be used for outlet flow during flood overtopping events?

Contributing issues:

170: Will Saw Pit Gully definitely be used for outlet flow during flood overtopping events?

248: How will pollution be prevented and water quality in Saw Pit Gully be maintained?

Drainage will be designed to integrate with natural drainage lines to maintain existing hydrology/surface flow to watercourses and wetlands. Drainage features will be designed to prevent flooding of the highway carriageways and by necessity include overflow or spillway structures to discharge flood flows to adjacent watercourses or drainage lines including Saw Pit Gully. Proposed bio-retention drains adjacent to Saw Pit Gully will manage typical flows protecting wetlands associated with the watercourses (see PER Appendix H, Drainage Strategy, Appendix A, Major Event Flow Paths, drawing NLWA-00-DR-SK-0009 – Saw Pit Gully is the second waterway north of Maralla Road). The drainage strategy including details of bio-retention drains is set out in PER Appendix H, Drainage Strategy.

Consolidated issue 68: Use of infiltration systems in palusplain zone and just north of Maralla Road.

Contributing issues:

165: Figure 3 of Appendix H demonstrates an arbitrary division of the project site into different zones. The southern border of the palusplain section should not start until the actual palusplain starts.

171: The generalisation about infiltration systems not being appropriate for the palusplain zone does not apply just north of Maralla Road. Should infiltration systems be considered for this area instead?

The palusplain zone extends north from between Maralla Road and Warbrook Road to Muchea. The area just north of Maralla Road is transitional between the P1 and palusplain zones. PER Appendix H, Drainage Strategy, sections 10.3 and 10.4 set out the strategy for managing drainage in these zones respectively.

Infiltration mechanisms have been selected to ensure the key drainage objectives can be met including flood mitigation, protection of the Gnangara Groundwater Mound, wetlands and Ellen Brook.

Grassed swales leading to bio-retention swales are the preferred drainage strategy at this location. Hydrological connectivity is provided by culverts on watercourses and drainage lines. PER Appendix H, Drainage Strategy, Appendix A, Drawing NLWA-00-DR-SK-0009 shows the location of grassed swales, bio-retention swales and basins, and culverts at this location.

12.9.4 Impact Assessment

Consolidated issue 71 (contributing issue 96): How will unsurveyed Mound Springs on property be impacted by PDNH? Who will fix any impacts?

All known Mound Springs within the flora study area were surveyed and the alignment of the proposal designed to avoid impacts to these springs. No mound springs have been identified in the vicinity of Cooper Road and Stock Road (see PER Chapter 10, Hydrological Processes and Inland Waters Environmental Quality, Figure 10.2D). Mound Springs west of the proposal are located upstream of the alignment and so

are unlikely to be impacted, as discussed in PER Chapter 10, Hydrological Processes and Inland Water Environmental Quality, Section 10.4.8.

A WDMMP will be developed as part of the EMP. The plan will include monitoring of the closest known occurrence of Mound Springs SCP TEC at Gaston Road, which is located upstream of the proposal. Monitoring will ensure impacts to the Mound Spring SCP TEC are identified and appropriately managed.

The location of mound springs that may represent the TEC Community Tumulus Mound Springs of SCP outside the flora study area (which encompasses the development envelope) can be discussed with the DPAW for further investigation and management, and consideration for listing at the state and federal levels as an additional occurrence.

Consolidated issue 72 (contributing issue 166): Credibility of referencing R. Froend et al. in estimating effects of climate change and Ellenbrook drawdown on local wetland vegetation.

The comment is noted. PER Appendix I Wetland Assessment sourced ecological water requirements (EWR) from the DOW's Perth Shallow Groundwater Systems Investigation: Lexia Wetlands (DOW, 2011), which considers a range of information sources including but not limited to Froend et al. (2004a, b).

Consolidated issue 73 (contributing issue 149): What evidence shows that 50 m is a large enough buffer between laydown areas and wetlands?

Laydown areas will be located as far as possible from sensitive environmental values including at least 50 m from WHPZs, CCWs, Mound Springs SCP TECs and Claypans of the SCP TEC. Where hazardous materials (predominantly diesel fuel) are stored at laydown areas they will be stored in protected tanks or cabinets and bunds. Spill response kits will be available at all fuel and chemical storage sites.

Guideline for the Determination of Wetland Buffer Requirements (WAPC, 2005) provides guidance on buffers to protect wetlands from direct and indirect impacts. The recommended buffers are the distances considered necessary to achieve the maintenance of wetland function and conservation of attributes including habitat value and aesthetics. The guideline recommends a 100 m buffer to CCW and a 50 m buffer to REW to protect these wetlands from weed invasion and edge effects and to protect wetland birds, while Guidance Statement 33, Environmental Guidance for Planning and Development (EPA, 2008) recommends a minimum 50 m buffer.

The alignment of the proposed highway has been designed to avoid wetlands to the greatest extent possible, noting that the drainage system is typically west to east across the proposed north–south road. Van Etten (2014) studied edge effects from a road through Banksia woodland and Melaleuca dominated damplands. The road southeast of Perth provides a useful facsimile for the effects that might be experienced along the proposed highway.

Van Etten (2014) concluded that the maximum edge effects on damplands after 10 years could be in the order of 20 to 40 m (predominantly due to dieback and physical damage) with no management. Van Etten noted that with management, edge effects on damplands (mainly from weed invasion) could be in the order of 3 m after 10 years.

The proposed 50 m buffer to wetlands (CCW and REW) is appropriate for laydown areas. Two of the proposed management measures include protecting wetlands from accidental spills through procedures for the transport, storage, handling and disposal of hazardous materials, surface water management and an emergency spill response procedure to be developed in consultation with emergency services. The proposed management measures will reduce the extent and severity of potential edge effects associated with laydown areas on wetlands and achieves the desired outcomes – maintenance of function and protection of habit.

The drainage strategy (PER Appendix H, Drainage Strategy) includes bio-retention swales and basins to assist in the removal of contaminants through settling, filtering and biological action before discharge to the environment. Bio-retention swales and basins will be installed near wetlands.

A WDMMP will also be developed and implemented, including a groundwater monitoring procedure, to ensure impacts to wetlands are being appropriately managed (see PER Chapter 10, Hydrological Processes and Inland Waters Environmental Quality, Section 10.5).

Consolidated issue 74 (contributing issue 142): How is the partial loss of wetland EPP Lake No. 450 justified?

Former EPP Lake 450 is mapped in association with MUW 8785 and is located adjacent to the Stock Road interchange. The location of the Stock Road interchange is constrained by various wetlands and local road network. The proposal has been aligned to avoid impacts to wetlands as much as possible in this area as depicted in PER Chapter 10, Hydrological Processes and Inland Waters Environmental Quality, Figure 10.2D.

While impacts to former EPP Lake 450 were unavoidable, the impact was minimised through design. A minor portion (0.04 ha) of this EPP Lake will be affected by construction of the interchange. This former EPP lake was mapped in association with MUW 8785, the condition of which is generally degraded as a result of the large-scale clearing, cattle grazing and declared weeds (see PER Chapter 10, Hydrological Processes and Inland Waters Environmental Quality, Section 10.4.6.2).

Natural flow through the wetland and under the proposal will be maintained by a culvert constructed along the natural drainage line (see PER Appendix I, Wetland Assessment, Section 8.3.2 and PER Appendix H, Drainage Strategy, Drawing NLWA-00-DR-SK-0010, Major Flow Paths Sheet 10).

MRWA notes that the EPP Lakes Policy was revoked on 20 November 2015 and as a result EPP Lakes are no longer recognised. However, MRWA is committed to preparing and implementing a WDMMP, which includes a groundwater monitoring procedure to detect changes in groundwater levels, to ensure impacts to wetlands are being appropriately managed.

Consolidated issue 75: Impacts to and management of CCW 8800.

Contributing issues:

146: What specific management of key threatening processes to wetland CCW 8800 will be put in place?

150: Will wetland CCW 8800 be considered as a special case to ensure it is fully protected or ignored because it is 'not in the proposal area'?

205: The impacts to wetland CCW 8800 are opposed. There should be a buffer of 50 to 100 m from the PDNH road reserve. There does not appear to be a buffer.

CCW 8800 is located within 28 m of the proposal footprint; it will not be directly impacted by the proposal (see PER Chapter 10, Hydrological Processes and Inland Waters Environmental Quality, Table 10.6 and Figure 10.2). This section of the proposal was aligned to avoid and minimise impacts to CCWs as much as possible (including CCW 8800, CCW 8798 and CCW 8926), but could not be located further away from CCW 8800 due to existing development constraints to the south (Ellenbrook).

The proposal will be managed in accordance with the Drainage Strategy to ensure hydrology and hydrogeology (quantity and quality) of all CCWs and REWs adjacent to the highway are maintained (PER Appendix H, Drainage Strategy). The Drainage Strategy includes a bio-retention basin between the proposal and CCW 8800. Stormwater from the highway will be directed to the bio-retention basin to assist in the removal of contaminants through settling, filtering and biological action before discharge to the

environment (PER Appendix H, Drainage Strategy, Drawing NLWA-00-DR-SK-0009, Major Flow Paths Sheet 8).

Further information relating to the management of dewatering impacts on CCW 8800 is provided in Consolidated issue 78 and for information about the management of weeds and dieback refer to Consolidated issue 140.

MRWA is committed to preparing and implementing a WDMMP, which includes a groundwater monitoring procedure to detect changes in groundwater levels, to ensure impacts to wetlands (and GDEs/vegetation mapped in association with these wetlands) are being appropriately managed.

Consolidated issue 84 (contributing issue 143): The loss of CCWs is unacceptable. Impacts could be lessened through use of bridges or diverting the PDNH alignment around the wetlands.

There are two possible engineering solutions, avoidance/diversion and bridging. The proposal has been aligned to avoid and minimise impacts to a number of REWs and CCWs, particularly north of Maralla Road where the proposal is less constrained with regard to existing development (see PER Chapter 10, Hydrological Processes and Inland Waters Environmental Quality, Figure 10.2).

Significant hydrological values which have been avoided in the development of this proposal include Mound Springs SCP TEC at Gaston Road, Claypans of the SCP TEC, one CCW (unique feature identifier (UFI) 8914) and three REWs (UFIs 8916, 8915 and 8541). The interchange at Warbrook Road was also relocated to Stock Road to avoid potential impacts on Twin Swamps Nature Reserve. In addition, 2.8 ha of CCW and 4.5 ha of REW within the development envelope have been avoided by the proposal footprint (see PER Chapter 10, Hydrological Processes and Inland Waters Environmental Quality, Section 10.5).

As detailed in the PER Chapter 10, Hydrological Processes and Inland Waters Environmental Quality, Section 10.4.6.1, Table 10.6, 7 CCWs, 4 REWs and 14 MUWs occur within the proposal footprint and will be directly impacted by the proposal. Installation of bridges to minimise impacts, particularly in areas of key ecological linkages was found to not be a feasible option taking into consideration cost and implications for noise and visual amenity. With regard to the specific wetlands raised in the submission, the following is noted:

- CCW 8773 and 8909 – Avoidance of these wetlands was not possible due to interchange configuration.
- CCW 13096 and 15033 – Impact to these wetlands is unavoidable as they are within the Reid/Tonkin/proposal interchange footprint, which is constrained by existing development.
- CCW 8792 – The proposal has been situated adjacent to Ellenbrook estate to minimise fragmentation impacts on conservation estate. It is not possible to realign the proposal to avoid this wetland.
- CCW 8404 – The proposal could not be realigned within MUW 8442 and MUW 8444 as they are within a significant power transmission corridor. Realigning the proposal within this corridor is not possible due to the risk to power transmission infrastructure and the potential for induced current on road traffic from the transmission line. Whilst it is desirable to place infrastructure such as roads, power and water into the same corridor, these infrastructure types are not always compatible land uses and require separation distances in order to operate safely and efficiently.
- CCW 8800 and 8801 – The proposal will have no direct impact on these wetlands.

12.9.5 Management of Surface Water

Consolidated issue 64: How will spills and runoff be managed to protect wetlands and groundwater during construction and operation phases?

Contributing issues:

45: What measures will be implemented to minimise pollutant runoff to wetlands 8800 and 8801?

94: Dewatering during construction doesn't mention the impact to local residents that rely on groundwater for domestic/stock water.

95: How will accidental chemical spills be managed prior to construction of settlement basins and silt curtains?

167: What engineering solutions will be used to maintain maximum groundwater levels and flow during construction and operation, and prevent pollution of groundwater by inevitable fuel and chemical spills?

169: What will be done to prevent ongoing runoff and spill incidents polluting the local potable groundwater supply?

212: How will spills from trucks on PDNH be managed to prevent contamination and pollution of groundwater and wetlands?

247: How will pollution from spills be prevented?

Management measures for spills and runoff during construction and when the highway is operational are set out in PER Chapter 10, Hydrological Processes and Inland Waters Environmental Quality, Section 10.5 and Table 10.9. They include measures relating to the generation, storage, handling and release of pollutants, surface water management and an emergency spill response procedure (developed in consultation with emergency services). The measures will be included in an EMP which will incorporate a WDMMP and an Emergency Response Plan (PER Appendix F, Environmental Management Plan, Tables 4.2 (management) and 5.1 (performance monitoring).

CCW 8800 and 8801 located west of the development envelope and north of Maralla Road will be protected by bio-retention basins to assist in the removal of contaminants from highway runoff through settling, filtering and biological action before discharge to the environment. Overflow from the basins will drain to the wetlands, as indicated in PER Appendix H, Drainage Strategy, Appendix A, Major Event Flow Paths, drawing NLWA-00-DR-SK-0009.

Laydown areas and stockpiles (including storage of hazardous materials and refuelling activities) will be located outside wellhead protection zones and at least 50 m from all CCW and REW wetlands, Mound Springs SCP, TEC and Claypans of the SCP TEC.

Consolidated issue 70 (contributing issue 97): Who will review and monitor the Wetland and Drainage Management and Monitoring Plan referred to in PER?

The Wetland and Drainage Management and Monitoring Plan will be provided to the OEPA, DOW and DPAW for review/comment. MRWA will be responsible for the implementation of the plan which will include audit reports that will be provided to relevant agencies.

OEPA may conduct audits of approval conditions, including adherence to any proposal commitments, including the preparation and implementation of this plan.

12.9.6 Management of Wetlands

Consolidated issue 81: Wetlands are already impacted and PDNH will further disrupt hydrological regimes. Will MRWA help fund more frequent and thorough wetland monitoring?

Contributing issues:

141: Wetlands are already impacted by other factors and PDNH will further disrupt hydrological regimes. Will MRWA help fund more frequent and thorough wetland monitoring?

151: When will piezometer monitoring as recommended in the wetlands study commence?

231: Will there be monitoring of the environments likely to be affected by water abstraction during construction?

Impacts to hydrology are predicted to be localised and temporary in nature due to management measures aimed at maintaining hydrological connectivity across the proposed highway. Culverts and bridges will be constructed on existing drainage lines to maintain flow in watercourses and to wetlands fed by the watercourses (see PER Chapter 10, Hydrological Processes and Inland Waters Environmental Quality, Table 10.9).

MRWA is committed to the development and implementation of a WDMMP which will include a groundwater monitoring procedure to ensure impacts to wetlands are detected and appropriately managed. Groundwater monitoring is anticipated to commence late 2015.

MRWA is unable to fund additional wetland monitoring outside of that required for this proposal.

Consolidated issue 82: Sensitive bushland and wetland areas in the palusplain zone each require a special strategy to ensure their conservation.

Contributing issues:

168: How will the area just north of Maralla Road be treated in terms of drainage in order to filter runoff and protect wetlands?

220: Sensitive bushland and wetland areas in the palusplain zone each require a special strategy to ensure their conservation

The Palusplain zone extends from Maralla Road to Muchea. As outlined in PER Chapter 10, Hydrological Processes and Inland Waters Environmental Quality, Table 10.1, this zone contains small ephemeral streams, wetlands and Ellen Brook, as well as isolated pockets of vegetation in good or better condition (see PER Chapter 8, Flora and Vegetation, Section 8.2.10).

PER Appendix H, Drainage Strategy, Section 10.4 sets out the strategy for managing wetlands within the Palusplain zone. The primary objective is the maintenance of existing hydrology/surface flow to wetlands and Ellen Brook. In accordance with this strategy, runoff from small rainfall events will be directed to earthen areas as close to the source as possible for infiltration through the most appropriate infiltration drainage system (i.e., vegetated/grassed swales/verge, bio-retention swales, soak well type pits and retention/detention basins). Selection of an appropriate drainage system is dependent on whether the section of the alignment is kerbed or not and its location and proximity to sensitive values. Where wetlands are adjacent to the road, stormwater will be directed to a bio-retention basin to assist in the removal of contaminants through settling, filtering and biological action before discharge to the environment.

To ensure that the proposal is designed and constructed in accordance with the drainage strategy a detailed infrastructure plan will be prepared for each stage of the development prior to construction. This

will include details of key drainage features including culverts, bio-retention swales and infiltration basins, and where possible, identification of any CCWs and REWs that can be retained through final design.

A WDMMP will be developed and implemented including a groundwater monitoring procedure to ensure impacts to wetlands (and Ellen Brook) are being appropriately managed (see PER Chapter 10, Hydrological Processes and Inland Waters Environmental Quality, Section 10.5). The WDMMP will consider the conservation status and proximity of wetlands to the proposal.

Consolidated issue 83: What engineering solutions will be used to maintain maximum groundwater levels and flow?

Contributing issues:

145: Wetlands are already dry and construction dewatering, as well as subsurface compaction, must be minimised.

167: What engineering solutions will be used to maintain maximum groundwater levels and flow during construction and operation, and prevent pollution of groundwater by inevitable fuel and chemical spills?

A detailed infrastructure plan will be prepared for each stage of the development prior to construction to ensure that the proposal is designed and constructed in accordance with the drainage strategy. The detailed infrastructure plan will consider the location, design and construction of infrastructure such as culverts, bridges, bio-retention swales and infiltration basins. This will ensure that hydraulic connectivity is maintained across the proposal, groundwater dewatering is minimised and impacts to wetlands and water quality are reduced. The location and design of drainage structures will also consider the effect of compaction on groundwater flow where clay underlies the proposal (i.e., northern section).

Compaction impacts will be minimal and limited to 1 to 2 m below ground level. A sand layer at the bottom of the highway embankment combined with culverts will ensure that the flow of groundwater near the surface is not restricted where it occurs close to, or at the surface.

Impacts on groundwater levels, flow and quality will be managed through implementation of the construction EMP and development and implementation of a WDMMP. The construction EMP will include measures for the transport, storage, handling and disposal of hazardous materials including fuel and chemicals. Spill response procedures will be captured in an Emergency Response Plan. Laydown areas with fuel and chemical storage will be located at least 50 m from WHPZs, CCWs, Mound Springs SCP TECs and Claypans of the SCP TEC. Fuel and chemicals will be stored in protected tanks or cabinets and bunds.

12.10 Amenity (Noise and Vibration)

12.10.1 Façade Treatment for Noise

Consolidated issue 56: What does the noise façade treatment involve?

Contributing issues:

12: Will the noise mitigation packages be fitted prior to the start of construction?

47: What does the noise façade treatment involve?

207: Our lifestyle will be severely impacted by noise from PDNH. What does façade treatment for noise involve?

PER Appendix O, Transportation Noise Assessment, Appendix E provides examples of treatment packages specified in the Implementation Guidelines for State Planning Policy 5.4 Road and Rail Transport Noise and

Freight Considerations in Land Use Planning (WAPC, 2014). Treatment packages include specifications for window glazing, thick solid timber doors with acoustic seals, roof/ceiling insulation and mechanical ventilation. The level and type of treatment required will be determined on a case-by-case basis in consultation with affected property owners. Building mitigation to affected residences will be installed prior to opening the highway to traffic.

Consolidated issue 57: How were properties chosen for noise mitigation works? Can other properties be included?

Contributing issues:

6: How were properties chosen for noise mitigation works? Can other properties be included?

178: Will our property be eligible for the Package B Architectural Treatment Package for noise control?

207: Our lifestyle will be severely impacted by noise from PDNH. What does façade treatment for noise involve?

Noise modelling was undertaken to determine road traffic noise levels resulting from the proposal. Where noise levels are predicted to exceed the day-time noise limit of 60 dB L_{Aeq}, noise mitigation measures are required to reduce noise levels. Noise walls are effective in residential areas and will be installed adjacent to residential areas south of Maralla Road. In rural and bushland settings north of Maralla Road, building treatments will be used to reduce indoor noise at affected residences. The noise limit (60 dB $L_{Aeq\ (Day)}$) is predicted to be exceeded at sixteen properties north of Maralla Road (see Appendix I, Revised Transportation Noise Assessment, Table 5-1 and Figures 5-5 and 5-6).

Where a resident is concerned that the noise limit is not being met at their property once operation has commenced, MRWA will investigate noise levels at the affected property and determine if additional treatments are required. Any requirement for additional treatment will be discussed and agreed with the affected property owner and arranged by MRWA.

Consolidated issue 58 (contributing issue 177): What is the impact of fitting 6 mm glazing? Glazing does nothing to reduce external noise.

Noise mitigation will be provided through screening walls and building treatments for residences north of Maralla Road where noise levels exceed the noise limit of 60 dB $L_{Aeq\ (Day)}$.

Glazing can reduce indoor noise levels upwards of 10 dB provided the windows are closed (VicRoads, 2010). The type of 6 mm glass (e.g. float or laminated) and building construction will determine the noise reduction achievable using this form of treatment.

Residents may experience the predicted noise levels when outdoors; however, the predicted noise levels assume worst case meteorological conditions (slight breeze from noise source to receiver). Meteorological conditions including wind speed and direction, cloud cover and inversions will change noise propagation and its level at affected residences.

12.10.2 Management and Monitoring of Noise

Consolidated issue 59: How will the proponent manage noise at Maralla Road?

Contributing issues:

48: Will noise abatement include planted vegetation? What other noise reduction measures will be used at Maralla Road?

208: How will noise be managed at properties given that PDNH will be at a high elevation at Maralla Road?

Noise at Maralla Road will be managed through the installation of visual screening walls where practicable and building treatments as mitigation to residences where the noise limit of 60 dB $L_{Aeq\ (Day)}$ is exceeded. Treatments will be discussed and agreed with the affected property owners.

Consolidated issue 60 (contributing issue 7): Noise mitigation for properties north of Ellenbrook will not reduce noise outdoors.

Outdoor noise levels at some properties north of Ellenbrook are likely to exceed the noise limit of 60 dB $L_{Aeq\ (Day)}$ (see Chapter 4, Amenity (Noise and Vibration), Section 4.2.2). Residents may experience the predicted noise levels when outdoors; however, the predicted noise levels assume worst case meteorological conditions (slight breeze from noise source to receiver). Meteorological conditions including wind speed and direction, cloud cover and inversions will change noise propagation and its level at affected residences.

Consolidated issue 61: If an acceptable level of noise mitigation isn't achieved by the strategies will they be rectified and additional treatments added? Will funds be available to undertake this?

Contributing issues:

13: If an acceptable level of noise mitigation isn't achieved by the strategies will they be rectified and additional treatments added? Will funds be available to undertake this?

14: Will noise monitoring continue once the highway has been completed?

Monitoring will be undertaken following the commencement of highway operation to demonstrate that the proposal does not exceed the SPP 5.4 noise limit of 60 dB $L_{Aeq\ (day)}$, excluding the properties north of Ellenbrook which are likely to exceed this limit.

Where a resident is concerned that the noise limit is not being met once operation has commenced, MRWA will investigate noise levels at the affected property and determine if additional treatments are required. Any requirement for additional treatment will be discussed and agreed with the affected property owner and arranged by MRWA.

Consolidated issue 187 (contributing issue 174): Will the impacted residential properties north of Ellenbrook receive noise walls?

Noise walls will not be installed north of Ellenbrook. Where practicable, 2.4-m-high visual screening walls will be installed adjacent to properties north of Maralla Road. The screening walls will provide some noise mitigation for rural residential properties.

Where the noise limit of 60 dB $L_{Aeq\ (Day)}$ is exceeded at residences north of Maralla Road, noise mitigation set out in the Implementation Guidelines for SPP 5.4 (WAPC, 2014) will be applied in discussion, and with the agreement of affected property owners.

Consolidated issue 188 (contributing issue 245): Can the noise wall be thicker or trees planted to reduce the noise level to below 50 dB?

Provided the noise wall meets the minimum density (15 kg/m^2), it will have sufficient acoustic properties to achieve the 60 dB L_{Aeq} noise limit.

Vegetation is not an effective noise mitigation measure on its own. It complements other more effective forms of noise mitigation including noise walls and earth mounds. Visual screening in the form of planting will be provided in road reserves to mitigate the visual impact of the highway.

The revised transportation noise assessment has shown that the noise level limit of 60 dB $L_{Aeq\ (Day)}$ can be achieved between Reid Highway/Tonkin Highway interchange and Hepburn Avenue.

Consolidated issue 189 (contributing issue 41): What noise and light management measures are in place to reduce the impact on local residents?

Noise mitigation will be provided by noise walls south of Maralla Road, and screening walls and building treatments for residences north of Maralla Road where noise levels exceed the noise limit of 60 dB $L_{Aeq\ (Day)}$.

Light spill or glare will be reduced by the following management measures:

- Lights will be directed towards construction activities to limit the amount of light spill to surrounding residences during construction.
- Where practicable, low-level lighting will be used during construction.
- Glare screens will also be provided on all temporary lighting during the construction stages to minimise light pollution.

Road lighting will consider Australian Standard AS 4282 'Control of the Obtrusive Effects of Outdoor Lighting' and comply with AS 1158 'Road Lighting'.

12.10.3 Modelling and Impact Assessment of Noise

Consolidated issue 54 (contributing issue 1): The monitored noise at Madura Close (50.3 dBA) is lower than Fewson Turn (55 dBA) despite being near a highway. Ballajura noise levels will increase by only 10 dBA despite traffic increasing from 30,000 to 100,000 which is an underestimation.

The measured noise at 21 Madura Close, Ballajura is lower than at Fewson Turn. Monitoring results at Madura Close were 49.4 dB $L_{Aeq\ (Day)}$ and 47.0 dB $L_{Aeq\ (Night)}$. At 12 Fewson Turn, Ellenbrook it was 49.1 dB $L_{Aeq\ (Day)}$ and 44.1 dB $L_{Aeq\ (Night)}$ (Appendix I, Revised Transportation Noise Assessment, Table 4-1 and 4.2). These measurements are reflective of the roads in the vicinity of the properties: 12 Fewson Turn is a through road as is the adjacent road; 21 Madura Close is a suburban road adjacent to Hepburn Ave, which is an arterial road.

Noise modelling has shown that the noise target of 60 dB $L_{Aeq\ (Day)}$ will be met at residences in Ballajura with the installation of 5-m-high noise walls. The noise modelling has been revised using forecast 2040 traffic volumes.

Noise is measured on a logarithmic scale; i.e., an increase of 10 dBA is perceived by people to be approximately twice as loud. Typical noise levels experienced by people are shown in Appendix I, Revised Transportation Noise Assessment, Appendix D, Typical noise levels.

Consolidated issue 55 (contributing issue 98): Statement that Stock Road has one of the highest noise levels during monitoring is difficult to believe. Will there be much of an increase in noise in the area?

PER Executive Summary, Table ES-5 incorrectly states "existing daytime noise levels were highest at the Stock Road West site in Bullsbrook (54.2 dB $L_{Aeq\ (Day)}$)" with respect to monitoring undertaken between Bayswater and Muchea. The monitoring site at Abbey Road, Morley recorded the highest noise levels during monitoring (59 dB $L_{Aeq\ (Day)}$).

Noise modelling predicts noise levels in the vicinity of the Stock Road interchange will exceed 60 dB $L_{Aeq\ (Day)}$ due to the previously cleared flat terrain. Affected residences are listed in the revised transportation noise assessment (Appendix I, Table 5-1 and Figure 5-5).

12.10.4 Damage from Vibration

Consolidated issue 50: What compensation will be available for damage to properties caused by vibration? What is involved in dilapidation surveys that may be conducted prior to construction?

Contributing issues:

42: Will repairs or compensation be provided to landowners if property damage occurs due to construction?

173: What compensation is available for residence with vibration damage such as inevitable cracks in bricks?

176: What is involved in dilapidation surveys that may be conducted prior to construction?

211: What compensation will be made to correct any damage caused by vibration?

As detailed in PER Chapter 11, Amenity (Noise and Vibration), Section 11.6, the Construction Noise and Vibration Management Plan will include a requirement to conduct dilapidation surveys.

A qualified assessor will conduct dilapidation surveys of properties within 50 m of construction activities prior to the commencement of construction. This dilapidation survey involves the inspection of a building's interior and exterior for existing damage, such as cracks, for use as a baseline. A second survey is undertaken following construction and the results of both surveys are compared to determine if construction works cause any damage.

Any damage to buildings and property due to the construction works associated with the proposal will be rectified by MRWA. The details of repairs or compensation will be assessed on a case by case basis.

Consolidated issue 51 (contributing issue 175): What does 'taking precautionary measures to avoid vibration damage to buildings near work sites' entail?

Precautionary measures to avoid vibration damage to buildings include selecting equipment and designing construction activities to ensure vibration does not exceed a particle velocity of 5 mm/s. This will include using non-vibrating rollers where practicable.

Damage caused by construction activities will be monitored by a dilapidation report of buildings prepared pre- and post-construction. A Construction Noise and Vibration Management Plan (CNVMP) to be developed to the satisfaction of DER and relevant local government authorities (see PER Chapter 11, Amenity (Noise and Vibration), Section 11.6.1) will include a requirement for noise and vibration monitoring in response to complaints.

12.11 Rehabilitation and Decommissioning

Consolidated issue 44 (contributing issue 159): Will the use of soils infected with dieback or infested with weeds near bushland be avoided?

Management of the risk of introduction and spread of weeds and dieback will be addressed through the preparation and implementation of a weed and dieback hygiene management plan, which will set out the hygiene measures to avoid the introduction and/or spread of weeds and dieback into protectable and dieback free areas, for example soils within the proposal footprint will not be moved between dieback occurrence categories. PER Chapter 8, Flora and Vegetation, Section 8.4.6 and 8.4.7 assesses the potential risk to native vegetation located adjacent to the proposal footprint associated with the introduction and spread of weeds and dieback. A detailed dieback survey of the alignment has been undertaken (PER Appendix D). The study identified current areas of infection and areas considered free from dieback infection.

Consolidated issue 45: Will revegetation works use local native provenance species and be representative of the existing neighbouring vegetation?

Contributing issues:

129: Will revegetation (including next to fauna underpasses) use local provenance plants not just local species?

158: Banksia Woodland species should be planted along verges adjacent to native vegetation, not only dry grassing and trees. Will the planting of out-of-place trees, shrubs and grasses be avoided?

Revegetation works will utilise local native provenance species. The species mix used in revegetation works will be representative of the existing neighbouring vegetation. PER Chapter 12, Rehabilitation and Decommissioning discusses the revegetation strategy for three separate zones across the proposal footprint – urban, transition and rural. As discussed in this chapter revegetation will focus on using local native provenance species in each of these zones that are suited to the surrounding land use and landscape characteristics, including the floristic formation of adjacent vegetation. This will include revegetation close to fauna underpass openings (see PER Chapter 9, Terrestrial Fauna, Section 9.5.8).

This strategy will be developed and supported by a detailed revegetation plan (PER Chapter 12, Rehabilitation and Decommissioning, Section 12.5).

Consolidated issue 47 (contributing issue 84): The rehabilitation chapter is superficial and is unacceptable.

PER Chapter 12, Rehabilitation and Decommissioning details the revegetation strategies for the proposal. This strategy will be developed and supported by a Detailed Revegetation Plan (PER Chapter 12, Rehabilitation and Decommissioning, Section 12.5).

As discussed in PER Chapter 12, Rehabilitation and Decommissioning, revegetation will focus on using local native provenance species in each of these zones that are suited to the surrounding land use and landscape characteristics, including the floristic formation of adjacent vegetation and so will contribute to maintaining biodiversity. While not inclusive of a full plant list this chapter does provide a preliminary list of species that may be used in each revegetation zone, for example the species suggested for revegetation in the transition zone (south of Maralla Road) include *Xanthorrhoea preissii, Melaleuca rhaphiophylla, Corymbia calophylla, Banksia attenuata* and *Banksia menziesii*.

The Detailed Revegetation Plan will include completion criteria, full species planting list and will take into consideration the translocation of suitable native species, including Balga (*Xanthorrhoea preissii*), Cycads (*Zamia* spp.) and Western Australia Christmas Trees (*Nuytsia* spp.).

MRWA will consider translocation of species which are identified suitable for use in feature planting of landscaping. It should be noted that translocation of mature species is extremely difficult to successfully complete and requires a significant amount of maintenance to result in successful translocations.

Consolidated issue 48 (contributing issue 157): Revegetation designed for the transition zone should be extended to Warbrook Road, or at least beyond 108 Halden Road.

PER Chapter 12, Rehabilitation and Decommissioning details the revegetation strategies for the proposal. This strategy will be developed and supported by a Detailed Revegetation Plan (PER Chapter 12, Rehabilitation and Decommissioning, Section 12.5). Revegetation will focus on using local native provenance species in each of the revegetation zones that reflect the surrounding land use and landscape characteristics, including the floristic formation of adjacent vegetation.

The suggested list of species for revegetation in the rural zone (PER Chapter 12, Rehabilitation and Decommissioning, Section 12.3.1) include species common to the vegetation associations described in PER Chapter 8, Flora and Vegetation, Table 8.3 and shown in Figure 8.2 for the section of highway between Maralla Road and Warbrook Road. The merits of extending transition zone revegetation north of Maralla Road where the proposed highway is adjacent to remnant vegetation will be considered in the detailed revegetation plan (PER Chapter 12, Rehabilitation and Decommissioning, Section 12.5).

Consolidated issue 49 (contributing issue 76): Why do table drains need to be 6 m wide overall? Native vegetation should be used for water flow control in drains, the back slopes at a minimum.

PER Chapter 4, Detailed Description of Proposal, Figure 4.2 shows a typical arrangement of the proposed highway including table drains to ensure the potential impacts of the proposal are understood. The width of table drains is determined by the catchment and expected rainfall and runoff. They are designed to prevent flooding of the highway carriageways. Table drains are revegetated with 'soft plants', typically sedges to prevent scouring, assist with filtration of runoff and avoid creating a safety hazard for motor vehicles leaving the carriageway. Revegetation with trees would pose a road safety hazard.

12.12 Aboriginal Heritage

Consolidated issue 43: Aboriginal heritage sites with significance should be avoided and protected in a manner acceptable to the local Nyungah people.

Contributing issues:

160: Aboriginal heritage sites with significance should be avoided and protected in a manner acceptable to the local Nyungah people.

179: Any potential impacts to Aboriginal heritage from the proposal can be addressed through the proposed Aboriginal Heritage management Plan and the provisions of the *Aboriginal Heritage Act 1972* (e.g. Section 18 consent).

(Repeated from Section 11.1)

Where possible, Aboriginal heritage sites will be avoided and protected. However where disturbance of Aboriginal heritage sites is required consent to disturb an Aboriginal site under Section 18 of the *Aboriginal Heritage Act 1972* will be obtained.

Members of the Nyungah (Noongar) community were involved in field surveys for Aboriginal cultural heritage (see PER Appendix Q, Ethnographical Aboriginal Heritage Survey and PER Appendix R, Aboriginal Archaeological Assessment).

The management process developed to monitor and minimise impacts to Aboriginal archaeological records is supported by the Noongar people (see PER Appendix R, Aboriginal Archaeological Assessment).

PER Chapter 13, Aboriginal Heritage, Section 13.4 sets out the measures to be incorporated in an Aboriginal Heritage Management Plan. The measures incorporate the recommendations set out in PER Appendix R, Aboriginal Archaeological Assessment.

12.13 European Heritage

Consolidated issue 33 (contributing issue 8): Heritage of Bulls Brook has not been considered despite being significant to history of Bullsbrook district.

Aboriginal and European cultural heritage were investigated and are addressed in PER Chapter 13, Aboriginal Heritage and PER Chapter 14, European Heritage, respectively. Historic sites in the Bulls Brook district were investigated in the European heritage study (PER Appendix S, European Heritage Desktop Assessment).

The study identified two protected places and several sites that might contribute to the history of the district. The protected places listed in PER Appendix S, European Heritage Desktop Assessment, Section 4.1.2 are adjacent to the proposal but will be avoided by the highway and proposed activities.

Historical sites associated with the township of Bullsbrook and the Bullsbrook railway siding, which is adjacent to Bulls Brook, are remote from the proposal.

The proposal crosses Bulls Brook at approximately chainage 28.1 km, downstream of the Bulls Brook Biodiversity Corridor established by the North Swan Landcare Group. Several culverts and fauna underpasses will be installed under the highway on the Bulls Brook floodplain to maintain hydrological and ecological connectivity.

12.14 Amenity (Reserves)

Consolidated issue 35 (contributing issue 161): Why is Nature Reserve R46919 not extended into the remainder of Bush Forever site 300? Is it owned by someone else / has it been vested in the state government?

The full extent of Nature Reserve R46919 is shown in PER Chapter 15, Amenity (Reserves), Figure 15.3B. The remainder of Bush Forever Site 300 is owned by the Western Australian Planning Commission.

Consolidated issue 36 (contributing issue 2): Money from sale of Whiteman Park should be reinvested into Whiteman Park.

MRWA will acquire that part of Whiteman Park required for the proposal. The land is vested in the WAPC and managed by the DOP. They are responsible for the management of the park's funding and maintenance. MWRA has no control over how payment for the land required is allocated in relation to management of the park.

12.15 Environmental Offsets

Consolidated issue 14: The proposal (including offsets) will still result in a net loss of biodiversity. Acquisition does not replace bushland, and MRWA should implement a revegetation offset.

Contributing issues:

10: Can offsets package include purchase of cleared/degraded land for rehabilitation to address net loss of important habitat associated with bushland and wetlands?

82: The net loss of black cockatoo habitat requires habitat replacement in the long term through acquisition and revegetation of degraded habitat to avoid continued cumulative losses. This also applies to all other fauna habitats.

85: While the implementation of Offset 1 is supported, the proposal will still result in a net loss of biodiversity at the species, population and community level.

87: The acquisition of properties does not sufficiently offset the impacts of the proposal. MRWA must be required to undertake a revegetation offset to actually replace lost bushland, even if attempts to do so do not completely succeed.

291: The acquisition of Ioppolo Road protects existing foraging habitat for black cockatoos but does not increase availability of habitat. Losses of habitat in the development envelope are therefore not mitigated.

292: The proponent should take into consideration rehabilitation and revegetation when proposing offsets, particularly regarding the EPA's recent strategic advice for the Perth and Peel regions.

(Repeated from Section 7.6)

MRWA's offset strategy (see Chapter 6) has been developed in accordance with the Commonwealth Environmental Offsets Policy (Government of Australia, 2012), WA Environmental Offsets Policy (Government of Western Australia, 2011) and WA Environmental Offsets Guideline (Government of Western Australia, 2014).

Land acquisition is recognised as an appropriate form of offset under these policies and guidelines:

- WA Environmental Offsets Policy: "Direct offsets vary... and include acquisition… of natural areas outside the project area."
- WA Environmental Offsets Guideline: "Land acquisition offsets… involve the protection of environmental values through improved security of tenure or restricting the use of the land."
- Commonwealth Environmental Offsets Policy: "The securing of existing unprotected habitat as an offset only provides a conservation gain if that habitat was under some level of threat of being destroyed or degraded, and as a result of offsetting will instead be protected in an enduring way and actively managed to maintain or improve the viability of the protected matter."

As detailed in Chapter 6, Environmental Offsets MRWA has purchased a parcel of land in the Chittering area (Ioppolo Road) for the purpose of offsetting impacts to Black Cockatoos from the proposal. This offset protects existing high quality habitat for Black Cockatoo species that was otherwise under threat of clearing and degradation from third party access and exploration and agricultural activities. It is an important ecological linkage to existing reserves to the west. The details of activities and funding arrangements for ongoing management will be included in the Land Acquisition and Management Plan in consultation with DPAW.

MRWA acquired the Ioppolo Road site prior to the release of the OEPA's strategic advice 'Perth and Peel @ 3.5 million Environmental impacts, risks and remedies' (EPA, 2015a). While EPA acknowledged that acquisition of bushland provides immediate value and certainty, it is recommended that in future greater emphasis is placed on rehabilitation and revegetation of degraded areas to achieve a net improvement in habitat and other environmental values.

Offset proposal 1 does not completely satisfy the offset requirement for Black Cockatoos. The proposal will also require offsets for a variety of other values, including SCP20a, a number of under-represented vegetation and CCWs, as discussed in Chapter 6. MRWA is considering the opportunity to include rehabilitation and revegetation in addressing these other offset requirements.

MRWA are currently developing a restoration offset plan for up to 31.5 ha across several properties adjacent to the alignment. The restoration plan will be aimed at wetlands, under-represented vegetation and Black Cockatoo habitat. The restoration plan is still in development and further details are not available at this stage.

Consolidated issue 16 (contributing issue 135): Offsets do not add to black cockatoo conservation effort and other management should be used. Will MRWA assist with ongoing monitoring of hollow nesting logs for black cockatoos?

MRWA is considering the opportunity to include rehabilitation and revegetation in addressing its offset requirements. It is also considering opportunities to involve community groups in the delivery/management of the proposal's rehabilitation and offsets.

The Ioppolo Road offset site protects valuable Black Cockatoo foraging and roosting habitat with mature eucalypt trees providing potential breeding habitat that will now be actively managed for conservation by DPAW. The need for an additional 60 ha of Forest Red-tailed Cockatoo habitat provides an opportunity to explore rehabilitation and revegetation of degraded habitat.

MRWA are currently developing a restoration offset plan for up to 31.5 ha across several properties adjacent to the alignment. The restoration plan will be aimed at wetlands, under-represented vegetation and Black Cockatoo habitat. The restoration plan is still in development and further details are not available at this stage.

Consolidated issue 19 (contributing issue 86): Offsets should be required to be implemented before environmental approval is given, particularly Offsets 2, 3 and 4, which have not yet been located.

MRWA will fund all land acquisition prior to the commencement of construction, unless otherwise agreed with DOTE and EPA. Where restoration is proposed, these plans will be submitted and approved prior to the commencement of construction. More detail on the proposed offsets is provided in Chapter 6, Environmental Offsets.

Consolidated issue 20 (contributing issue 17): Was Lot 5892 Maralla Road Bullsbrook considered as a potential offset? If not, can it be?

Lot 5892 Maralla Road, Bullsbrook was considered as an offset site. However, the owner is not interested in selling the property.

Consolidated issue 90 (contributing issue 250): Will MRWA consider the installation and monitoring of next boxes for Carnaby's Black Cockatoo?

The proposal will not result in the removal of any known breeding trees for Black Cockatoos. The Ioppolo Road offset site contains mature eucalypt trees which could provide breeding habitat for Black Cockatoos. MRWA will consider the provision of Black Cockatoo nest boxes in consultation with the DPAW to

encourage use of the Ioppolo Road site and maintain use of remnant vegetation in and adjacent to Dick Perry Reserve and Whiteman Park.

12.16 Other Issues

Consolidated issue 7 (contributing issue 46): Will air pollution from exhausts be monitored and controlled?

An assessment of air quality (vehicle emissions) was not a requirement of the ESD and not required by DER. Emissions from exhausts will not be monitored during construction or operation. Dust will be monitored during construction through inspection and in response to complaints. Measures to limit and suppress dust are set out in PER Appendix F, Environmental Management Plan, Chapter 5, Performance Monitoring, Table 5.1, Performance monitoring.

The DOT is responsible for the implementation of the Road Traffic (Vehicle Standards) Rules 2002 and Road Traffic (Vehicles) Regulations 2014, which include requirements on vehicle emissions

Consolidated issue 8 (contributing issue 56): Please advise which local roads will be accessible between Halden Road and Stock Road in order to get to PDNH.

The highway will sever all existing local roads that it crosses between Maralla Road and Stock Road. Access from local roads to the west of the highway will be via the Stock Road interchange. Halden Road will be constructed north of Maralla Road to connect to existing local roads, which provide access to Stock Road.

Consolidated issue 9: How will rubbish dumping around Maralla Road and Halden Road and other areas be prevented, controlled, monitored and/or cleaned up, during both construction and operation?

Contributing issues:

44: Rubbish dumping along Maralla Road and Halden Road is a concern. What monitoring will there be to prevent illegal dumping? Will there be signage? Who will clean up rubbish dumping to prevent continued dumping in the same location?

119: Will every such area be fenced to prevent impacts such as rubbish dumping, trail biking, off road driving and fires?

152: How will uncontrolled access, rubbish and fires be managed?

162: How will uncontrolled access, rubbish dumping, weeds, dieback and the degradation of vegetation through off-road activities be managed?

221: Existing rubbish dumping and unauthorised access and destruction around Maralla Road will worsen with PDNH. How will illegal activities be managed during and after construction?

Uncontrolled access and illegal dumping of rubbish within the proposal area will be monitored during construction. Temporary fencing during construction and permanent fencing post construction (see PER Chapter 9, Terrestrial Fauna, Figure 9.5) will restrict access from the highway. Fauna underpasses have also been designed to limit human use (see PER Chapter 9, Terrestrial Fauna, Section 9.5.8).

This proposal provides for the upgrade of Maralla Road and Halden Road for local road users, as Maralla Road will be severed by the highway. There will be no access to Maralla Road or Halden Roads from the highway once operational. It is not anticipated that this proposal will significantly increase traffic movements and any associated rubbish dumping along these local roads.

Maralla and Halden roads are local roads administered by the City of Swan. Illegal dumping of rubbish on public land including road reserves is regulated under the *Litter Act 1979*.

No funding arrangements to support ongoing third party access, rubbish dumping or weed management (e.g., by DPAW at Maralla Road Nature Reserve) has been considered as part of this proposal. However, MRWA will liaise with relevant agencies to discuss measures to prevent and manage access from the highway.

Consolidated issue 10: How will local utilities and services be interrupted or continued during construction and operation? Will there be any compensation?

Contributing issues:

51: Will utilities (e.g. electricity) be interrupted during construction? If so, how will it be minimised or compensated?

55: How will services like mail delivery and rubbish collection be continued in Maralla Road [assumed to mean west of PDNH alignment]?

Utilities will be relocated if they cross the highway. Connections to affected properties will be maintained except for limited times when utilities are disconnected to facilitate connection modifications. This will be carried out in consultation with property owners to limit impacts.

No changes to mail or rubbish services are proposed as part of the proposal. If mail is currently delivered, then this service will be maintained.

Consolidated issue 12: How will emergency access for properties west of PDNH on Maralla Road be addressed?

Contributing issues:

43: Severance of local roads will reduce emergency access west of PDNH. What is the emergency access strategy during fires? Who will maintain emergency accesses? How will locked emergency access gates be controlled? Increased fire risk is a major concern.

200: A second/alternative access for residents in the Maralla Road area west of PDNH should be provided in case of emergencies such as fire.

224: PDNH will increase emergency response times in western Maralla Road. How will emergency access be addressed for properties west of PDNH in case of bushfire?

Emergency access provision will be included across the highway at Maralla Road and Warbrook Road. In an emergency, residents will be able to use the emergency access for the highway if directed to do so by emergency services. Emergency access arrangements and revision of emergency response plans are currently being discussed and agreed with DFES and the State Emergency Service (SES). The highway will provide a high speed link into this area for emergency response vehicles improving general response times.

Emergency access to/from the highway reserve will be maintained by MRWA, emergency access to/from local government road reserves will be maintained by the relevant local government authority. Gates will be locked to ensure general access to/from highway is not permitted. Keys to these gates will be provided to the local government, DFES and SES. These gates will also be designed to be removed in an emergency.

Consolidated issue 13 (contributing issue 156): Will MRWA provide fire brigades with extra water sources to fight bushfires?

No additional water sources will be provided as part of the proposal. MRWA is working with DFES to minimise fire risk and provide improvements through additional firebreaks and provision for emergency access. The highway itself will create a firebreak.

13 CONSOLIDATED LIST OF ENVIRONMENTAL OUTCOMES AND PROPOSED MANAGEMENT MEASURES

Consistent with Environmental Assessment Guideline 11 for Recommending Environmental Conditions (EPA, 2013), MRWA is committed to achieving environmental outcomes through the implementation of appropriate management measures that are relevant to specific site conditions. MRWA has proposed management measures to achieve the desired outcomes. The measures are based on conceptual design and will be effective in managing the identified impacts. Alternative management strategies may arise during detailed design, investigations and as a result of construction contractor experience. Focus on achieving the environmental outcomes will enable the listed management measures to be reviewed, revised and, where appropriate, replaced by more effective measures.

A number of changes to the environmental outcomes and proposed management measures within the PER have been proposed within this document in response to submissions, the results of additional surveys and changes to the development envelope.

This chapter presents a consolidated list of the current environmental outcomes and proposed management measures to address the impacts of the proposal (Table 13.1). Where proposed management measures address more than one environmental factor, they have not been repeated. This list has been annotated as to whether each outcome/measure is unchanged from the PER, new, revised or deleted (e.g., it is no longer required because the commitment has been fulfilled).

This consolidated list also includes updated information on MRWA's commitments for offsetting unavoidable significant impacts on Threatened ecological communities, flora and fauna habitat.

Table 13.1 Consolidated list of environmental outcomes and proposed management measures

Aspect	Proposed environmental outcomes and management measures	Previous environmental outcome/management measure (if different)	Status and reason for change (if any)
Flora and vegetation			
Environmental outcomes	FV01 – Avoid Mound Springs SCP TEC at Gaston Road.		Unchanged.
	FVC02 – Avoid Claypans of the SCP TEC adjacent to the existing Great Northern Highway.		Unchanged.
	FVC03 – Avoid known locations of *Caladenia huegelii*, *Grevillea curviloba* subsp. *incurva* and *Darwinia foetida* threatened flora.		Unchanged.
	FVC04 – Avoid known locations of *Cyathochaeta teretifolia* (P3), *Ornduffia submersa* (P4) and *Stylidium striatum* (P4) priority flora.		Unchanged.
	FVC05 – Avoid any direct impact to Bush Forever site 13, including Conservation Category Wetland UFI 8926.	Avoid any direct impact to Bush Forever site 13 (west of Sawpit Road, Bullsbrook), including Conservation Category Wetland UFI 8926.	Revised. Removed unnecessary location detail.
	FVC06 – A maximum of 206 ha of intact native vegetation will be cleared.	A maximum of 205 ha of intact native vegetation will be cleared.	Revised. The area of intact native vegetation to be cleared has been revised (see consolidated issue 178 in Section 7.3.2).
	FVC07 – A maximum of 49.6 ha of GDEs will be cleared.		Unchanged.

Aspect	Proposed environmental outcomes and management measures	Previous environmental outcome/management measure (if different)	Status and reason for change (if any)
	FVC08 – A maximum of 129.9 ha of intact native vegetation within Bush Forever sites will be cleared.	A maximum of 128.5 ha of intact native vegetation within Bush Forever sites will be cleared.	Revised. The area of intact native vegetation within Bush Forever sites has been revised (see consolidated issue 182 in Section 7.3.2).
	FVC09 – A maximum of 4.0 ha of State-listed TEC SCP20a will be cleared.	A maximum of 4.4 ha of State listed TECs (SCP02 and SCP20a) will be cleared.	Revised. SCP02 is no longer considered to exist in the development envelope (see Section 3.3).
	FVC10 – A maximum of 145.5 ha of State-listed PECs (SCP21c, SCP22, SCP23b, SCP24 and Banksia dominated woodlands of the Swan Coastal Plain) will be cleared.		Unchanged.
	FVC11 – A maximum of 30 ha of critical habitat for *Caladenia huegelli* will be cleared.	(No previous outcome.)	New. Not captured previously as an 'environmental outcome'. The area of *Caladenia huegelii* critical habitat presented in the PER was revised following additional surveys (see Section 3.1).
	FVC12 – Edge effects do not extend more than 10 m from the new vegetation edge.	(No previous outcome.)	New. Not captured previously as an 'environmental outcome'.

Aspect	Proposed environmental outcomes and management measures	Previous environmental outcome/management measure (if different)	Status and reason for change (if any)
Proposed management strategies	(No current commitment.)	Additional targeted surveys for Threatened and Priority listed flora will be undertaken prior to vegetation clearing to clearly define population boundaries, and to identify any additional populations within and adjacent to the proposal.	Deleted. Additional targeted surveys have now been completed (see Chapter 3, Spring Ecological Surveys).
	(No current commitment.)	Additional targeted surveys of the known populations of *Millotia tenuifolia* var. *laevis* and *Meeboldina decipiens* subsp. *decipiens* ms to clearly define populations and known individuals. The survey results will be provided to the EPA as part of the response to submissions process to inform the EPA's assessment of the proposal.	Deleted. Additional targeted surveys have now been completed (see Chapter 3, Spring Ecological Surveys).
	FVM01 – Progressive clearing and revegetation will occur through the life of the construction phase of the proposal.		Unchanged.
	FVM02 – Delineation of the clearing boundary prior to clearing.	Delineation of an approved clearing boundary	Revised. Removed 'approved' as the clearing boundary will not be defined until after this assessment is complete.

Aspect	Proposed environmental outcomes and management measures	Previous environmental outcome/management measure (if different)	Status and reason for change (if any)
	FVM03 – Preparation and implementation of an EMP to limit risk of fire, the introduction and/or spread of weeds (i.e. WONS and declared pests) and/or dieback, littering and unauthorised access. The EMP will also include measures for hot work and the transport, generation, storage, handling, use and disposal of pollutants (including total suspended solids (TSS), ASS, hydrocarbons and chemicals), including an emergency spill response procedure.	Preparation and implementation of an EMP to limit risk of fire, the introduction and/or spread of weeds and/or dieback and litter to protect ecosystems that supports Threatened and Priority taxa. This EMP will include a monitoring program to monitor the condition of environmentally significant vegetation along the edge of the proposal footprint (i.e. TECs, PECs and threatened flora buffers) for any indirect impacts, including significant environmental weed incursions (i.e. WONS and declared pests) and refuse.	Revised. Removed unnecessary justification text. Management and monitoring of environmentally significant vegetation removed as this is now addressed under new management measure FVM04. Revised to amalgamate various commitments with regard to the EMP.
	FVM04 – Preparation and implementation of a Flora and Vegetation Management and Monitoring Plan to manage impacts on environmentally significant flora and vegetation, including TECs, PECs and Threatened and Priority flora including *Caladenia huegelii*, *Grevillea curviloba* subsp. *incurva* and *Darwinia foetida*. The plan will include establishing baseline condition, undertaking monitoring and implementing remedial actions should changes to vegetation health and condition be detected.	(No previous management measure.)	New. This commitment has been split off from a previous management measure regarding an EMP (FVM03). *Darwinia foetida* has been added following its recent discovery in the proposal footprint (see Section 3.5).

Aspect	Proposed environmental outcomes and management measures	Previous environmental outcome/management measure (if different)	Status and reason for change (if any)
	FVM05 – Develop a detailed infrastructure plan for each stage of the development prior to construction to ensure the proposal is: • Designed, and the clearing boundary defined, within the approved development envelope (and the impact limits set by the 'proposal footprint'). • Identifies areas of native vegetation/habitat to be retained. • Designed and constructed in accordance with the drainage strategy. • Identifies any areas of CCW and REW to be retained.	Develop a detailed infrastructure plan for each stage of the development prior to construction to ensure the proposal is designed within the approved development boundary ('proposal footprint') and identifies areas of native vegetation to be retained.	Revised. The commitment's wording has been made consistent with other language in the PER. Amalgamates various commitments with regard to the detailed infrastructure plan.
	FVM06 – Design and installation of culverts in accordance with the drainage strategy.	Design and installation of culverts to reduce shadowing and ponding.	Revised. Minor change to wording to link to drainage strategy. Removed unnecessary justification text.
	(No current commitment.)	Threatened and Priority listed flora and ecological communities will be demarcated outside of the proposal footprint.	Deleted. This is addressed under management measure FVM10.

Aspect	Proposed environmental outcomes and management measures	Previous environmental outcome/management measure (if different)	Status and reason for change (if any)
	FVM07 – Preparation and implementation of a weed and dieback hygiene management plan including: • A risk assessment of potential sources and activities. • The identification of 'protectable' areas adjacent to the proposal footprint. • Requirements for hygiene washdown locations that consider risk in the surrounding landscape. • A program to monitor and report on compliance and corrective actions where non-compliance has occurred. • Quarterly auditing of washdown sites to identify weed incursions. • Regular walk-overs at strategic locations along the proposal footprint (i.e. in association with native vegetation) to identify and ameliorate weed incursions. • An auditable hygiene inspection form will be prepared to detail inspection results at the hygiene locations.		Unchanged.
	FVM08 – Educational and induction material will include information on significant flora and ecological communities to reduce the risk of accidental clearing.	Educational and induction material will be provided about the significant flora and ecological communities to contractors working on the construction to reduce the risk of accidental clearing.	Revised. Minor change to wording.
	FVM09 – Revegetation will occur at the earliest opportunity within designated revegetation areas and corridors to maintain ecological linkages.		Unchanged.

Aspect	Proposed environmental outcomes and management measures	Previous environmental outcome/management measure (if different)	Status and reason for change (if any)
	FVM10 – A temporary fence will be installed during construction along environmentally sensitive areas. Environmentally sensitive areas include, but are not limited to, conservation estate, Bush Forever sites, Cullacabardee, Whiteman Park, Lexia wetlands, Dick Perry Reserve and locations of Threatened and Priority listed flora and ecological communities and their buffers.	A fence will be installed along environmentally sensitive areas to reduce the risk of unauthorised or uncontrolled access impacting on the sensitive features. Environmentally sensitive areas will include, but not limited to conservation estate, Bush Forever sites, Cullacabardee, Whiteman Park, Lexia wetlands, Dick Perry Reserve and locations of Threatened and Priority listed flora and ecological communities.	Revised. Removed unnecessary justification text. Specified the temporary nature/timing of this commitment.
	FVM11 – No movement of plant, vehicles or equipment outside of the clearing boundary during construction, unless within existing areas of disturbance.	No movement of plant (construction) or vehicles outside of the designated clearing line during construction.	Revised. The commitment's wording has been made consistent with other language in the PER. Amended to allow movement of vehicle/machinery/equipment within existing areas of disturbance (i.e., tracks).
	(No current commitment.)	Additional vegetation surveys and analysis of the vegetation inferred to be consistent with the TEC SCP02 to determine if the vegetation is consistent with the TEC SCP02. The surveys and analysis will occur in spring 2015 with the analysis and FCT determination available shortly after the survey completion.	Deleted. Additional targeted surveys have now been completed (see Chapter 3, Spring Ecological Surveys).

Aspect	Proposed environmental outcomes and management measures	Previous environmental outcome/management measure (if different)	Status and reason for change (if any)
	FVM12 – Locate access points and PSP away from environmentally significant vegetation, where practicable. If this is unavoidable, then the access points and paths will be designed to minimise the risk of uncontrolled access.	Access points and the PSP will be located away from extant native vegetation, where possible. If this is unavoidable, then the access points and paths will be designed to minimise the risk of uncontrolled access into significant native vegetation (i.e. Maralla Nature Reserve).	Revised. The commitment's wording has been made consistent with other language in the PER and generalised to refer to all environmentally significant vegetation.
	FVM13 – Species used by Thynnid wasps as food sources will be incorporated in revegetation of the road reserve adjacent to *Caladenia huegelii* critical habitat in the vicinity of Ellenbrook.	(No previous management measure.)	New. This management measure has been added in Section 5.1.1.1 in response to consolidated issue 135 (see Section 12.7.1).
Terrestrial fauna			
Environmental outcomes	TFC01 – A maximum of 207.2 ha of Carnaby's Black Cockatoo foraging habitat, 120.5 ha of Forest Red-tailed Black Cockatoo foraging habitat, and 120.5 ha of breeding habitat (inclusive of 763 potential breeding trees) and 56.5 ha of roosting habitat for both species will be removed.	A maximum of 201.8 ha of Carnaby's Cockatoo foraging habitat; 120.1 ha of Forest Red-tailed Black Cockatoo foraging habitat; and 120.1 ha of breeding habitat (inclusive of 737 potential breeding trees) and 58.6 ha of roosting habitat for both Black Cockatoo species will be removed.	Revised. The area of Black Cockatoo habitat has been revised (see Table 6.2 and response to consolidated issue 88 in Section 12.8.1).
	TFC02 – A maximum of 160.1 ha of natural fauna habitat will be removed.	A maximum of 159.3 ha of natural fauna habitat will be removed.	Revised. The area of natural fauna habitat to be cleared has been revised (see consolidated issue 118 in Section 12.8.3).

Aspect	Proposed environmental outcomes and management measures	Previous environmental outcome/management measure (if different)	Status and reason for change (if any)
	TFC03 – Maintain ecological connectivity across the proposal where practicable.	Ecological connectivity will be maintained across the PDNH alignment.	Revised. The commitment's wording has been made consistent with other language in the PER. The revision also recognises that maintenance of ecological connectivity across the entire proposal is not possible given the nature of linear infrastructure projects.
	TFC04 – Minimise the occurrence of fauna mortality associated with vegetation clearing and vehicle interaction during construction and operation.	The occurrence of fauna mortality, associated with vegetation clearing, vehicle interaction will be minimised during construction and operation.	Revised. Minor change to wording.
Proposed management measures	TFM01 – A total of 21 underpasses and two bridges will be constructed in key locations along the proposal. Multiple underpasses will be installed in close proximity at each key location. The effectiveness of fauna underpasses will be assessed via a monitoring program.	A total of 21 underpasses and two bridges are planned to be constructed in key locations along the proposal. The use of multiple fauna underpasses close to each other to reduce the risk of predators taking advantage of the funnelling effect of underpasses on fauna. Fauna underpass monitoring program will be developed.	Revised. Rephrased to combine three management measures.

Aspect	Proposed environmental outcomes and management measures	Previous environmental outcome/management measure (if different)	Status and reason for change (if any)
	(See FVM02.)	Boundary fencing or flagging will be used to delineate extent of clearing so clearing outside of the specified boundary will not occur.	Deleted. This is addressed under management measure FVM02.
	(See FVM05.)	Clearing to occur only within construction footprint in Maralla Road Bushland and Whiteman Park/Cullacabardee Bushland where ecological connectivity is paramount.	Deleted. This is addressed under management measure FVM05.
	(See FVM03.)	An environmental management plan will be implemented to limit the risk of fire, spread of weeds, rubbish and vehicle tracks caused during construction.	Deleted. This is addressed under management measure FVM03.
	(See Offset Proposal 1.)	An offset site in Chittering has been purchased to offset the impacts of habitat loss from the proposal and includes 673.5 ha of Black Cockatoo habitat. A summary of the fauna values of the offset site is contained in Chapter 17.	Deleted. This is addressed by Offset Proposal 1.
	(See FVM05 and FVM09.)	Retain or rehabilitate roadside vegetation, especially along the Reid Highway section of the proposal footprint to help facilitate fauna movement between local habitats.	Deleted. Delineation of clearing boundary and areas to be retained are addressed under management measure FVM05. Rehabilitation and maintenance of ecological corridors is addressed under management measure FVM09.

Aspect	Proposed environmental outcomes and management measures	Previous environmental outcome/management measure (if different)	Status and reason for change (if any)
	TFM02 – Retain and translocate hollow logs from cleared area to surrounding habitats.	Retain and translocate hollow logs to surrounding habitats. Logs are an important refuge site for many animal species and provide shelter against predation and provide shelter against predation.	Revised. Minor change to wording. Removed unnecessary justification text.
	TFM03 – Furniture (objects to provide shelter) and revegetation will be used in and around fauna underpasses.	The use of furniture (objects to provide shelter) in fauna underpasses to reduce risk of predation. Revegetation as close to fauna underpasses as possible to reduce risk of predation.	Revised. Rephrased to combine two management measures. Removed unnecessary justification text.
	(See TFM01).	The use of multiple fauna underpasses close to each other to reduce the risk of predators taking advantage of the funnelling effect of underpasses on fauna.	Deleted. This is addressed under management measure TFM01.
	TFM04 – Limit the use of *Banksia* and other Black Cockatoo foraging resources as part of revegetation activities within 10 m of the road.	The use of Banksia and other Black Cockatoo foraging resources will be limited as part of revegetation activities within 10 m of the road. Having foraging resources close to the road will create a higher chance of vehicle impact on these species.	Revised. Minor change to wording. Removed unnecessary justification text.

Aspect	Proposed environmental outcomes and management measures	Previous environmental outcome/management measure (if different)	Status and reason for change (if any)
	TFM05 – Clearing of vegetation will be conducted outside spring where possible.	Clearing to occur outside of spring wherever possible, to minimise impacts to the breeding cycle of resident fauna e.g. nesting birds. If clearing is conducted during spring fauna spotters must be present.	Revised. Minor change to wording. Removed unnecessary justification text. Fauna spotters are addressed under management measure TFM07.
	TFM06 – A trapping and relocation program will be conducted for ground dwelling fauna in areas of native vegetation prior to clearing in accordance with a licence to take fauna for education or public purpose issued by the DPAW under section 15 of the *Wildlife Conservation Act 1950*.	A trapping and translocation program will be conducted for ground dwelling fauna in areas of native vegetation prior to clearing. Fauna will be released in comparable habitat outside of the construction footprint.	Revised. Minor text change to refer to the relevant licencing process.
	TFM07 – Fauna spotters will be present during clearing of native vegetation to help relocate any fauna to adjacent comparable habitat.	Fauna spotters will be present during the clearing of native vegetation to help translocate any fauna to adjacent suitable habitat and minimise any mortalities.	Revised. Minor change to wording. Removed unnecessary justification text.

Aspect	Proposed environmental outcomes and management measures	Previous environmental outcome/management measure (if different)	Status and reason for change (if any)
	TFM08 – Fauna fencing will be installed on both sides of the road in areas north of Hepburn Avenue along the alignment to at least 100 m north of Maralla Road to restrict fauna access to the road. The fauna fence design will be consistent with MRWA Drawing No. 200331-110.	Fauna fencing will be installed on both sides of the road in areas north of Hepburn Avenue along the alignment to a minimum of 100 m north of Maralla Road to restrict fauna access to the road. The fauna fence design will be consistent with MRWA Drawing No. 200331-110 (1,800 mm high and dug into the ground 500 mm). The design of fauna fencing restricts medium to large ground dwelling fauna from obtaining access to the road and guides them to safe crossing points at the fauna underpass locations.	Revised. Removed fence dimensions as these are specified in the drawing. Removed unnecessary justification text.
	TFM09 – Fauna escape ramps or gates will be installed every 200 m along fauna fencing to allow trapped animals safe egress from the road reserve while preventing ingress.	Fauna escape ramps will be installed a minimum of every 200 m in sections containing fauna fencing. Fauna escape ramps are one-way devices that allow trapped animals safe egress from the road reserve. The ramps are required to be a 1,500 mm high to prevent fauna access in the wrong direction.	Revised. Minor change to wording to allow flexibility in design by contractor whilst ensuring the environmental outcomes can be achieved.

Aspect	Proposed environmental outcomes and management measures	Previous environmental outcome/management measure (if different)	Status and reason for change (if any)
	TFM10 – A 40 km/h speed limit will be enforced when travelling through vegetation within the road reserve (e.g., Whiteman Park and Maralla Road Nature Reserve) until clearing has been completed and fauna fencing has been installed.	A 40 km/h speed limit will be enforced within the construction zone to mitigate against animal strikes.	Revised. Removed unnecessary justification text. The speed limit is unnecessary in areas that are already cleared (including existing roads) and following installation of fauna fencing.
	TFM11 – All fauna injured during the construction period will be taken to an authorised veterinarian or wildlife carer.		Unchanged.
	TFM12 – Fauna warning signs will be installed, if required, in areas not protected by fauna fencing.	Fauna warning signs will be installed in areas where native vegetation occurs next to the roadside.	Revised. Fauna fences are designed to eliminate fauna access to the highway, obviating the need for warning signs in fenced areas. Warning signs are most effective if used only in areas of actual risk.
	(See FVM03.)	The risk of fire will be managed by minimising fuel load and controlling ignition sources through the implementation of an EMP and an emergency response procedure.	Deleted. This is addressed under management measure FVM03.
	TFM13 – Impacts from fire during the operation phase of the proposal will be managed by the inclusion and maintenance of firebreaks.		Unchanged.

Aspect	Proposed environmental outcomes and management measures	Previous environmental outcome/management measure (if different)	Status and reason for change (if any)
	(No current commitment.)	The proposal will act as a firebreak and the footpaths and access tracks will allow greater access for fire fighters.	Deleted. This is a natural outcome of the proposal rather than a specific management measure.
	TFM14 – Light spill to surrounding fauna habitat will be reduced by directing lighting into construction areas, using low-level lighting and fitting screens/shrouds where practicable.	Lights will be directed towards construction activities to limit the amount of light spill to surrounding habitats. Where possible low level lighting will be used during the construction phase of the proposal. Artificial screening will be employed along areas adjacent to native vegetation.	Revised. Rephrased to combine two management measures.
	TFM15 – Road lighting will consider AS 4282 'Control of the Obtrusive Effects of Outdoor Lighting' and comply with AS 1158 'Road Lighting'.	The road lighting will consider AS 4282 'Control of the Obtrusive Effects of Outdoor Lighting' and road lighting will comply with AS 1158 'Road Lighting' to reduce impacts from light pollution.	Revised. Minor change to wording. Removed unnecessary justification text.
	TFM16 – Evidence of nesting Rainbow Bee-eaters will be recorded, demarcated and temporarily avoided during clearing until the birds have left the nest.	(No previous management measure.)	New. This management measure has been added in response to consolidated issue 111 (see Section 12.8.5).

Aspect	Proposed environmental outcomes and management measures	Previous environmental outcome/management measure (if different)	Status and reason for change (if any)
Hydrological processes and inland waters environmental quality			
Environmental outcomes	HPC01 – A maximum of 16 ha of CCW and 14 ha of REW will be removed.	A maximum of 14.8 ha of CCW (including 0.04 ha of EPP Lake 450) and 14.0 ha of REW will be removed.	Revised. The impact to CCW has been increased to account for indirect impacts to severed portion of CCW 15260 (see Table 7.3 in consolidated issue 154 in Section 7.3.2). Reference to EPP Lake 450 has been removed following revocation of the Environmental Protection (Swan Coastal Plain Lakes) Policy 1992 on 20 November 2015.
	HPC02 – No adverse hydrological change in the condition to remaining wetlands, Ellen Brook, Mound Springs SCP TEC and Claypans of the SCP TEC.		Unchanged.
	HPC03 – No adverse impact on groundwater quality or availability of the Gnangara Mound.		Unchanged.
Proposed management measures	(See FVM03.)	An EMP will be developed and implemented during construction and will include measures for mitigating and managing hydrological impacts particularly in regard to the generation, storage, handling and release of pollutants (including total suspended solids (TSS), ASS, hydrocarbons and chemicals), including an emergency spill response procedure.	Deleted. This is addressed under management measure FVM03.

Aspect	Proposed environmental outcomes and management measures	Previous environmental outcome/management measure (if different)	Status and reason for change (if any)
	HPM01 – A wetland and drainage management and monitoring plan will be developed and implemented, including groundwater monitoring to ensure impacts to wetlands and the Gnangara Mound are appropriately managed and there are no unforeseen impacts.	A drainage management and monitoring plan will be developed and implemented, including a groundwater monitoring procedure to ensure impacts to Gnangara Mound are being appropriately managed.	Revised. Rephrased to combine two management measures (i.e., single hydrological management and monitoring plan rather than two).
	(See HPM01.)	A wetland management and monitoring plan will be developed and implemented, including groundwater monitoring to ensure impacts to wetlands (including Ellen Brook) are appropriately managed and there are no unforeseen impacts.	Deleted. This is addressed under management measure HPM01.
	(See FVM05.)	A detailed infrastructure plan will be prepared for each stage of the development prior to construction to ensure that the proposal is designed and constructed in accordance with the drainage strategy. This will include details of key proposal elements including locations and dimensions (e.g. culverts, bioretention swales, infiltration basins) and, where possible, identify any areas of CCW and REW that can be retained following final design.	Deleted. This is addressed under management measure FVM05.
	HPM02 – The road surface will be constructed above the design maximum groundwater level.		Unchanged.

Aspect	Proposed environmental outcomes and management measures	Previous environmental outcome/management measure (if different)	Status and reason for change (if any)
	HPM03 – Design and construct culverts in accordance with the drainage strategy to maintain surface water flows, including maintaining hydraulic connectivity between areas of wetland intersected/fragmented by the proposal.	Design and locate culverts to maintain surface water flows, including maintaining hydraulic connectivity between areas of wetland intersected/fragmented by the proposal.	Revised. Minor change to wording. A reference to the drainage strategy has been included.
	HPM04 – Maintain hydraulic connectivity of groundwater upstream and downstream of the road embankment where clay is present within 0.5 m of the road embankment foundation through the installation of culverts where surface flows are anticipated.		Unchanged.
	HPM05 – Design and construct the proposal in accordance with the drainage strategy including promoting runoff for small rainfall events onto the ground as close to the source as possible for infiltration through the most appropriate infiltration drainage mechanism (i.e. vegetated/grassed swales/verge, bio-retention swales, soak well type pits and retention/detention basins).	Promote runoff for small rainfall events onto the ground as close to the source as possible for infiltration, through the most appropriate infiltration drainage mechanism (i.e. vegetated/grassed swales/verge, bioretention swales, soak well type pits and retention/detention basins).	Revised. Minor change to wording. A reference to the drainage strategy has been included.
	HPM06 – Construction laydown areas and stockpiles (including storage of hazardous materials and refuelling activities) will be located outside the WHPZs and 50 m from all CCWs, Mound Springs SCP TECs and Claypans of the SCP TEC to mitigate potential water quality impacts.		Unchanged.
	HPM07 – Undertake bridge construction at Ellen Brook during low flows and outside the low flow channel. Bridge footings will be piled.	Bridge construction at Ellen Brook will be undertaken during periods when Ellen Brook is at low flow. All construction works will be completed outside the low flow area to prevent impacts to surface water flow during construction and bridge footings will be piled.	Revised. Minor change to wording. Removed unnecessary justification text.

Aspect	Proposed environmental outcomes and management measures	Previous environmental outcome/management measure (if different)	Status and reason for change (if any)
	HPM08 – A detailed ASS investigation will be undertaken to inform the development of an ASS Management Plan.	Following final design and the definition of likely soil disturbance, a detailed ASS investigation will be undertaken to inform the development of an ASS Management Plan.	Revised. The timing link is a constraint and does not provide any practical benefit. A sufficient ASS investigation can be conducted using a near-final design.
	HPM09 – Following final design and identification of appropriate water abstraction locations (where not in accordance with an existing bore/licence) an investigation into water abstraction requirements will be undertaken to understand the extent and scale of associated impacts on groundwater.		Unchanged.
	HPM10 – Construction water abstraction bores will be sited and operated such that drawdown impacts to environmentally sensitive receptors are within the usual seasonal variations of groundwater levels for those receptors, unless further studies into those receptors' ecological water requirements (EWRs) show impacts to be insignificant. Monitoring bores may be used to monitor groundwater levels and verify hydrogeological modelling.		Unchanged.
	HPM11 – Where practical, construction of bridge footings will be scheduled during summer to avoid dewatering requirements. If dewatering is required, dewatering methods (e.g. well-point spears) that minimise the radius of influence in confirmed areas of ASS and on sensitive receptors (e.g. wetlands) will be utilised.		Unchanged.

Aspect	Proposed environmental outcomes and management measures	Previous environmental outcome/management measure (if different)	Status and reason for change (if any)
	HPM12 – Any dewatering and abstraction of construction water will be undertaken in accordance with approved licences under the *Rights in Water and Irrigation Act 1914*. A dewatering management plan (including ASS management) will be developed and implemented in support of any application for dewatering and a groundwater licence operating strategy will be developed and implemented as necessary to support the supply of construction water.		Unchanged.
	HPM13 – The use of spread footings in final design will be considered where sands are deemed suitable to support structures at raised interchanges, to minimise the extent of any anticipated disturbance to ASS.		Unchanged.
	HPM14 – Interference with Ellen Brook bed and banks during bridge construction and direct impacts to wetlands from road construction will be undertaken in accordance with a permit under the *Rights in Water and Irrigation Act 1914*.	Interference with beds and banks associated with bridge construction over Ellen Brook and direct impacts to wetlands from road construction will be undertaken in accordance with an approved permit under the *Rights in Water and Irrigation Act 1914*.	Revised. Minor change to wording.
	HPM15 – The EMP will emphasise the importance of the Gnangara UWPCA and refer to the appropriate policies and Water Quality Protection Notes.	(No previous management measure.)	New. This management measure has been added in response to consolidated issue 79 (see Chapter 9, Response to Department of Water Issues) and following consultation with Department of Water.

Aspect	Proposed environmental outcomes and management measures	Previous environmental outcome/management measure (if different)	Status and reason for change (if any)
	HPM16 – All fuel and chemicals will be stored in a double skin tank and placed in bunds capable of storing 125% of the capacity of the largest tank.	(No previous management measure.)	New. This management measure has been added in response to consolidated issue 79 (see Chapter 9, Response to Department of Water Issues) and following consultation with Department of Water.
	HPM17 – Spill response kits will be available during refuelling which will only be conducted outside WHPZs. Individual fuel storage tanks will not exceed 5,000 L capacity within the P1 area.	(No previous management measure.)	New. This management measure has been added in response to consolidated issue 79 (see Chapter 9, Response to Department of Water Issues) and following consultation with Department of Water.
Amenity (noise and vibration)			
Environmental outcomes	NVC01 – Construction noise will comply with the prescribed standards for noise emissions under the Environmental Protection (Noise) Regulations 1997.	(No previous outcome.)	New. Although mentioned in PER Table 11.3 (Noise and Vibration), Section 11.7, this was not explicitly stated as a commitment.

Aspect	Proposed environmental outcomes and management measures	Previous environmental outcome/management measure (if different)	Status and reason for change (if any)
	NVC02 – Operational noise will not exceed the noise limit of 60 dB L_{Aeq} as prescribed in State Planning Policy 5.4 between Reid Highway and Ellenbrook.	(No previous outcome.)	New. Although mentioned in PER Table 11.3 (Noise and Vibration), Section 11.7, this was not explicitly stated as a commitment.
Proposed management measures	NVM01 – A Construction Noise and Vibration Management Plan (CNVMP) will be developed for any out of hours works (outside of 7.00 a.m. to 7.00 p.m. Monday to Saturday) in accordance with the Environmental Protection (Noise) Regulations 1997, to the satisfaction of DER and relevant local government authorities. The CNVMP will be developed prior to construction to ensure all works are carried out in accordance with AS 2436:2010 - Guide to Noise and Vibration control on Construction, Demolition and Maintenance sites, and will include the following mitigation/management measures: • Using equipment with low noise levels and maintaining noise control devices on equipment. • Using broadband reversing alarms on construction equipment. • Taking precautionary measures to avoid vibration damage to buildings near work sites. • Vibration will not exceed a particle velocity of 5 mm/s during construction.		Unchanged.

Aspect	Proposed environmental outcomes and management measures	Previous environmental outcome/management measure (if different)	Status and reason for change (if any)
	• A dilapidation survey will be undertaken prior to construction. • Providing a 24-hour noise and vibration complaint hotline during construction and maintaining a complaints register. • Obtaining necessary approval to work outside of normal working hours, if required. • Providing public notification where receptors may be impacted by construction noise and/or vibration, particularly when works will occur outside normal working hours. • Minimising the amount of night-time traffic and construction adjacent to residential areas. • Undertaking noise and vibration monitoring during construction in response to complaints or at potentially affected locations to alert operators of exceedances of noise and vibration limits.		
	NVM02 – Locate road infrastructure as far as practicable to the west within the road reserve in the vicinity of Ellenbrook to minimise noise impacts.	Locating the road infrastructure as far to the west within the road reserve as far as is practicable, in the vicinity of Ellenbrook, to minimise noise impacts.	Revised. Minor change to wording.
	NVM03 – Use the quietest practical road surface.	Using the quietest practical road surface.	Revised. Minor change to wording.

Aspect	Proposed environmental outcomes and management measures	Previous environmental outcome/management measure (if different)	Status and reason for change (if any)
	NVM04 – Construct noise walls to a maximum height of 5 m adjacent to noise sensitive premises between Reid Highway and Ellenbrook and of a material with a surface density exceeding 15 kg/m^2 to achieve the noise limit of 60 dB $L_{Aeq\ (Day)}$.	Constructing noise walls to a maximum height of 5 m at noise sensitive premises adjacent to the alignment between Hepburn Avenue and Ellenbrook with the aim to ensure noise levels do not exceed the noise target of 55 dB L_{Aeq} at these premises, as far is reasonably practicable. Noise walls will be a constructed of material with a surface density exceeding 15 kg/m^2.	Revised. The revised transportation noise assessment (see Chapter 4, Amenity (Noise and Vibration)) has shown that the noise limit of 60 dB $L_{Aeq\ (Day)}$ can be met at noise sensitive receivers south of Maralla Road. While modelling shows that the noise target of 55 dB $L_{Aeq\ (Day)}$ will be achieved at most residences in Ellenbrook, it is not practicable to achieve this noise level at some locations due to the 5 m cap on noise wall height.
	(See NVM04.)	Should the construction of noise walls not result in achieving the noise target of 55 dB L_{Aeq} at noise sensitive receptors between Hepburn Avenue and Ellenbrook, efforts will be made to achieve the noise limit of 60 dB L_{Aeq}.	Deleted. The revised transportation noise assessment shows that the noise limit of 60 dB L_{Aeq} will be met for these sensitive receptors (see Chapter 4, Amenity (Noise and Vibration), Table 4.2). This is addressed under management measure NVM04.
	NVM05 – Construct screening walls of a maximum height of 2.4 m at noise sensitive premises north of Ellenbrook where they are within 100 m of the road.	Where the road is located within 100 m of residential properties north of Ellenbrook, a visual screening wall will be constructed of 2.4 m in height.	Revised. Minor change to wording.

Aspect	Proposed environmental outcomes and management measures	Previous environmental outcome/management measure (if different)	Status and reason for change (if any)
	NVM06 – Where the SPP 5.4 noise limit (60 dB $L_{Aeq\ (Day)}$) is unable to be achieved at rural residential properties north of Ellenbrook, indoor noise levels at these properties will be reduced to as low as reasonably practicable through the application of noise mitigation, set out in the Implementation Guidelines for SPP 5.4 (WAPC, 2014), as discussed and agreed with the affected property owners.	Façade protection packages will be implemented at identified properties north of Ellenbrook where noise levels are likely to exceed the day limit criteria of 60 dB L_{Aeq}. The level of treatment provided will be determined on a case-by-case basis in consultation with affected property owners and is likely to consist of 6 mm thick glazing to windows.	Revised. Minor change to wording. This management measures now aligns with EAG 13. Specific reference to 6 mm glazing has been removed as building mitigation will be determined in consultation with affected residents (see Chapter 4, Amenity (Noise and Vibration), Table 4.2).
	NVM07 – Noise monitoring will be undertaken to confirm the as built and operating highway achieves the SPP 5.4 noise limit (60 dB $L_{Aeq\ (Day)}$) at residences south of Maralla Road. Based on the results of the monitoring, MRWA may implement additional noise mitigation.	(No previous management measure.)	New. This management measure has been added in response to submissions on noise and consultation with affected residents. It will verify the results of the transportation noise assessment.
Rehabilitation and decommissioning			
Environmental outcomes	RDC01 – All areas of temporary disturbance will be revegetated by the re-establishment of a cover of vegetation suited to the location.		Unchanged.
	RDC02 – Rehabilitation of the road verge will improve the amenity of the site, improve the stability of unpaved surfaces and promote ecological sustainability.	Rehabilitation of the road verge will improve the amenity of the site, the stability of unpaved surfaces and promote ecological sustainability.	Revised. Minor change to wording.

Aspect	Proposed environmental outcomes and management measures	Previous environmental outcome/management measure (if different)	Status and reason for change (if any)
Proposed management measures	(See FVM03.)	An EMP will be developed and implemented during construction.	Deleted. This is addressed under management measure FVM03.
	RDM01 – A detailed revegetation plan will be developed outlining a clear timeframe for mitigation and management measures, monitoring actions and completion targets.		Unchanged.
	RDM02 – Retain topsoil for placement on areas where revegetation will be undertaken. In the absence of adequate topsoil, suitable growth medium will be used. If additional topsoil is required, materials must be contaminant and weed free.		Unchanged.
	(See FVM03.)	Dieback hygiene procedures will be implemented to ensure no cross-contamination of dieback free material occurs.	Deleted. This is addressed under management measure FVM03.
	(See FVM03.)	Weed hygiene procedures will be implemented to minimise the risk of introducing weeds into rehabilitated areas.	Deleted. This is addressed under management measure FVM03.
	RDM03 – Conserve and where possible chip good quality vegetation during clearing for reuse as mulch.	Conserving and where possible chipping good quality vegetation, during clearing, for reuse as mulch.	Revised. Minor change to wording.
	RDM04 – Unsuitable topsoil and cleared vegetation will be treated or disposed during the clearing works	Treating or disposing unsuitable topsoil and cleared vegetation during the clearing works.	Revised. Minor change to wording.

Aspect	Proposed environmental outcomes and management measures	Previous environmental outcome/management measure (if different)	Status and reason for change (if any)
	RDM05 – Landscaping will be undertaken in accordance with the landscaping types and extent present in the proposal footprint (rural zone, transition zone and urban zone).		Unchanged.
	RDM06 – Local provenance native species that represent the floristic formations of the proposal footprint will be selected for revegetation.		Unchanged.
	RDM07 – Rehabilitation will be scheduled progressively where practicable. Timing of activities will, however, be dependent on optimal seasons.	Scheduling rehabilitation progressively where practicable. Timing of activities will, however, be dependent on optimal seasons.	Revised. Minor change to wording.
	RDM08 – Ongoing maintenance will be performed as part of a maintenance program.	Ongoing maintenance will form part of the regional Maintenance Program and will be the responsibility of the Asset Manager.	Revised. Minor change to wording and removal of specific role titles/program names.
Aboriginal heritage			
Environmental outcomes	AHC01 – No disturbance to any Aboriginal heritage site outside of that approved under Section 18 of the *Aboriginal Heritage Act 197*2.		Unchanged.
	AHC02 – Minimise impacts to unknown Aboriginal heritage sites.		Unchanged.
Proposed management measures	AHM01 – An EMP will be developed and implemented during construction and will include measures for mitigating and managing impacts to known and unknown Aboriginal heritage sites. It will include induction requirements for contractors, protection of known and potential (e.g., NorthLink 14-01 and 14-02) Aboriginal heritage sites and procedures to be followed if a previously unknown Aboriginal heritage site is found.	Prepare and implement an Aboriginal Heritage Management Plan.	Revised. The EMP will address management of impacts to Aboriginal heritage sites during construction.

Aspect	Proposed environmental outcomes and management measures	Previous environmental outcome/management measure (if different)	Status and reason for change (if any)
	AHM02 – Obtain the necessary Section 18 consent under the *Aboriginal Heritage Act 197*2 prior to disturbing any Aboriginal heritage site within the proposal footprint.	An application under Section 18 of the AH Act will be submitted to the DAA to obtain approval from the Minister of Aboriginal Affairs to disturb these sites within the proposal footprint.	Revised. Minor change to wording.
	(See AHM01.)	All relevant staff/contractors will be informed about the presence and location of Aboriginal archaeological sites NorthLink 14-01 and NorthLink 14-02, which may be considered Aboriginal sites under Section 5(a) of the AH Act.	Deleted. This is addressed under management measure AHM01.
	(No proposed commitment.)	Other stakeholders such as landowners will be informed about any sites on their property.	Deleted. All landowners are made aware of the presence of Aboriginal sites on their property through the application process under Section 18 of the AHA Act (see AHM02).
	AHM03 – Prior to nearby ground disturbance, sites NorthLink 14-01 and NorthLink 14-02 will be clearly delineated using physical markers and/or fencing. Physical barriers will be inspected periodically to ensure they are maintained throughout construction.	Prior to nearby ground disturbance, sites NorthLink 14-01 and NorthLink 14-02 will be clearly delineated using physical markers and/or fencing and existing induction programmes/materials altered to alert staff in the area about the restrictions in entering or working near these heritage areas. Physical barriers may require periodic maintenance to ensure effectiveness.	Revised. Minor change to wording. Removed unnecessary justification text. The applicable timeframe (i.e., construction) has been specified.

Aspect	Proposed environmental outcomes and management measures	Previous environmental outcome/management measure (if different)	Status and reason for change (if any)
	AHM04 – South-West Aboriginal Land and Sea Council (SWALSC) and other relevant Aboriginal people will be consulted before commencing work within the boundaries of Stored (archaeological) place 3552.		Unchanged.
	AHM05 – Should any ground disturbance be proposed for Registered (archaeological) sites, Lodged Places DAA Place ID 3692, DAA Place ID 20058, DAA Place ID 21393, DAA Place ID 21620, NorthLink 14-01 and NorthLink 14-02: • MRWA will seek formal, written advice from the DAA as to whether Ministerial consent is required under Section 18 of the *Aboriginal Heritage Act 1972* for the proposed works. • Consultation with SWALSC and other relevant Aboriginal people will take place. • An application will be made under Section 18 of the *Aboriginal Heritage Act 1972* to disturb ground on which these sites are located, where necessary.		Unchanged.
	AHM06 – Monitoring by archaeologists and/or appropriately trained members of the Noongar community will take place in areas that have high potential for sites with some archaeological integrity.		Unchanged.
	AHM07 – MRWA will continue to consult with SWALSC and other relevant Aboriginal people on the documentation and management of Aboriginal sites.		Unchanged.
European heritage			
Environmental outcomes	EHC01 –No disturbance to any European heritage site outside of the proposal footprint.		Unchanged.

Aspect	Proposed environmental outcomes and management measures	Previous environmental outcome/management measure (if different)	Status and reason for change (if any)
Proposed management measures	EHM01 – A site visit will be undertaken to enable external photographs to be taken of the Ellenbrook Estate Area, Muchela and Drainage/Irrigation Channel that may be subject to the Government Heritage Property Disposal Process (GHPDP). The site visit should enable an understanding of the nature and extent of original/historic fabric remaining on site.	A site visit will be undertaken to enable external photographs to be taken of the Ellenbrook Estate Area, Muchela and the Drainage/Irrigation Channel that may be subject to the GHPDP. The site visit should enable an understanding of the nature and extent of original/historic fabric remaining on-site.	Revised. Minor change to wording.
	EHM02 – Comply with the Government Heritage Property Disposal Process with regard to the Ellenbrook Estate Area, Muchela, the Drainage/Irrigation Channel and the Forestry Department's Divisional Headquarters' and Fire Lookout site.	Comply with the GHPDP through preparing a letter to the State Heritage Office advising of further clearance of the Ellenbrook Estate Area, Muchela, the Drainage/Irrigation Channel and the Forestry Department's Divisional Headquarters' and Fire Lookout site.	Revised. Minor change to wording.
	EHM03 –Inform the City of Swan, Shire of Chittering and City of Bayswater that the proposal is occurring in close proximity to, and may have an impact on, locally listed heritage places and confirm the requirement for any further planning approval (e.g., planning approval under the Shire of Chittering's Local Planning Scheme No. 6).	Inform the Shire of Chittering and advise that the proposal is occurring and will directly impact on two locally listed heritage places: Muchela and the Drainage/Irrigation Channel. Clarification is required on the status of these places on the Shire's Heritage List and what process is required to enable the further clearance of this site.	Revised. Minor change to wording. Rephrased to combine two management measures.

Aspect	Proposed environmental outcomes and management measures	Previous environmental outcome/management measure (if different)	Status and reason for change (if any)
	EHM04 – Site inductions will include information on European Heritage values identified within and adjacent to the development envelope (including maps) and will ensure that all construction personnel are aware of their location and the need for care during construction.	Clearly mark the European heritage values identified adjacent to the study area on future mapping for the proposal in order to ensure that all construction personnel are aware of their location and the need for care during construction or with any future boundary changes.	Revised. Minor change to wording. The commitment's wording has been made consistent with other language in the PER.
	(No new commitment.)	Inform the City of Swan, Shire of Chittering and City of Bayswater that the proposal is occurring and that it is occurring in close proximity to locally listed heritage places.	Deleted. This is addressed under management measure EHM03.
Amenity (Reserves)			
Environmental outcomes	ARC01 – Minimise impacts to Dick Perry Reserve and Whiteman Park.	(No previous outcome.)	New. Although mentioned in PER Chapter 15, Amenity (Reserves), this was not explicitly stated as a commitment.
Proposed management measures	ARM01 – Re-establishment of a barrier fence along the western side of the proposal to ensure access to the Dick Perry Reserve is controlled. Access gates for fire management activities will be established at regular intervals as agreed with DPAW.	Re-establishment of a barrier fence along the western side of the proposal to ensure access to the reserve is controlled. Gates for access for fire management activities will be established at regular intervals as agreed with DPAW.	Revised. Minor change to wording.
	ARM02 – Linking of walk trails with PSP at the interchanges on Gnangara Road and at Ellenbrook to ensure continuity of the trails within Dick Perry Reserve.	Linking of walk trails with PSP at the interchanges on Gnangara Road and at Ellenbrook to ensure continuity of the trails.	Revised. Minor change to wording.

Aspect	Proposed environmental outcomes and management measures	Previous environmental outcome/management measure (if different)	Status and reason for change (if any)
	ARM03 – To ensure safe exit in the event of fire, a vehicle underpass will be provided at the crossing of Baal Street in Whiteman Park. Additionally, an access road parallel to the alignment will be constructed in the vicinity to provide access for the Cullacabardee community.	To ensure safe exit in the event of fire, a vehicle underpass will be provided further south at the crossing of Baal Street. Additionally, an access road parallel to the alignment will be constructed in this vicinity to provide access for the Cullacabardee community.	Revised. Minor change to wording.
	ARM04 – MRWA will continue to work with DPAW in the preparation of an agreement, including detailed site plans and specifications, for construction of the length of the proposed highway through Dick Perry Reserve. The agreement may include removal and provision of an alternative water source for Black Cockatoos.	(No previous management measure.)	New. This commitment has been added following the submission from and further consultation with DPAW (see consolidated issue 34 in Section 8.4) and a submission from a member of the public (see consolidated issue 85 in Section 12.8.1).
	ARM05 – MRWA will retain and translocate heritage cork trees in Dick Perry Reserve.	(No previous management measure.)	New. This commitment has been added following a submission from and further consultation with DPAW (see consolidated issue 34 in Section 8.4).
	ARM06 – MRWA will provide additional planting in the vicinity of Cyrenian House for screening and amenity.	(No previous management measure.)	New. This commitment has been added following further consultation with Cyrenian House (see consolidated issue 3 and Table 12.1 in Section 12.5).

Aspect	Proposed environmental outcomes and management measures	Previous environmental outcome/management measure (if different)	Status and reason for change (if any)
Matters protected under the EPBC Act			
Environmental outcomes	(See FVC01, FVC02, FVC03, FVC11, TFC01 and HPC02.)	(No previous outcome.)	No environmental outcomes were explicitly stated in PER Chapter 16, Matters Protected Under the EPBC Act. However, environmental outcomes relating to MNES are addressed under management measures FVC01, FVC02, FVC03, FVC11, TFC01 and HPC02.
Proposed management measures (Threatened flora)	MPM01 – Establish, clearly demarcate and maintain a 50 m vegetated buffer around known locations of *Caladenia huegelii*.	A vegetated buffer will be maintained around the known locations of threatened flora [*Caladenia huegelii*]. The buffer will be a minimum of 50 m where possible.	Revised. Minor change to wording. Rephrased to combine two management measures. Management and monitoring is addressed under management measure FVM04.
	(See MPM01.)	Vegetation to be retained as a buffer for Threatened flora will be clearly demarcated.	Deleted. This is addressed under management measures FVM10 and MPM01.
	(See FVM03 and FVM04.)	Preparation and implementation of an EMP and monitoring program prior to construction to ensure impacts to Threatened flora and their vegetated buffers are being appropriately managed.	Deleted. This is addressed under management measures FVM03 and FVM04.

Aspect	Proposed environmental outcomes and management measures	Previous environmental outcome/management measure (if different)	Status and reason for change (if any)
	(No new commitment.)	If clearing occurs within the [Threatened flora] buffer, the impacted vegetation will be immediately rehabilitated and revegetated.	Deleted. Management measures are in place to prevent clearing within Threatened flora buffers.
	(No new commitment.)	Additional targeted surveys [for *Caladenia huegelii*] will be undertaken prior to vegetation clearing to clearly define population boundaries and to identify any additional populations within and adjacent to the proposal footprint, to inform the final design and construction.	Deleted. Additional targeted surveys have now been completed (see Chapter 3, Spring Ecological Surveys).
	(No new commitment.)	If populations of Grand Spider Orchid are identified as occurring within the proposal footprint, the merits of translocation will be researched. If feasible, the plants will be translocated to adjacent populations.	Deleted. Additional targeted surveys have now been completed- no population were identified within the proposal footprint (see Chapter 3, Spring Ecological Surveys).
	(No new commitment.)	Habitat surveys [for *Caladenia huegelii*] will occur in spring 2015 to further define the extent of critical habitat within the proposal footprint.	Deleted. Additional targeted surveys have now been completed (see Chapter 3, Spring Ecological Surveys).
	MPM02 – Establish, clearly demarcate and maintain a 10 m vegetated buffer around known locations of *Grevillea curviloba* subsp. *incurva*.	A vegetated buffer will be maintained around the known locations of [*Grevillea curviloba* subsp. *incurva*]. The buffer will be a minimum of 10 m.	Revised. Minor change to wording.

Aspect	Proposed environmental outcomes and management measures	Previous environmental outcome/management measure (if different)	Status and reason for change (if any)
	MPM03 – Avoid direct impact to and maintain the continuity of *Grevillea curviloba* subsp. *incurva* habitat in the Brand Highway road reserve by using a bridge structure.	Vegetation located along the Brand Highway road reserve will be maintained during final design of the proposal with the aid of a bridge structure. The construction of a bridge will ensure continuity in the habitat along Brand Highway.	Revised. Minor change to wording.
	MPM04 – Establish, clearly demarcate and maintain a 10 m buffer in existing vegetation around known locations of *Darwinia foetida*	(No previous management measure.)	New. *Darwinia foetida* has been added following its recent discovery in the proposal footprint (see Section 3.5).
Proposed management measures	(See FVM02 and FVM05.)	Disturbance will be restricted to the proposal footprint.	Deleted. This is addressed under management measures FVM02 and FVM05.

Aspect	Proposed environmental outcomes and management measures	Previous environmental outcome/management measure (if different)	Status and reason for change (if any)
(TECs)	(See FVC01 and FVC02.)	The Commonwealth TEC Claypans of the SCP will be avoided. The Commonwealth TEC Mound Springs SCP will be avoided. The Commonwealth TEC Muchea Limestone on the SCP will be avoided.	Deleted. TEC Muchea Limestone on the SCP does not occur within the development envelope and is not at risk of being directly impacted by the proposal. Claypans of the SCP is addressed under environmental outcomes FVO01. Mounds Springs SCP is addressed under environmental outcomes FVO02.
	(See HPM09 and HPM10.)	An investigation into dewatering and water abstraction requirements will be undertaken to understand the extent and scale of impacts on the groundwater and the TEC.	Deleted. This is addressed under management measures HPM09 and HPM10.
	(See HPM10.)	Groundwater abstraction will not adversely impact the groundwater levels that influence the TEC.	Deleted. This is addressed under management measure HPM10.
	(See FVM03 and FVM04.)	Preparation and implementation of an EMP and monitoring program prior to construction to ensure there are no indirect impacts to the functionality of the TEC.	Deleted. This is addressed under management measures FVM03 and FVM04.

Aspect	Proposed environmental outcomes and management measures	Previous environmental outcome/management measure (if different)	Status and reason for change (if any)
Proposed management measures (Threatened and migratory fauna species)	(See FVM02 and FVM05.)	Avoidance of vegetated areas in design (49.6 ha) and keep clearing to a minimum during construction.	Deleted. Delineation of clearing boundary and areas to be retained are addressed under management measures FVM02 and FVM05.
	(See FVM02 and FVM05.)	Reduce design footprint to minimise impact on suitable breeding trees (68 trees avoided) and foraging habitat.	Deleted. Delineation of clearing boundary and areas to be retained are addressed under management measures FVM02 and FVM05.
	(See Offset Proposal 1.)	Offsetting of lost [Black Cockatoo] habitat.	Deleted. This is addressed by Offset Proposal 1.
	(See TFM04.)	Landscaping design to avoid foraging species planted on road verge.	Deleted. This is addressed under management measure TFM04.
	(See FVM03.)	Implementation of management measures in the EMP.	Deleted. This is addressed under management measure FVM03.
Proposed management measures	(See FVM03 and FVM04.)	An EMP will be prepared and implemented, including management and monitoring of intact native vegetation.	Deleted. This is addressed under management measures FVM03 and FVM04.

Aspect	Proposed environmental outcomes and management measures	Previous environmental outcome/management measure (if different)	Status and reason for change (if any)
(Commonwealth land)	(See FVM02 and FVM05.)	Disturbance will be restricted to the proposal footprint.	Deleted. Delineation of clearing boundary and areas to be retained are addressed under management measures FVM02 and FVM05.
	(See FVM02 and FVM05.)	Finalisation of design will endeavour to avoid and minimise impacts to CCW and REWs within the proposal footprint. Where any areas of CCW and REW can be retained these will be identified within a detailed infrastructure plan prior to construction.	Deleted. This is addressed under management measure FVM05.
	(See HPM01.)	A wetland management and monitoring plan will be prepared and implemented.	Deleted. This is addressed under management measure HPM01.
	(See FVM02.)	During construction use boundary fencing or flagging will be used.	Deleted. This is addressed under management measure FVM02.
	(See Offset Proposal 1)	Offsetting of lost [Black Cockatoo] habitat.	Deleted. This is addressed by Offset Proposal 1.

Aspect	Proposed environmental outcomes and management measures	Previous environmental outcome/management measure (if different)	Status and reason for change (if any)
Offsets			
Offset Proposal 1	MRWA will fund the Acquisition of 673.5 ha of land at Lot M2091 (Plan 6457) Ioppolo Road, Chittering to be vested with the Conservation Commission for conservation purposes in perpetuity, and subsequent management by DPAW to offset the loss of Black Cockatoo habitat.	MRWA will vest 673.5 ha of land with the Conservation Commission, and subsequent management by the DPAW for conservation purposes.	Revised. The proposal's offset strategy has been amended – see Chapter 6, Environmental Offsets.
Offset Proposal 2	MRWA will prepare a restoration offset plan that will include the acquisition and covenanting of several properties to be managed for conservation, including restoration and management funding for a period of 7 years (or until restoration completion criteria are met), to offset the loss of CCWs, Black Cockatoo habitat and under-represented vegetation.	MRWA will fund the acquisition or covenanting of a property or properties to be managed for conservation, or for improved management or rehabilitation to offset the loss of CCW. The properties will contain at least 32 ha of CCW.	Revised. The proposal's offset strategy has been amended – see Chapter 6, Environmental Offsets.
Offset Proposal 3	MRWA will provide funding for a period of up to 10 years for the ongoing management of potential critical *Caladenia huegelii* habitat within existing reserves 46919 and 46875, Bush Forever site 300 and Whiteman Park.	MRWA will undertake further surveys of the site that potentially represents TEC SCP02 Southern Wet Shrublands. These surveys will be conducted in spring 2015. If the TEC is confirmed, MRWA will commit to acquire or covenant the location of one ha of land representative of this TEC or a TEC of similar of greater threat	Revised. The proposal's offset strategy has been amended – see Chapter 6, Environmental Offsets.

Aspect	Proposed environmental outcomes and management measures	Previous environmental outcome/management measure (if different)	Status and reason for change (if any)
Offset Proposal 4	MRWA will fund the acquisition or covenanting of a property or properties to be managed for conservation, including management funding for a period of 7 years to offset the loss of SCP20a.	MRWA will fund the acquisition or covenanting of a property or properties to be managed for conservation or for improved management or rehabilitation to offset the loss of Forest Red-tailed Black Cockatoo habitat in addition to the offset area proposed in Offset Proposal 1. Offset Proposal 1 does not contain sufficient Forest Red-tailed Black Cockatoo habitat to offset the impacts of the proposal and an additional 60 ha of habitat in similar condition to Offset Proposal 1 is required.	Revised. The proposal's offset strategy has been amended – see Chapter 6, Environmental Offsets.

This page is intentionally blank.

14 GLOSSARY

14.1 Abbreviations

Term	Definition
AH Act	*Aboriginal Heritage Act 1972*
ASS	acid sulfate soils
CCTV	closed-circuit television
CCW	Conservation Category Wetland
CEMP	Construction Environmental Management Plan
CNVMP	Construction Noise and Vibration Management Plan
CR	Critically Endangered
CS Act	*Contaminated Sites Act 2003*
DAA	Department of Aboriginal Affairs
DBNGP	Dampier to Bunbury Natural Gas Pipeline
DEC	Department of Environment and Conservation
DER	Department of Environment Regulation
DFES	Department of Fire and Emergency Services
DOD	Department of Defence
DOL	Department of Lands
DOP	Department of Planning
DOT	Department of Transport
DOTE	Department of the Environment
DOW	Department of Water
DPAW	Department of Parks and Wildlife
DRF	Declared Rare Flora
EAG	Environmental Assessment Guideline
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EN	Endangered
EP Act	*Environmental Protection Act 1986*
EPA	Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPP Lakes	*Environmental Protection (Swan Coastal Plain Lakes) Policy 1992* Note: this policy was revoked 20 November 2015.

Term	Definition
ESD	Environmental Scoping Document
EWR	ecological water requirements
FCT	floristic community type
FVMMP	Flora and Vegetation Management and Monitoring Plan
GDEs	groundwater dependent ecosystems
GHPDP	Government Heritage Property Disposal Process
GNH	Great Northern Highway
GSS	Gnangara Sustainability Strategy
IBRA	Interim Biogeographic Regionalisation of Australia
ISCA	Infrastructure Sustainability Council of Australia
M	Migratory
MNES	Matters of National Environmental Significance
MRS	Metropolitan Region Scheme
MRWA	Main Roads Western Australia
MUW	Multiple Use Wetland
OEPA	Office of the Environmental Protection Authority
P1	Priority 1
P2	Priority 2
P3	Priority 3
P4	Priority 4
P5	Priority 5
PDNH	Perth–Darwin National Highway
PEC	Priority Ecological Community
PER	Public Environmental Review
PPR	Perth-Peel Region
PSP	Principal Shared Path
RAP	Recycled Asphalt Planings
REW	Resource Enhancement Wetland
RIWI Act	*Rights in Water and Irrigation Act 1914*
ROM	Regional Operations Model
SAPPR	Strategic Assessment of the Perth and Peel Regions
SCP	Swan Coastal Plain
SES	State Emergency Service
SRE	short-range endemic

Term	Definition
SWA02	Perth subregion 2 in IBRA
SWALSC	South-West Aboriginal Land and Sea Council
T	Threatened
TEC	Threatened Ecological Community
TSS	Total Suspeneded Soilds
UFI	unique feature identifier
UWPCA	Underground Water Pollution Control Area
VU	Vulnerable
WA	Western Australia
WAH	Western Australian Herbarium
WAPC	Western Australia Planning Commission
WC Act	*Wildlife Conservation Act 1950*
WDMMP	Wetland and Drainage Managament and Monitoring Plan
WHPZ	Wellhead Protection Zone
WONS	weeds of national significance
WPP	weed prioritisation process
WQPN	Water Quality Protection Notes

14.2 Units and Symbols

°	degrees
%	percentage
°C	degrees Celsius
dB	decibel
dBA	A-weighted decibel
ha	hectare
km	kilometre
kg	kilogram
L_{Aeq}	average noise energy
$L_{A10,18\ hour}$	the average of the hourly L_{a10} (noise level exceeded for 10% of the measuring period) levels between 6.00 a.m. and midnight
$L_{Aeq\ (Day)}$	the average of the hourly L_{Aeq} levels between 6.00 a.m. and 10.00 p.m.
$L_{Aeq\ (Night)}$	the average of the hourly L_{Aeq} levels between 10.00 p.m. and 6.00 a.m.
m	metre
m^2	square metre

mm millimetre

14.3 Definitions

A

Amenity *n.* features, facilities, or services of a house, estate, district, etc., which make for a comfortable and pleasant life.

B

Bush Forever sites *n.* a plan designed to identify, protect and manage regionally significant bushland in metropolitan Perth.

C

Carriageway *n.* each of the two sides of a dual carriageway or motorway, each of which usually have two or more lanes.

Controlled action *adj.* a proposed action that is likely to have a significant impact on: a matter of national environmental significance; the environment of Commonwealth land (even if taken outside Commonwealth land); or the environment anywhere in the world (if the action is undertaken by the Commonwealth).

Congestion *adj.* condition on road networks that occurs as use increases, and is characterized by slower speeds, longer trip times, and increased vehicular queueing. The most common example is the physical use of roads by vehicles.

Constrained area *n*. an area where there is an expectation that development will be able to proceed, this may include urban, urban deferred or industrial zoned land or land with existing development approvals.

D

Dampland *n.* a type of vegetation characterised by occasional *Eucalyptus rudis* trees over *Melaleuca preissiana* and/or *Melaleuca rhaphiophylla* low woodland over occasional heath scrub dominated by *Pericalymma spp., Astartea spp*. and *Melaleuca spp*. over sedges and rushes. This habitat type is an area where moisture collects and during the winter months becomes seasonally waterlogged.

Dieback *n.* a condition of plants observed to start at the outer leaf tips causing gradual yellowing, loss of leaves and progressive lifelessness; may be caused by a variety of agents including salinity, drought, insect damage or plant pathogens such as the fungus *Phytophthora cinnamomi*.

Development envelope *n.* the area for which MRWA is seeking approval to implement the proposal within.

E

Edge effect *n.* refers to the changes in population or community structures that occur at the boundary of two habitats.

Ephemeral creek *adj*. a creek or portion of a creek which flows briefly in direct response to precipitation in the immediate vicinity and whose channel is at all times above the ground water reservoir.

Environmental offset *n.* is an offsite action or actions to address significant residual environmental impacts of a development or activity.

F

Flyovers *n.* a high-level overpass, built above main overpass lanes, or a bridge built over what had been an at-grade separation.

Foraging *n.* the seeking or obtaining of food.

G

Grade separation *n.* is the method of aligning a junction of two or more surface transport axes at different heights (grades) so that they will not disrupt the traffic flow on other transit routes when they cross each other.

H

Habitat fragmentation *n.* is the process by which habitat loss results in the division of large, continuous habitats into smaller, more isolated remnants.

P

Precautionary principle *n*. an ethical and political principle, applying particularly in the environmental context, which states that if there is the risk of serious or irreversible harm occurring to people or to the environment, lack of full scientific certainty about the existence of the risk should not be used as a reason for failing to take or for postponing measures to prevent it.

Predation *n.* the killing of an individual of another species as a habitual source of food.

Proposal footprint *n.* the area required to be disturbed based on the proposal's current design.

R

Rehabilitation *adj.* is the repair of ecosystem processes and includes the management of weeds, disease or feral animals.

S

Short-range endemic *n.* species of animal (predominantly Invertebrates) that have a restricted distribution, less than 10,000 km^2.

Study area *n.* is the survey area identified in the initial design footprint and will differ depending on the specialist study.

T

Topographical *adj*. relating to the arrangement or accurate representation of the physical features of an area.

V

Vegetation association *n.* a concept that covers two or more plant communities with similar structure and dominant species. May vary significantly in associated species but all stands referred to it will have some visual similarity.

Vegetation complex *n.* a concept that covers a range of structural types that occur in a related pattern with borders defined by major geomorphological units with some subdivision on floristics between southern and northern parts of the geomorphological units.

W

Wetland *n.* an area in which the soil is frequently or permanently saturated with or under water, as a swamp, marsh.

This page is intentionally blank.

15 REFERENCES

Publications

360 Environmental. 2014. Swan Valley Bypass, Perth–Darwin National Highway: Level 2 Flora and Vegetation Survey. February. Draft report prepared for Main Roads Western Australia by 360 Environmental Pty Ltd.

Bamford. 2011. Roads and Wildlife. A Review of Purpose-Built Fauna Underpasses. July. Report prepared by M.J. and A.J. Bamford Consulting Ecologist for City of Armadale.

Bissonette, J and Hammer, M., 2000. Effectiveness of Earthen Return Ramps in Reducing Big Game Highway Mortality in Utah. November. USGS Utah Cooperative Fish and Wildlife Research Unit, Department of Fisheries and Wildlife, College of Natural Resources, Utah State University, Utah.

Coffey. 2015a. Public Environmental Review: Perth-Darwin National Highway (Swan Valley Section). Volume 1: Main text. September. Report prepared for NorthLink WA by Coffey Environments Pty Ltd, Burswood, Western Australia.

Coffey. 2015b. Level 2 Flora and Vegetation Assessment: Perth–Darwin National Highway. May. Prepared for NorthLink WA by Coffey Environments Australia Pty Ltd, Burswood, Western Australia.

Coffey. 2015c. NorthLink WA: Perth-Darwin National Highway – Preliminary Black Cockatoo Offset Consideration. Memorandum. 13 July 2015.

Coffey. 2015d. Flora, Vegetation and Fauna Assessment. Lot M2091 Ioppolo Road, Chittering. Perth–Darwin National Highway. April. Report prepared for NorthLink WA by Coffey Environments Australia Pty Ltd, Burswood, Western Australia.

Coffey. 2015e. Perth-Darwin National Highway: Targeted Forest Red-tailed Black Cockatoo Survey of the Ioppolo Road Offset Site. Memorandum. 31 August 2015.

DEC. 2009. Grand Spider Orchid (Caladenia huegelii) Recovery Plan. Department of Environment and Conservation, Kensington, Western Australia.

DOP. 2015. Bush Forever dataset. Metropolitan_Region_Scheme_Bush_Forever_Areas_DOP_20151203. Current 3 December 2015. Department of Planning, Perth, Western Australia.

DOTE. 2004. Water Quality Protection Note No. 25. Land use compatibility in Public Drinking Water Source Areas. July. Prepared by the Department of the Environment.

DOTE. 2013. Matters of National Environmental Significance. Significant Impact guidelines 1.1. Department of the Environment, Canberra, Australian Capital Territory.

DOTE. 2016. *Darwinia foetida* in Species Profile and Threats Database. A WWW publication accessed on 25 February 2016 at http://www.environment.gov.au. Department of the Environment, Canberra, Australian Capital Territory.

DOW. 2004. Stormwater Management Manual. February. Department of Water, Perth, Western Australia.

DOW. 2009. Decision process for stormwater management in WA. August. Department of Water, Perth, Western Australia.

DOW. 2011. Perth Shallow Groundwater Systems Investigation. Lexia Wetlands. Hydrogeological record series. May. Department of Water, Perth, Western Australia.

DPAW. 2013a. A methodology for the evaluation of specific wetland types on the Swan Coastal Plain, Western Australia. August. Draft report prepared by Department of Parks and Wildlife, Bentley, Western Australia.

DPAW. 2013b. Weed Prioritisation Process for DPAW (formerly DEC) - "An integrated approach to Weed Management on DPAW-managed lands in WA". November. Department of Parks and Wildlife, Western Australia.

DPAW. 2015. Corporate Guideline No. 14: Environmental Offsets – Proponent Land Management Contributions. August. Department of Parks and Wildlife, Western Australia.

DSEWPAC. 2012. EPBC Act referral guidelines for three threatened black cockatoo species. Department of Sustainability, Environment, Water, Population and Communities.

EPA. 2004a. Guidance for the Assessment of Environmental Factors – Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia No. 56. June. Environmental Protection Authority, Western Australia.

EPA. 2004b. Guidance for the Assessment of Environmental Factors – Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia No. 51. June. Environmental Protection Authority, Western Australia.

EPA. 2006. Guidance for the Assessment of Environmental factors – Level of Assessment for Proposal Affecting Natural Areas within the System 6 Region and Swan Coastal Plain Portion of the System 1 Region No. 10. June. Environmental Protection Authority, Perth, Western Australia.

EPA. 2008. Environmental Guidance for Planning and Development. Guidance Statement No. 33. May. Environmental Protection Authority, Western Australia.

EPA. 2013. Environmental Assessment Guideline for Recommending environmental conditions. September. EAG 11. Environmental Protection Authority, Western Australia.

EPA. 2014. Environmental Assessment Guideline for Consideration of environmental impacts from noise. EAG 13. September. Environmental Protection Authority, Western Australia.

EPA. 2015a. Perth and Peel @ 3.5 Million. Environmental impacts, risks and remedies. July. Environmental Protection Authority, Western Australia.

EPA. 2015b. Environmental Assessment Guideline for Environmental principles, factors and objectives. EAG 8. January. Environmental Protection Authority, Western Australia.

Finn, H., Barrett, G., Groom, C., Blythmann, M. and Williams, M. 2014. The 2014 Great Cocky Count: a community-based survey for Carnaby's Black Cockatoos (*Calyptorhynchus latirostris*) and Forest Red-tailed Black Cockatoos (*Calyptorhynchus banksii naso*). June. Report prepared by Birdlife Australia and Department of Parks and Wildlife, Western Australia.

Froend, R., Loomes, R., Horwitz, P., Bertuch, M., Storey, A. and Bamford, M. 2004a. Study of Ecological Water Requirements on the Gnangara and Jandakot Mounds under Section 46 of the Environmental Protection Act. Task 2: Determination of Ecological Water Requirements. Prepared for Waters and Rivers Commission by Centre for Ecosystem Management, Edith Cowan University, Joondalup, Western Australia.

Froend, R., Loomes, R., Horwitz, P., Rogan, R., Lavery, P., How, J. Storey, A., Bamford, M. and Metcalf, B. 2004b. Study of Ecological Water Requirements on the Gnangara and Jandakot Mounds under Section 46 of the Environmental Protection Act. Task 1: Identification and Re-evaluation of Ecological Values. September. Prepared for Waters and Rivers Commission by Centre for Ecosystem Management, Edith Cowan University, Joondalup, Western Australia.

GHD. 2013a. Mitchell Freeway extension. Flora and fauna assessment report. November. Prepared for Main Roads Western Australia by GHD Pty Ltd.

GHD. 2013b. Perth–Darwin National Highway – Tonkin Highway Link Alignment Definition Study: Environmental Impact Assessment and Biological Survey. October. Report prepared for Main Roads Western Australia, by GHD Pty Ltd.

Gibson, N., Keighery, B. J., Keighery, G. J., Burbidge, A. H. and Lyons, M. N. 1994. A Floristic Survey of the southern Swan Coastal Plain. Unpublished report for the Australian Heritage Commission prepared by Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.).

Golder. 2015a. Design Groundwater Level for Central Section of NorthLink WA Road Alignment. NorthLink WA Perth–Darwin National Highway. April. Report prepared for NorthLink WA by Golder Associates.

Golder. 2015b. Design Groundwater Level for Northern Section of NorthLink WA Road Alignment. NorthLink WA Perth–Darwin National Highway. August. Report prepared for NorthLink WA by Golder Associates.

Golder. 2015c. Design Groundwater Level for Southern Section of NorthLink WA Road Alignment. NorthLink WA Perth–Darwin National Highway. May. Report prepared for NorthLink WA by Golder Associates.

Government of Western Australia. 2000. State Planning Policy 1: State Planning Framework Policy. May. Prepared under Section 5AA of the Town Planning and Development Act 1928 by Western Australia Planning Commission, Perth, Western Australia.

Government of Western Australia. 2009. State Planning Policy 5.4: Road and Rail Transport Noise and Freight Considerations in Land Use Planning. September. Prepared under Section 26 of the Planning and Development Act 2005 by Western Australia Planning Commission, Perth, Western Australia.

Government of Western Australia. 2011. WA Environmental Offsets Policy. September. Environmental Protection Authority, Western Australia.

Government of Australia. 2012. *Environment Protection and Biodiversity Conservation Act 1999* Environmental Offsets Policy. October. Department of Sustainability, Environment, Water, Population and Communities, Canberra, Australian Capital Territory."

Government of Western Australia. 2014. WA Environmental Offsets Guidelines. August. Environmental Protection Authority, Western Australia.

Griffin, E. A. and Trudgen, M. E. 2015. Analysis of floristic data from Ioppolo Road and Hepburn Avenue to assign sites to floristic community types. December. Report prepared for Coffey Environments by E. A. Griffin & Associates with M. E. Trudgen & Associates.

Hill, A. L., Semeniuk, C. A., Semeniuk, V. and Del Marco, A. 1996. Wetlands of the Swan Coastal Plain. Vol. 2b. Wetland Mapping, Classification and Evaluation, Wetland Atlas. Water and Rivers Commission and Department of Environment Protection, Western Australia.

Johnstone, R. E., and Storr, G. M. 1998. Handbook of Western Australian Birds. Vol. 1 - Non-Passerines (Emu to Dollarbird). Western Australian Museum, Perth, Western Australia.

Keighery, B. J. Keighery, G. J. Longman, V. M. and Clarke, K. A. 2012. Native and Weed Flora of the Southern Swan Coastal Plain: 2005 Dataset. Department of Environment and Conservation, Kensington, Western Australia.

MRWA. 2004. Environmental Policy Statement. June. Prepared by Main Roads Western Australia.

MRWA. 2010. Design of Fauna Underpasses. A WWW publication accessed on 23 January 2015 at https://www.mainroads.wa.gov.au/BuildingRoads/StandardsTechnical/RoadandTrafficEngineering/RoadsideItems/Pages/Design_of_Fauna_Underpasses.aspx. Main Roads Western Australia, East Perth, Western Australia.

MWH. 2016. Muchea Bell (*Darwinia foetida*) population located adjacent to the Perth-Darwin National Highway. February. Report prepared by MWH Australia Pty Ltd, Subiaco, Western Australia.

QDMR. 2000. Fauna Sensitive Road Design. Queensland Department of Main Roads, Planning, Design and Environment Division, Brisbane, Queensland.

Phoenix Environmental. 2015. Flora and fauna assessment for Muchea North and Chittering study area. Great Northern Highway, Muchea to Wubin Upgrade Stage 2 Project. December. Final report prepared for Muchea to Wubin Integrated Project Team (Main Roads WA, Jacobs and Arup) by Phoenix Environmental Sciences Pty Ltd, Balcatta, Western Australia.

Roe 7 Alliance. 2004. *Caladenia huegelii* Conservation and Management Plan. Rev C. May. Prepared by the Roe 7 Alliance.

South Metro Connect. 2011. Roe Highway Extension: Public Environmental Review. Prepared for Main Roads Western Australia.

The University of Western Australia. 2013. The Factors Affecting the Use of Fauna Underpasses by Quenda and Bobtail Lizards. October. Report prepared for Main Roads Western Australia.

Van Etten, E. J. 2014. Assessment of edge effects and other indirect impacts of the proposed Keane Road Strategic Link. March. Report prepared for Enviroworks and City of Armadale.

VicRoads. 2010. Interpretation and applicable of VicRoads Traffic Noise Reduction Policy 2005. VicRoads, Victoria. July 2010.

WAPC. 2005. Guideline for the Determination of Wetland Buffer Requirements. December. Prepared for the Department for Planning and Infrastructure. Western Australian Planning Commission, Perth, Western Australia.

WAPC. 2014. Implementation Guidelines for State Planning Policy 5.4 - Road and Rail Transport Noise and Freight Considerations in Land Use Planning. Published by Department of Planning, Western Australia.

WAPC. 2015. May 2015 Draft Perth and Peel@3.5million. May. Western Australian Planning Commission, Perth, Western Australia.

Woodman Environmental. 2015a. Perth-Darwin National Highway (Swan Valley Section) - Supplementary Biological Studies 2015: Assessment and Refinement of Potential Critical Habitat for *Caladenia huegelii* (T-DRF) within the Development Envelope. November. Report prepared for Coffey Environments Pty Ltd on behalf of Main Roads Western Australia by Woodman Environmental Consulting Pty Ltd.

Woodman Environmental. 2015b. Perth-Darwin National Highway (Swan Valley Section) - Supplementary Bioloigcal Studies 2015: Spring surveys for *Meeboldina decipiens* subsp. *decipiens* (P3) and *Millotia tenuifolia* var. *laevis (*P2). November. Report prepared for Coffey Environments Pty Ltd on behalf of Main Roads Western Australia by Woodman Environmental Consulting Pty Ltd.

Woodman Environmental. 2015c. Perth-Darwin National Highway (Swan Valley Section) - Supplementary Biological Studies 2015: Spring Surveys and Analysis to Investigate SCP02 Presence. November. Report prepared for Coffey Environments Pty Ltd on behalf of Main Roads Western Australia by Woodman Environmental Consulting Pty Ltd.

Woodman Environmental. 2015d. Perth-Darwin National Highway (Swan Valley Section) - Supplementary Biological Studies 2015: Assessment of the Presence of the TEC SCP20a at Ioppolo Rd, Chittering. November. Report prepared for Coffey Environments Pty Ltd on behalf of Main Roads Western Australia by Woodman Environmental Consulting Pty Ltd.

Personal Communications

Chambers, B. Research Fellow, School of Animal Biology, University of Western Australia. Telephone conversation. Late 2014.

Errington, A. Land Tenure Project Officer, Department of Parks and Wildlife, Perth, Western Australia. Email. 25 August 2015.

This page is intentionally blank.