



mainroads
WESTERN AUSTRALIA

Roe Highway Extension

Wetland Restoration Plan



Prepared for
Main Roads Western Australia
by Strategen

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Table of contents

1. Introduction	1
1.1 Background	1
1.2 Purpose and scope of document	3
1.2.1 Statement 1008	3
1.2.2 Scope	3
1.3 Relationship to management plans required by Statement 1008	3
2. Environmental setting	5
2.1 North Lake characteristics	5
2.2 Horse Paddock Swamp characteristics	5
2.3 Climatic influence on water level in North Lake and Horse Paddock Swamp	5
3. Wetland restoration plan	7
3.1 Rehabilitation objectives	7
3.2 Performance targets and indicators	7
4. Rehabilitation activities	8
4.1 Management actions	8
5. Monitoring	12
5.1 Monitoring plots	12
5.1.1 Horse Paddock Swamp treatment areas	12
5.1.2 North Lake treatment area	12
6. Contingency actions	14
7. Completion criteria	15
8. Responsibilities	16
8.1 Funding	16
9. Review and reporting	17
9.1 Review	17
9.2 Reporting	17
10. Auditing	18
11. References	19

List of tables

Table 1: Relevant condition requirements of Statement 1008	3
Table 2: Targets and indicators for rehabilitation objectives for the Project	7
Table 3: Rehabilitation treatments areas	8
Table 4: North Lake wetland treatment area	9
Table 5: Horse Paddock Swamp wetland treatment areas	10
Table 6: Monitoring actions	13
Table 7: Contingency actions for Horse Paddock Swamp treatment areas	14
Table 8: Contingency actions for North Lake treatment area	14
Table 9: Completion criteria	15
Table 10: Responsibilities	16

List of figures

Figure 1: Project development envelope	2
Figure 2: North Lake and Horse Paddock Swamp rehabilitation areas	4

List of appendices

Appendix 1 North Lake outline schedule identifying indicative timing for key actions
Appendix 2 Horse Paddock Swamp outline schedule identifying indicative timing for key actions
Appendix 3 Indicative species list

1. Introduction

Main Roads Western Australia (Main Roads) proposes to construct the Roe Highway Extension (the Project, Figure 1) as part of the Perth Freight Link Project.

The Project involves the construction of approximately 5 km of highway, extending Roe Highway from its current terminus at the Kwinana Freeway in Jandakot to Stock Road in Coolbellup (the development envelope). The proposed extension to Roe Highway is largely located within a primary regional road reserve which adjoins Beeliar Regional Park (the Park).

This document presents the Wetland Restoration Plan for North Lake and Horse Paddock Swamp, to offset the potential effects of clearing within Roe Swamp and its buffer, and the loss of native vegetation throughout the development envelope.

1.1 Background

The Project is located approximately 14 km south of Perth within the Swan Coastal Plain Bioregion. The Project is largely contained within the City of Cockburn, however, parts of the design extend northward in to the City of Melville along Murdoch Drive and Kwinana Freeway. Generally, the proposed Project is oriented east-west largely, within a road reserve that was set aside in the Metropolitan Region Scheme (MRS) in 1963. The alignment is between North and Bibra Lakes, which are part of the Eastern Chain of the Beeliar Wetlands.

The Project will consist of a dual carriageway with two lanes in each direction, separated by a concrete barrier in place of a median strip. The preferred design was selected following an extensive options analysis and consultative process. Once selected, the preferred design was optimised to avoid and minimise environmental impacts to the maximum extent possible.

In 2009 the Project was referred to the Environmental Protection Authority (EPA) under the Environmental Protection Act 1986 (EP Act), and to the then Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC), now the Department of the Environment (DotE), under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). The Project was set a level of assessment of Public Environmental Review (PER) and the bilateral agreement between the State and Commonwealth governments was enacted. The PER was released on the 20 June 2011 for a 12 week public review period.

The Project was approved by the Minister for Environment in July 2015, with the release of Ministerial Statement 1008 (Statement 1008) establishing conditions for the Project implementation.

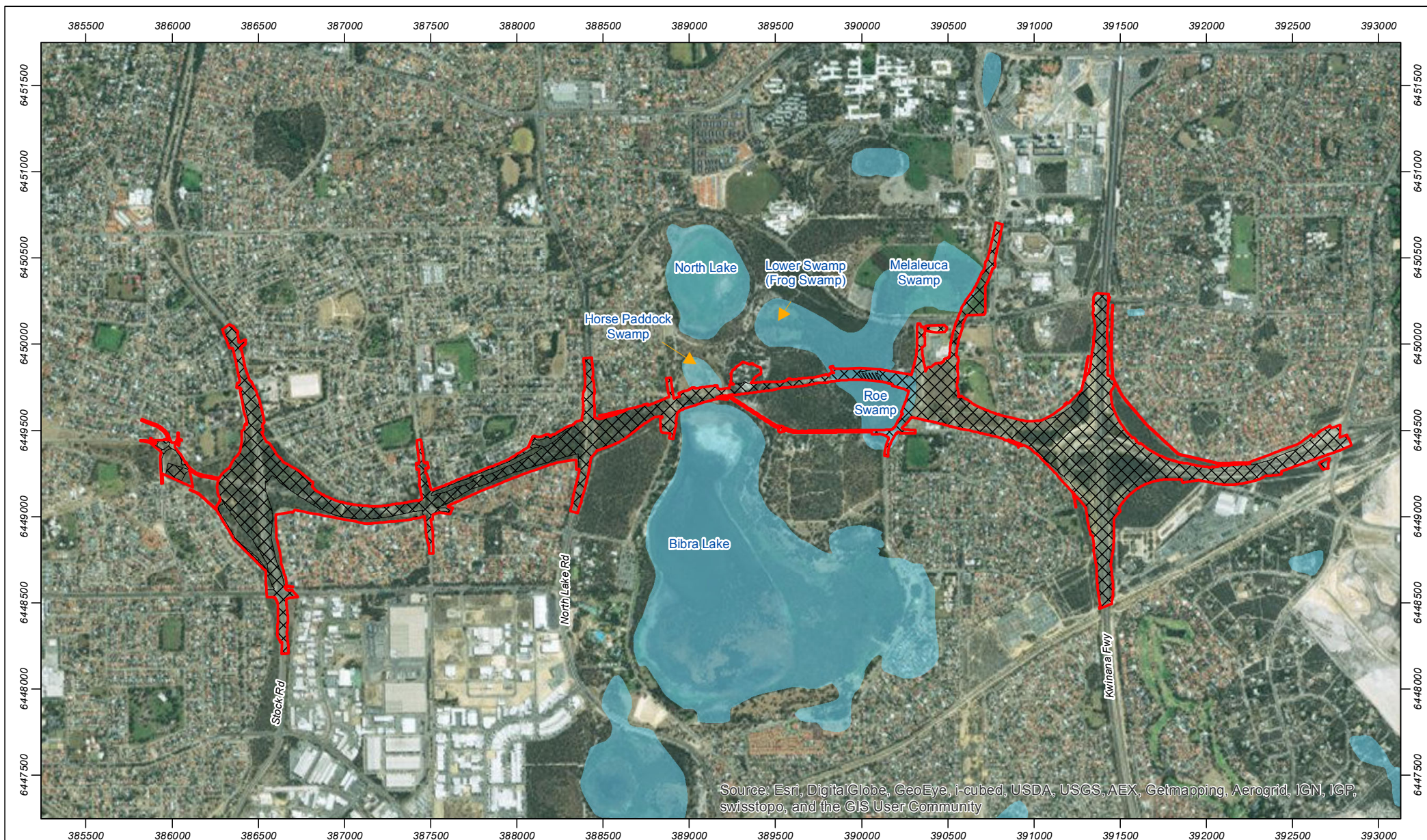


Figure 1: Project development envelope

Scale 1:30,000 at A4
0 200 400 600 800 1,000 Meters

Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 19/11/2015

Author: jcrute

Source: Aerial image: ESRI online approx. 2010. Wetlands: DPAW 2014. Development envelope: Client 2015

Path: Q:\Consult\2015\MRO\MRO15099\ArcMap_documents\MRO15099_09\R001\MRO15099_09_R001_RevB_F001.mxd



Legend

- Project development envelope
- Proposed construction footprint
- Wetlands

1.2 Purpose and scope of document

1.2.1 Statement 1008

This Wetland Restoration Plan (WRP) has been prepared on behalf of Main Roads to address the requirements under Conditions 12-6 to 12-9 of Statement 1008 dated 2 July 2015, as outlined in Table 1.

Table 1: Relevant condition requirements of Statement 1008

Condition	Requirement	Section
12-6	Prior to commencement of construction, or as otherwise agreed by the CEO, the proponent shall prepare a Wetland Restoration Plan to the requirements of the CEO.	This Plan
12-7	The Wetland Restoration Plan identified in condition 12-6, shall include details on:	N/A
	1. activities to be undertaken including the final area to be rehabilitated and restored;	Section 4
	2. timeframes for undertaking management activities;	Table 4 and Table 5
	3. roles and responsibilities;	Section 8
	4. funding arrangements for implementation of the plan;	Section 8.1
	5. monitoring and reporting requirements; and	Section 5 and 9
	6. completion criteria.	Section 7
12-8	The Wetland Restoration Plan identified in condition 12-6 shall apply to the areas delineated in Figure 3.	Figure 2
12-9	Prior to the commencement of construction, or as otherwise agreed by the CEO, the proponent shall implement the Wetland Restoration Plan until the CEO advises implementation may cease.	Section 10

1.2.2 Scope

The WRP applies to the rehabilitation areas shown in Figure 2, including:

- weed control over the wetland fringe at North Lake
- restorative planting over the degraded wetland areas of Horse Paddock Swamp.

In developing the WRP consideration has been given to the key commitments and management actions for wetland rehabilitation outlined in the following documents as related to the conditions:

- Roe Highway Extension Public Environmental Review (Southmetro Connect 2011)
- Report and Recommendations of the Environmental Protection Authority, Roe Highway Extension, Main Roads Western Australia, Report 1489 (EPA 2013)
- Roe Highway Extension Response to Public Submissions (Southmetro Connect 2013)
- Beeliar Regional Park Final Management Plan (CALM 2006).

1.3 Relationship to management plans required by Statement 1008

In addition to the preparation of the WRP, Statement 1008 also requires the preparation of:

- a Baseline Wetland Condition Survey and Baseline Basin Monitoring (BWCS, Condition 9-2 and 8-3), including monitoring of the pre-development surface and groundwater conditions within and adjacent to North Lake, Bibra Lake, Horse Paddock Swamp and Roe Swamp, and baseline monitoring adjacent to drainage basins
- a Wetlands Monitoring and Management Plan (WMMP, Condition 9-4) to undertake ongoing monitoring of surface and groundwater conditions within and adjacent to the wetlands
- a Flora and Vegetation Monitoring and Management Plan (FVMMP, Condition 10-4) to manage impacts on vegetation and specify rehabilitation of areas within the development envelope.

The WRP has been prepared to complement the above documents.

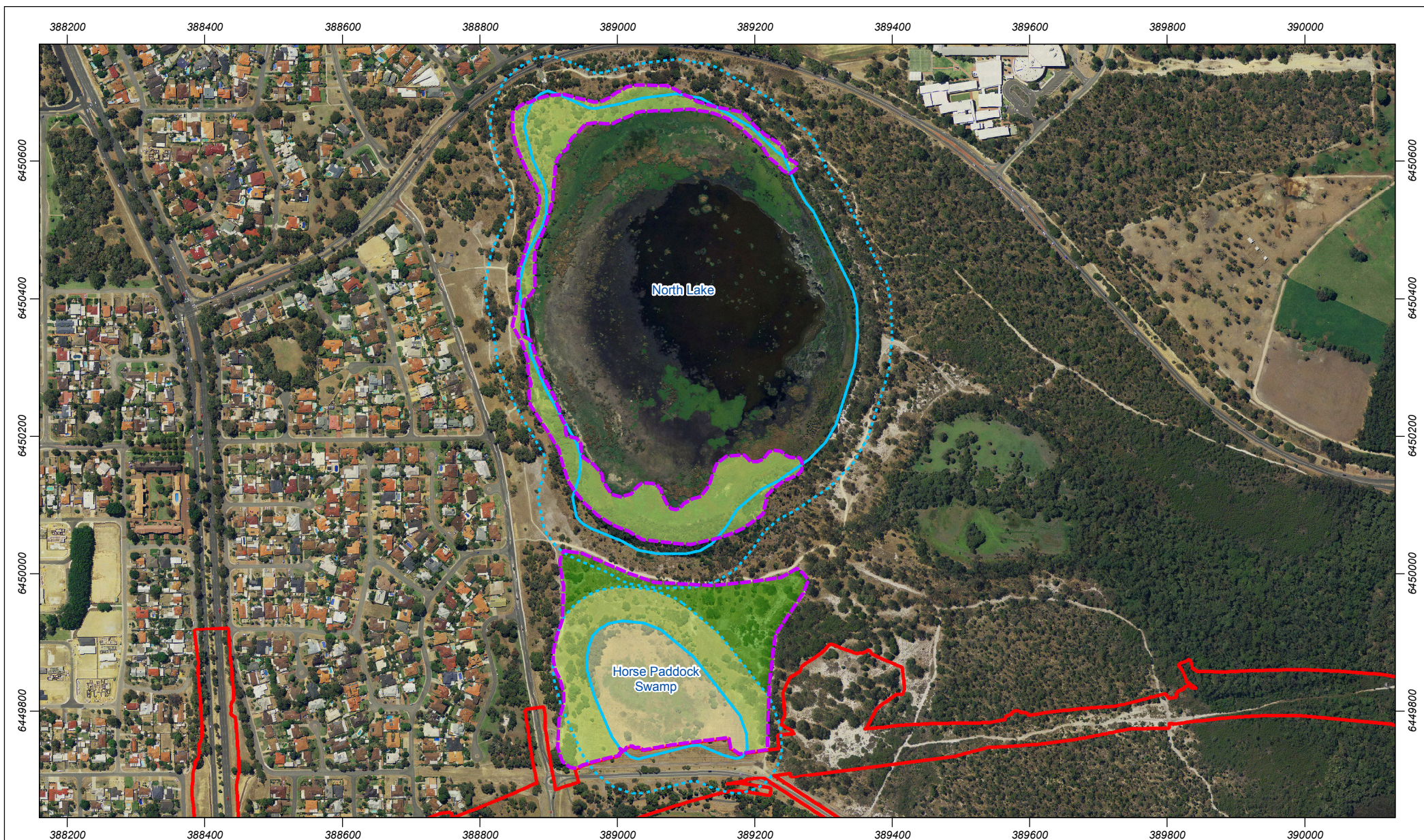


Figure 2: North Lake and Horse Paddock Swamp Rehabilitation Areas

Scale 1:7,500 at A4
 0 50 100 150 200 250 m
 Coordinate System: GDA 1994 MGA Zone 50
 Note that positional errors may occur in some areas
 Date: 19/11/2015
 Author: DWWhite
 Source: Aerial image & rehabilitation data: Client 2015. Wetland boundary: DPAW 2014.

Legend

- Project development envelope
- Extent of rehabilitation
- Conservation Category Wetland (CCW) boundary
- CCW with 50m buffer
- Upland Species
- Transition Species
- Wetland Species

2. Environmental setting

North Lake and Horse Paddock Swamp form part of the Beeliar Wetlands chain and occur within the Beeliar Regional Park, which is managed by the Department of Parks and Wildlife (DPaW).

2.1 North Lake characteristics

The Geomorphic Wetlands of the Swan Coastal Plain dataset (DPaW 2015) classifies North Lake (UFI 6599) as a Lake (permanently inundated basin) with a Conservation Category Wetland (CCW) management category (AECOM 2012b).

North Lake is a large, steep sided lake and reaches a depth of 12.4m AHD on the eastern side. Groundwater flow from the western Jandakot groundwater mound enters the lake through the sandy eastern shore. North Lake is connected to nearby Roe Swamp via a drain (AECOM 2012b).

The lake supports high habitat diversity with areas of open water, sedgeland and fringing woodlands belonging to the Herdsman Complex. The fringing vegetation comprises *Eucalyptus rudis* and *Melaleuca raphiophylla* open forest or open woodland and includes extensive *Melaleuca raphiophylla* and *Banksia articulata* stands (AECOM 2012b; Bourke et al. 2015).

North Lake is protected under the Environmental Protection (Swan Coastal Plain Lakes) Policy 1992 and lies within Bush Forever Site 244 (AECOM 2012b).

2.2 Horse Paddock Swamp characteristics

Horse Paddock Swamp (UFI 6600) is located between Bibra Lake and North Lake and is a degraded, cleared, ephemeral lake. While the wetland resembles a paddock, it is classified as a CCW and is protected under the Environmental Protection (Swan Coastal Plain Lakes) Policy 1992. Horse Paddock Swamp also lies within Bush Forever Site 244 (AECOM 2012b), which describes the wetland vegetation as being equivalent to the Herdsman Complex (AECOM 2011). However, no remnant vegetation exists within the designated wetland area, except for occasional *Eucalyptus rudis* and *Melaleuca raphiophylla* on the wetland fringes. The vegetation condition is Completely Degraded (AECOM 2012b).

The hydrology of Horse Paddock Swamp is unusual in comparison to other wetlands in the Bibra/North Lake area. Most nearby wetlands are surface expressions of groundwater and water levels are almost entirely reliant on groundwater. Horse Paddock Swamp is not connected to groundwater and relies on surface water flows (AECOM 2015b).

Overall, Horse Paddock Swamp has undergone significant modification and is largely devoid of native vegetation. Introduced grasses and weeds including *Carpobrotus edulis*, *Zantedeschia aethiopica* and *Oxalis pes-caprae* dominate the vegetation present in the wetland (AECOM 2012b).

2.3 Climatic influence on water level in North Lake and Horse Paddock Swamp

The closest meteorological recording station to the Project is Jandakot Aero Weather Station (Jandakot Airport), which commenced recording rainfall in 1972 and is maintained by the Bureau of Meteorology (station 009172). The mean annual rainfall at Jandakot Airport is approximately 818.5 mm with the wettest months occurring between May and September (AECOM 2011).

Reduced rainfall and changes to other climate variables across the southwest, including slight increases in mean temperature, may have affected available water for the wetlands. It is difficult to determine the extent of this impact, given the considerable amount of land development that has occurred in the last 50 years, including water extraction from the Jandakot groundwater mound (AECOM 2011).

While having been previously described as a permanent wetland, since the mid 1990s the North Lake has dried more often and has dried every year since 2006, reducing its value as a summer refuge for waterbirds (Bourke et al. 2015).

North Lake dries when water levels reach 12.38 mAHD, which has occurred in eight of the last 10 years. This has lead to native vegetation encroaching into previously inundated areas, declining condition of fringing vegetation, and threats of exotic vegetation becoming dominant in some areas. Encroaching vegetation in turn results in loss of muddy shorelines and shallows that form habitat for waterbirds (Bourke et al. 2015).

There has been limited surface water in Horse Paddock Swamp in recent years, primarily due to a drying climate. Stormwater drainage into Horse Paddock Swamp has also been modified in the suburbs on the western side of the wetland, resulting in reduced inflow (AECOM 2015b).

Predicted water levels in wetlands govern species selection and timing of planting for rehabilitation, and have been considered in the preparation of this WRP. Encroaching exotic vegetation as a result of declining water levels will be targeted through weed management around North Lake, as described in Section 4.

3. Wetland restoration plan

3.1 Rehabilitation objectives

The objectives of the WRP have been developed to meet Condition 12-7 of Statement 1008 and with consideration of the overarching strategies of Beeliar Regional Park Final Management Plan (CALM 2006) (BRPFMP). North Lake and Horse Paddock Swamp fall within BRPFMP Zone10. The management emphasis of this zone is to:

Protect and where possible, enhance the biodiversity conservation values and landscape qualities of the Park. Priority will be given to maintaining the natural state of Conservation and Protection areas with a minimum of impairment. Visible evidence of management will be minimal (CALM 2006).

In order to address key issues and strategies outlined in the BRPFMP, the following principles have been considered in the preparation of the WRP:

- protection and re-establish wetland fringing vegetation in disturbed areas
- appropriate weed control
- use of local plant species, preferably sourced from within the Park
- use of weed and disease free materials.

The objectives of this WRP are as follows:

- establishment of self-sustaining wetland and upland native vegetation in Horse Paddock Swamp
- reduction and control of declared and environmental weeds around North Lake.

3.2 Performance targets and indicators

Targets and indicators have been developed for each objective, to enable rehabilitation performance to be measured (Table 2). A set of performance indicators has been developed for each target, to enable measurement of rehabilitation performance against the completion criteria described in Section 7.

Table 2: Targets and indicators for rehabilitation objectives for the Project

Objective	Target	Indicators
Establishment of self-sustaining wetland, transitional and upland native vegetation in Horse Paddock Swamp (as show in Figure 2).	No less than 25 native plant species established over the three treatment areas, which includes an appropriate mixture of overstorey, mid storey and understorey relevant to the treatment area (as per Appendix 3).	Area of rehabilitation Numbers and species planted Species composition
	At least 2000 stems planted per hectare in Horse Paddock Swamp as show in Figure 2.	
	At least 70% survival rate of stems planted for each treatment area.	
	Use translocated rehabilitation material from construction envelope during revegetation where available.	Vegetation translocated to Horse Paddock Swamp
	No introduction of declared plants, weeds of national significance (WONS) and significant environmental weeds.	Weed composition and signs of dieback or other plant diseases
	No increase in weed cover of Declared plants, WONS and significant environmental weeds.	Weed coverage.
	Less than 10% weed cover within monitoring plots and transects.	Weed coverage
Reduction and control of population of declared and environmental weeds around North Lake (as show in Figure 2).	Weed cover is reduced so the existing weeds are no longer inhibiting native vegetation growth over a 3 year monitoring period.	Weed coverage Native plant growth
	No new infestation of Declared Plants, WONS and significant environmental weeds.	Weed composition and coverage
	No increase in weed cover of Declared Plants, WONS and significant environmental weeds.	Weed coverage

4. Rehabilitation activities

Actions described in the following sections have been developed to achieve the objectives of the WRP and to progress rehabilitation towards completion criteria. Proposed outline schedules identifying indicative timing for key actions for North Lake and Horse Paddock Swamp have been developed to support implementation of the WRP described below and are provided in Appendix 1 and Appendix 2, respectively.

4.1 Management actions

Four rehabilitation treatments areas have been identified based on the rehabilitation requirements and likely site conditions, these include:

1. North Lake wetland treatment area.
2. Horse Paddock Swamp wetland treatment area.
3. Horse Paddock Swamp transition treatment area.
4. Horse Paddock Swamp upland treatment area.

Rehabilitation activities in the North Lake wetland treatment area will focus on weed control, while rehabilitation activities within the three Horse Paddock Swamp treatment areas will include the establishment of self-sustaining native vegetation. These treatment areas and their key rehabilitation requirements and proposed planting mixes are detailed in Table 3 and shown in Figure 2.

Table 3: Rehabilitation treatments areas

Treatment area	Key rehabilitation requirements	Proposed planting mix
North Lake wetland treatment area	Key rehabilitation activities include: <ul style="list-style-type: none"> • installation of signage • weed control as applicable to the individual weed species. 	None
Horse Paddock Swamp wetland treatment area	Key rehabilitation activities include: <ul style="list-style-type: none"> • installation of signage 	Wetland species as per Table A 1 in Appendix 3
Horse Paddock Swamp transition treatment area	<ul style="list-style-type: none"> • deep ripping across gradient in areas of compacted sandy soil • seedling planting and the installation of seedling guards • weed control as applicable to the individual weed species 	Transitional species as per Table A 2 in Appendix 3
Horse Paddock Swamp upland treatment area	<ul style="list-style-type: none"> • installation seedling protection measures (may include tree guards and/or fencing). 	Upland species as per Table A 3 in Appendix 3

Further detail of the current proposed rehabilitation management actions, including planning and maintenance measures for each rehabilitation treatment area in order to achieve objectives and targets, and ultimately completion criteria are provided in Table 4 and Table 5.

During the implementation of the WRP, appropriate local community groups such as the Wetlands Conservation Society and the Cockburn Wetlands Education Centre will be consulted in order to ensure the success of the program. Any changes to the program proposed in response to this consultation will be provided to the OEPA for approval.

Table 4: North Lake wetland treatment area

Parameter	Action	Timing	Responsibility
Preparation and planning	Visit site to confirm: <ul style="list-style-type: none"> • baseline weed distribution • Priority Flora populations • weed composition and coverage • signs of dieback and other plant diseases • site conditions. 	Prior to rehabilitation.	Environmental Manager
	Develop clear, detailed rehabilitation drawings based on the site visit indicating areas to undergo weed control.	Prior to rehabilitation.	Environmental Manager
	Install signage around the rehabilitation treatment area summarising the purpose of rehabilitation works, key works to be undertaken, and access restrictions.	Prior to rehabilitation.	Environmental Manager
	Place weed control warning signs at all entrances to public access ways and around the perimeter of the treatment area at no more than 200 m intervals. Warning signs must be as per Department of Health (Pesticide Safety Division) regulations.	Prior to weed control	Accredited weed contractor
	Undertake weed control, which could include a combination of spot spray herbicide, manual removal / slashing, and /or herbicide wipe. The use of herbicides in the following areas and conditions, will be avoided where possible: <ul style="list-style-type: none"> • within close proximity to wetland areas • within close proximity in areas of Priority flora populations • during windy conditions. If application in proximity to wetland areas is required, herbicides that are safe for local fauna will be used in consultation with DPaW.	Twice a year in: <ul style="list-style-type: none"> • late autumn/ early winter • late winter/early spring prior to seed set 	Accredited weed contractor
Hygiene	Follow hygiene procedure to prevent the introduction or spread of dieback and other plant disease, and weeds during access to rehabilitation areas. Hygiene measures include: <ul style="list-style-type: none"> • ensure vehicles used in transport are clean and free from soil or plant material prior to arriving on site from a potentially dieback infected area • brushdown contaminated vehicles off site in dry weather • wash down contaminated vehicles with water and an appropriate reagent off site during wet weather • secure the site from unauthorised access • ensure footwear is free of mud and soil when entering the rehabilitation area. 	Prior to and during rehabilitation	All personnel
Maintenance period	Undertake follow up weed control where necessary, which could include a combination of spot spray herbicide, manual removal / slashing and /or herbicide wipe. The use of herbicides in the following areas and conditions, will be avoided where possible: <ul style="list-style-type: none"> • within close proximity to wetland areas • within close proximity in areas of Priority flora populations • during windy conditions. If application in proximity to wetland areas is required, herbicides that are safe for local fauna will be used in consultation with DPaW.	Twice a year in: <ul style="list-style-type: none"> • late autumn/ early winter • late winter/early spring prior to seed set 	Accredited weed contractor
Record keeping	Maintain GIS shape files showing areas subject to weed control.	Until handover	Environmental Manager
	Maintain hygiene management records including evidence of the implementation of hygiene procedures.	Until handover	Environmental Manager
	Maintain weed control records including location, techniques used, and qualification details.	Until handover	Environmental Manager

Table 5: Horse Paddock Swamp wetland treatment areas

Parameter	Action	Timing	Responsibility
Preparation and planning	Visit site to confirm: <ul style="list-style-type: none"> • baseline vegetation condition • weed and native vegetation composition and coverage • signs of dieback and other plant diseases • soil compaction • site conditions. 	Prior to rehabilitation	Environmental Manager
	Develop clear, detailed revegetation drawings based on the site visit indicating areas to be rehabilitated.	Prior to rehabilitation	Environmental Manager
	Consult with DPaW and community groups regarding rehabilitation drawings.	Prior to rehabilitation	Environmental Manager
	Identify plants within the construction footprint that can be potentially translocated.	Prior to rehabilitation	Environmental Manager
	Translocate any viable plants to a nursery for caretaking until planting commences at Horse Paddock Swamp.	Prior to clearing	Environmental Manager
	Install signage around all rehabilitation areas, summarising the purpose of rehabilitation works, key works to be undertaken, and access restrictions.	Prior to rehabilitation	Environmental Manager
	Place weed control warning signs at all entrances to public access ways and around the perimeter of the treatment area at no more than 200 m intervals. Warning signs must be as per Department of Health (Pesticide Safety Division) regulations.	Prior to weed control	Accredited weed contractor
	Undertake initial weed control, which could include a combination of spot spray herbicide, manual removal / slashing, soil scalping and /or herbicide wipe. The use of herbicides in the following areas and conditions, will be avoided where possible: <ul style="list-style-type: none"> • within close proximity to wetland areas • within close proximity in areas of Priority flora populations • during windy conditions. If application in proximity to wetland areas is required, herbicides that are safe for local fauna will be used in consultation with DPaW.	Late autumn/ early winter prior to seedling planting	Accredited weed contractor
	Deep rip any compacted sandy soil identified during site visit across gradient to improve seedling root penetration.	Prior to seedling planting	Environmental Manager
Seed collection and sourcing of seedlings	Determine the quantity of tubestock required of various native flora species for each treatment area as per the recommended species listed in Appendix 3.	Prior to rehabilitation	Environmental Manager
	Engage a seed collector licensed by DPaW to undertake seed collection and/or sourcing of other seed supplies.	Prior to rehabilitation	Environmental Manager
	Ensure seed is stored appropriately, including keeping the seed in a dry facility, out of direct sunlight and at an ambient temperature and humidity.	Prior to rehabilitation	Environmental Manager
	Monitor native seed and maintain a register of volumes, species collected, locations and quantities.	Prior to rehabilitation	Environmental Manager
	Place nursery orders with an accredited nursery that is certified as dieback and disease free within an appropriate time frame to ensure adequate supply.	Winter/Spring the year prior to Seedling Planting	Environmental Manager
Planting and translocation	Plant tubestock at a density of 1 seedling per 2 m2. Native tube-stock and seedlings may be artificially watered in the first summer to increase survival rates, as required.	Winter	Environmental Manager
	Install seedling protection measures as appropriate (may include tree guards and/or fencing).	After seedling planting	Environmental Manager
	Translocate species from nursery to Horse Paddock Swamp, where possible.	During rehabilitation	Environmental Manager

Parameter	Action	Timing	Responsibility
Hygiene	Follow hygiene procedure to prevent the introduction or spread of dieback and other plant disease, and weeds during access to rehabilitation areas. Hygiene measures include: <ul style="list-style-type: none"> • ensure vehicles used in transport are clean and free from soil or plant material prior to arriving on site from a potentially dieback infected area • brush down contaminated vehicles off site in dry weather • wash down contaminated vehicles with water and an appropriate reagent off site during wet weather • secure the site from unauthorised access • ensure footwear is free of mud and soil when entering the rehabilitation zones • source all plants and other materials used in rehabilitation from dieback free areas. 	Prior to and during rehabilitation	All personnel
Maintenance/ plant establishment period	Undertake post planting weed control where necessary, which could include a combination of spot spray herbicide, manual removal / slashing and /or herbicide wipe. The use of herbicides in the following areas and conditions, will be avoided where possible: <ul style="list-style-type: none"> • within close proximity to wetland areas • within close proximity in areas of Priority flora populations • during windy conditions. If application in proximity to wetland areas is required, herbicides that are safe for local fauna will be used in consultation with DPaW.	Twice a year in: <ul style="list-style-type: none"> • late autumn/ early winter • late winter/early spring prior to seed set 	Accredited weed contractor
	Implement supplementary management activities as determined by monitoring and contingency action (Sections 5 and 6), which may include: <ul style="list-style-type: none"> • infill planting (likely to be at least 20% of the initial planting density for the first two years) • pest management • use of tree guards and/or fencing • use of fertilisers and/or watering strategies. 	As required	Environmental Manager
Record keeping	Maintain planting records including evidence of numbers and species planted.	Until handover	Environmental Manager
	Maintain GIS shape files showing areas subject to planting, seeding and weed control.	Until handover	Environmental Manager
	Maintain translocation records including evidence of numbers and species collected and translocated.	Until handover	Environmental Manager
	Maintain hygiene management records including evidence of implementation of hygiene procedure.	Until handover	Environmental Manager
	Maintain weed control records including evidence of location, techniques used, and qualification details.	Until handover	Environmental Manager

5. Monitoring

Monitoring is required to measure the success of rehabilitation and to track progress against completion criteria. The monitoring program will be implemented at North Lake and Horse Paddock Swamp after baseline data is collected, and following initial weed control at North Lake and seedling planting at Horse Paddock Swamp. The monitoring program will continue for five years following initial planting.

As part of the program monitoring sites will be established within the rehabilitation treatment areas as detailed below.

5.1 Monitoring plots

Permanent monitoring plots will be established within rehabilitation treatment areas to provide quantifiable data for assessment of rehabilitation against the targets and completion criteria. The monitoring plots will be in the form of either monitoring quadrats and/or transects with an overall monitoring area of 100 m². At least one plot will be established for each rehabilitation treatment area and at least one plot will be established for each hectare of rehabilitation. Once plots are established the same site will be monitored each year to enable comparison and to determine whether completion criteria are being met.

5.1.1 Horse Paddock Swamp treatment areas

Monitoring plots (quadrats and/or transects) will be established through the rehabilitation area at Horse Paddock Swamp as detailed above. The locations will be selected to capture rehabilitation success across habitat types (for example, wetland – transitional and transition – upland).

As per Table 6 each monitoring plot will record the following data during the annual monitoring events:

- native species present and growth habit
- number of stems of native seedlings
- projected foliage cover of native species
- weed species present and percentage cover
- other visual observations including fire, signs of dieback and other plant diseases, signs of water stress or nutrient deficiency, vandalism or grazing of vegetation
- a photograph taken at a designated point that can be compared to subsequent and/or previous photographs, to assess visible progress in maturing vegetation growth and visual aesthetics.

Only flora species recorded within monitoring plots that are of a size /form and or maturity that can be identified in the field will be identified.

5.1.2 North Lake treatment area

Given the narrow dimensions of the North Lake treatment area, this area will be monitored primarily through monitoring transects.

As per Table 6 each transect will record the following data during the annual monitoring events:

- dominant weed species present, area covered and severity of infestation
- presence and coverage of declared plants, WONS and significant environmental weeds
- whether area requires control, monitoring or no action depending upon the species of weed present
- other visual observations including fire, signs of dieback and other plant diseases.

In addition to the formal monitoring described above, monthly site walkover inspections will be undertaken as per Table 6 to visually check for any maintenance issues (e.g. vandalism of fencing or signage, water stress in seedlings or translocated plants, and priority weed areas). Where the monthly site walkover coincides with annual monitoring, all required monitoring items will be covered in one monitoring event.

Table 6: Monitoring actions

Parameter	Timing/Frequency	Purpose	Responsibility
<u>Horse Paddock Swamp monitoring plots:</u> <ul style="list-style-type: none"> • native species present and growth habit • number of stems of native species • projected foliage cover of native species • weed species present and coverage • visual signs of plant health (e.g. fire, signs of dieback and other plant diseases, signs of water stress or nutrient deficiency, vandalism or grazing of vegetation). 	Initial monitoring first autumn after planting, then annually before the end of autumn for five years following initial planting.	To monitor rehabilitation success.	Environmental Manager
<u>Horse Paddock Swamp informal monitoring for:</u> <ul style="list-style-type: none"> • maintenance issues (e.g. vandalism of fencing or signage, water stress in seedlings or translocated plants, priority areas for weed control or infill planting). 	Monthly site walkover inspections.	To visually check for any maintenance issues (e.g. vandalism of fencing or signage, water stress in seedlings or translocated plants, priority weed areas).	Environmental Manager
<u>North Lake monitoring plots:</u> <ul style="list-style-type: none"> • dominant weed species present, area covered and severity of infestation • presence and coverage of declared plants, WONS and significant environmental weeds • whether area requires control, monitoring or no action depending upon the species of weed present • other visual observations including fire, signs of dieback and other plant diseases. 	Annually before the end of autumn for five years following initial planting.	To monitor rehabilitation success.	Environmental Manager
<u>North Lake informal monitoring for</u> <ul style="list-style-type: none"> • maintenance issues (e.g. vandalism of fencing or signage, priority areas for weed control). 	Monthly site walkover inspections.	To visually check for any maintenance issues (e.g. vandalism of fencing or signage, priority weed areas).	Environmental Manager

6. Contingency actions

Main Roads will implement contingency actions in the event that monitoring outcomes indicate inadequate progress towards completion criteria (Table 8 and Table 7). Main Roads will consult with DPaW prior to implementation of contingency actions.

Table 7: Contingency actions for Horse Paddock Swamp treatment areas

Trigger	Action	Responsibility
Monitoring indicates weed cover does not meet the targets in Table 9.	<ol style="list-style-type: none"> 1. Identify cause. 2. Identify new weeds, location and coverage. 3. Liaise with DPaW on any supplementary control that may be required. 4. Engage weed contractor so that new weeds can be targeted. 5. Monitor success of control in annual monitoring. 	Environmental Manager
Monitoring indicates new signs of dieback infestation or other plant disease.	<ol style="list-style-type: none"> 1. Confirm presence and consult with DPaW. 2. Identify cause. 3. Undertake sampling to determine extent. 4. Consult expert to determine treatment and management requirements. 5. Undertake treatment and implement management requirements, if required. 6. Monitor success of control in annual monitoring. 	Environmental Manager
Monitoring indicates signs of degradation through vandalism.	<ol style="list-style-type: none"> 1. Determine the cause. 2. Plan and undertake site works as appropriate to treat land degradation and prevent further degradation. 3. Monitor success of control in annual monitoring. 	Environmental Manager
Monitoring indicates native plant density, diversity, and/or structure does not meet targets described in Table 9.	<ol style="list-style-type: none"> 1. Determine missing vegetation components (via monitoring report). 2. Identify likely cause. 3. Address cause (this may involve weed control, fertilising, watering strategies, soil stabilisation, pest control, tree guards, rabbit proof fencing). 4. Plan infill planting to compensate for missing vegetation components. 5. Monitor success of control in annual monitoring. 	Environmental Manager

Table 8: Contingency actions for North Lake treatment area

Trigger	Action	Responsibility
Monitoring indicates weed cover does not meet the targets in Table 9.	<ol style="list-style-type: none"> 1. Identify cause. 2. Identify the weeds, location and coverage. 3. Liaise with DPaW on any supplementary control that may be required. 4. Engage weed contractor so that the weeds can be targeted. 5. Monitor success of control in annual monitoring. 	Environmental Manager
Monitoring indicates new signs of dieback infestation or other plant disease.	<ol style="list-style-type: none"> 1. Confirm presence and consult with DPaW. 2. Identify cause. 3. Undertake sampling to determine extent. 4. Consult expert to determine treatment and management requirements. 5. Undertake treatment and implement management requirements, if required. 6. Monitor success of control in annual monitoring. 	Environmental Manager
Monitoring indicates signs of degradation through vandalism.	<ol style="list-style-type: none"> 1. Determine the cause of land degradation issue. 2. Plan and undertake site works as appropriate to treat land degradation and prevent further degradation. 3. Monitor success of control in annual monitoring. 	Environmental Manager

7. Completion criteria

Preliminary completion criteria have been developed to provide clear targets that must be met before rehabilitation activities can cease (Table 9).

Table 9: Completion criteria

Location	Parameter	Completion criteria
North Lake	Weed cover	Weed cover is reduced so the existing weeds are no longer inhibiting native vegetation growth over a 3 year monitoring period.
		No new infestation of Declared Plants, WONS and significant environmental weeds.
		No increase in weed cover of Declared plants, WONS and significant environmental weeds.
Horse Paddock Swamp	Species and structural diversity	No less than 25 native plant species established over the three treatment areas, which includes an appropriate mixture of overstorey, mid storey and understorey relevant to the treatment area (as per Appendix 3).
	Number of stems of native seedlings	At least 2000 stems planted per hectare over 8.4 ha over the rehabilitation treatment areas.
		A minimum of 70% survival of stems planted for each treatment area.
	Vegetation condition	Less than 10% of vegetation showing signs of water stress (visual observation), disease, grazing, and nutrient deficiency within monitoring plots and transects.
	Weed cover	No new infestation of Declared plants, WONS and significant environmental weeds.
		No increase in weed cover of Declared plants, WONS and significant environmental weeds.
		Less than 10% weed cover within monitoring plots and transects.

8. Responsibilities

This section provides a summary of the key personnel involved in the implementation of the WRP and their roles and responsibilities (Table 10).

Table 10: Responsibilities

Role	Responsibility
Main Roads	<ul style="list-style-type: none"> Main Roads has the overall responsibility for the implementation of this WRP for five years, following construction, or until the OEPA agrees the completion criteria have been achieved once completion criteria have been achieved the rehabilitation areas will become the responsibility of DPaW under the management of the Park and Main Roads will be responsible for handover of rehabilitation areas to DPaW the roles below may be delegated to a contractor by Main Roads if the roles are delegated, Main Roads has the responsibility to audit compliance and ensure any contingency actions are implemented Main Roads will appoint an Environmental Manager who will be responsible for the day to day implementation of the WRP.
Environmental manager	<ul style="list-style-type: none"> provide technical support to all Project personnel to ensure this WRP is implemented correctly and complied with implement and maintain this WRP, review its effectiveness and review implementation as required implement requirements for preparation and planning, seed collection, seed sourcing, translocation, and planting and seeding, as specified in this WRP undertaking ongoing monitoring, documenting monitoring results, and keeping records assess the performance against objectives, targets, performance indicators and completion criteria liaise with stakeholders, regulators and technical advisors for advice and resolution of management aspects/objectives as required implement, review and close out any contingency actions report as required to regulating authorities may delegate all or part responsibility to an appropriately qualified person providing data to Main Roads for inclusion in the annual compliance report.
Contractors	<ul style="list-style-type: none"> overall accountability for auditing and compliance assessment with this WRP during rehabilitation activities to ensure it is maintained and meets objectives and targets comply with all legal requirements and the requirements of this WRP undertake weed control as specified in this WRP ensure staff employed are adequately trained as specified in this WRP ensure all personnel involved in the Project adhere to the requirements of this WRP seek advice from Main Roads when in doubt about requirements.
Accredited weed control contractor	<ul style="list-style-type: none"> ensure all personnel undertaking control activities will have plant identification skills – both native and introduced species ensure all personnel undertaking control activities will have a WA Pest Management Technicians Licence issued under the Health (Pesticides) Regulations 2011 has a registered pest management business in accordance with the Health (Pesticides) Regulations 2011 ensure signs are placed at all entrances to public access ways and around the perimeter of the treatment area at no more than 200 m intervals. Warning signs must be as per the Health (Pesticides) Regulations 2011.
All personnel	<ul style="list-style-type: none"> all personnel will be responsible for strictly adhering to the hygiene control requirements set out in this WRP.

8.1 Funding

Main Roads will fund the implementation of this WRP, which forms part of Condition 12-7 of Statement 1008.

9. Review and reporting

9.1 Review

The WRP will be reviewed on an annual basis to ensure that the plan takes into consideration monitoring results, audits, continuous improvement and changes in regulatory and corporate requirements.

9.2 Reporting

A monitoring report will be prepared after each monitoring event, summarising the results produced prior to the preparation of the Annual Compliance Report. Main Roads will also maintain records of all rehabilitation activities for the duration of rehabilitation.

10. Auditing

Auditing of the WRP shall be conducted in accordance with Main Roads Corporate Procedure 6707/044 Environmental Auditing.

Internal audits will be undertaken every three months during construction, and compliance audits will be undertaken annually during construction and annually for the first five years of operation.

An annual compliance report, detailing the results of the compliance audit, shall be provided to the CEO of the OEPA.

The Annual Compliance Report will include:

- location and size of areas to be rehabilitated (map, including ESRI shapefiles)
- description of the rehabilitation and rehabilitation activities undertaken within reporting period (including dates of activities)
- summary of the results of annual monitoring events
- comparison of monitoring results to completion criteria
- documentation of any contingency actions undertaken.

Main Roads will continue to implement the WRP until the CEO of the OEPA advises implementation may cease. A closeout report to verify the achievement of completion criteria will be prepared following agreement to cease implementation of the WRP. The completion report will assess the efficacy of what has been done and determine whether the key objectives are met. On submission of the closeout report, Main Roads will seek confirmation from the OEPA that responsibility for the management of the rehabilitated areas can revert to DPaW.

11. References

- AECOM 2012a, *Rehabilitation Strategy – Roe Highway Extension*, unpublished report prepared for Main Roads Western Australia, July 2012.
- AECOM 2012b, *Wetland Buffer Study – Roe Highway Extension*, unpublished report prepared for Main Roads Western Australia, June 2012.
- AECOM 2013, *Offset Strategy – Roe Highway Extension*, unpublished report prepared for Main Roads Western Australia, March 2013.
- Bourke, SA, Hammond, MJ & Clohessy, SG 2015, *Perth Shallow Groundwater Systems Investigation: North Lake, Hydrogeological Record Series, report no. HG42*, Department of Water, Perth.
- Department of Conservation and Land Management (CALM) 2006, *Beeliar Regional Park Final Management Plan*, CALM, Perth.
- Department of Parks and Wildlife (DPAW) 2015, *Geomorphic Wetlands of the Swan Coastal Plain data set*. http://www.water.wa.gov.au/idelve/gwa/metadata_statements/geomorph_wetlands.html. Date accessed: 26 May 2015.
- Environmental Protection Authority (EPA) 2013, *Roe Highway Extension Report and Recommendations of the Environmental Protection Authority*, EPA Report 1489, Government of Western Australia, Perth.
- Southmetro Connect (SMC) 2011, *Roe Highway Extension Public Environmental Review*, unpublished report prepared for Main Roads Western Australia, June 2011.
- Southmetro Connect (SMC) 2013, *Roe Highway Extension Response to Public Submissions*, unpublished report prepared for Main Roads Western Australia, May 2013.
- Water and Rivers Commission 2001, *Water Note No. 22 – Herbicide Use in Wetlands*, Government of Western Australia, Perth.

Appendix 1
North Lake outline schedule
identifying indicative timing for key
actions

North Lake - Outline schedule identifying indicative timing for key action:

[illegible]

Appendix 2
Horse Paddock Swamp outline
schedule identifying indicative timing
for key actions

Horse Paddock Swamp - Outline schedule identifying indicative timing for key actions

[illegible]

Appendix 3

Indicative species list

Table A 1: Horse Paddock Swamp wetland treatment area indicative planting list

Scientific name	Common name	Height
<u>Overstorey</u>		
<i>Banksia littoralis</i>	Swamp Banksia	9.0 m
<i>Melaleuca preissiana</i>	"Modong"	8.0 m
<i>Melaleuca raphiophylla</i>	Swamp Paperbark	7.0 m
<i>Melaleuca teretifolia</i>	"Banbar"	4.0 m
<i>Melaleuca thymoides</i>	-	1.0 m
<u>Midstorey</u>		
<i>Astartea scoparia</i>	-	1.5 m
<i>Hypocalymma angustifolium</i>	White Myrtle	1.0 m
<i>Myoporum caprarioides</i>	Slender Myoporum	1.2 m
<u>Understorey</u>		
<i>Baumea articulata</i>	Jointed Twig-rush	2.5 m
<i>Baumea juncea</i>	Bare Twig-rush	1.0 m
<i>Baumea preissii</i>	-	1.0 m
<i>Bolboschoenus caldwellii</i>	Marsh Club-rush	0.8 m
<i>Brachycome iberidifolia</i>	Swan River Daisy	0.3 m
<i>Carex appressa</i>	Tall Sedge	1.5 m
<i>Carex fascicularis</i>	Tassell Sedge	1.2 m
<i>Cyathochaeta teretifolia</i>	-	2.0 m
<i>Isolepis cernua</i>	Nodding Club-rush	0.2 m
<i>Juncus kraussii</i>	Sea Rush	1.0 m
<i>Juncus pallidus</i>	Giant Rush	2.0 m
<i>Lobelia anceps</i>	Angled Lobelia	0.3 m
<i>Schoenoplectus validus</i>	Lake Club-rush	2.0 m

Source: AECOM 2012

Table A 2: Horse Paddock Swamp transition treatment area indicative planting list

Scientific name	Common name	Height
<u>Overstorey</u>		
<i>Corymbia calophylla</i>	Marri	9.9 m
<i>Melaleuca lateritia</i>	Robin Redbreast Bush	2.5 m
<i>Melaleuca thymoides</i>	-	1.0 m
<u>Midstorey</u>		
<i>Acacia cyclops</i>	Red Eyed Wattle	3.0 m
<i>Acacia pulchella</i>	Prickly Moses	1.5 m
<i>Astartea scoparia</i>	-	1.5 m
<i>Hypocalymma angustifolium</i>	White Myrtle	1.0 m
<i>Kunzea glabrescens</i>	Spear Wood	3.0 m
<i>Myoporum caprarioides</i>	Slender Myoporum	1.2 m
<i>Regelia ciliata</i>	-	1.5 m
<i>Viminaria juncea</i>	Swish Bush	4.0 m
<i>Xanthorrhoea preissii</i>	Grass Tree	3.0 m
<u>Understorey</u>		
<i>Anigozanthos humilis</i>	Catpaw	0.2 m
<i>Brachycome iberidifolia</i>	Swan River Daisy	0.3 m
<i>Carex appressa</i>	Tall Sedge	1.5 m
<i>Carex fascicularis</i>	Tassell Sedge	1.2 m
<i>Dianella revoluta</i>	Flax Lily, Blueberry Lily	0.5 m
<i>Lobelia anceps</i>	Angled Lobelia	0.3 m

Source: AECOM 2012a

Table A 3: Horse Paddock Swamp upland treatment area indicative planting list

Scientific name	Common name	Height
<u>Overstorey</u>		
<i>Corymbia calophylla</i>	Marri	9.9 m
<u>Midstorey</u>		
<i>Acacia cyclops</i>	Red Eyed Wattle	3.0 m
<i>Acacia pulchella</i>	Prickly Moses	1.5 m
<i>Beaufortia elegans</i>	Elegant Beaufortia	0.8 m
<i>Dianella revoluta</i>	Flax Lily, Blueberry Lily	0.5 m
<i>Dodonaea hackettiana</i>	Perth Hopbush	3.0 m
<i>Hakea prostrata</i>	Harsh Hakea	3.0 m
<i>Hakea varia</i>	Variable Leaved Hakea	3.0 m
<i>Jacksonia furcellata</i>	Grey Stinkwood	3.0 m
<i>Kunzea glabrescens</i>	Spear Wood	3.0 m
<i>Regelia ciliata</i>	-	1.5 m
<i>Viminaria juncea</i>	Swish Bush	4.0 m
<i>Xanthorrhoea preissii</i>	Grass Tree	3.0 m
<u>Understorey</u>		
<i>Anigozanthos humilis</i>	Catpaw	0.2 m
<i>Logania vaginalis</i>	White Spray	1.8 m

Source: AECOM 2012a