

Access

A dual-use path for passive recreation use will be installed to DEC specifications between the wetland revegetation and the dryland revegetation (Figure 5). The pathway is to be asphalt sealed (30mm compacted), 2.4m wide and colored using a crushed granite aggregate with 2% red oxide intrinsic coloring. The subgrade is to be 3m wide, boxed out to a depth of 200 mm, and comprised of compacted 75mm grade crushed limestone, thereby leaving a 300 mm limestone shoulder on either side of the asphalt path. The path is to have a 3% nominal cross fall depending upon site conditions. The path must conform to the requirements of Austroads Part 14 (bicycles) and other relevant Australian Standards.

Revegetation will be set back approximately 1 m from the dual-use path on both sides to reduce maintenance from overhanging tree branches, increase fire protection measures and increase visual surveillance of the area.

To control unauthorised access, fencing (consistent with CoW specification for conservation style fencing, Standard Drawing TS01-7) will be installed between the wetland buffer and the POS and along the northern boundary between the wetland/wetland buffer and the road (Figure 5). The final location of the dual-use path is to be determined in consultation with DEC and the City of Wanneroo.

Disease

A dieback assessment was not conducted for the Project area due to the lack of indicator species present. Therefore, a precautionary approach will be undertaken with regards to dieback management, particularly near the wetland.

A Dieback Management Plan (Strategen 2010) has been prepared to comply with Condition 39 of the WAPC subdivision approval (Application No. 140326) which requires a dieback management plan to be prepared and implemented to the satisfaction of the WAPC. Therefore dieback management is not discussed further in this document. The Dieback Management Plan should be referred to for all management actions in regards to this disease.

Fire

Fire management will be undertaken in accordance with the Fire Management Plan prepared to address condition 38 of the WAPC subdivision approval (Application 140326). In addition, a Hydrant Plan (WC Engineering 2010) has been prepared to indicate locations of hydrants within the Project area once developed.

The dual-use pathway will be constructed as per DEC specifications outlined above which will in turn, act as a fire protection measure. The *Typha* control to be implemented as a 10 m buffer area will also act as a firebreak on the western side of the site.

6.2 MANAGEMENT ACTIONS

Management actions have been developed to achieve the objectives for the environmental factors considered significant at the Project site (Table 3). The timing for revegetation works is subject to change based on the completion date for Water Corporation sewer works on site.

Table 3 Management actions

Factor	Topic	Action	Timing	Responsibility
Geology, geomorphology and soils	Erosion	Stabilise each stage of works following completion to prevent erosion and dust lift off.	During construction and as required	Contractor
		Erect temporary fencing to restrict access to wetland and wetland buffer areas at risk from erosion.	During construction	Contractor
		Erect permanent fencing to restrict access between POS and wetland/wetland buffer areas (Figure 5).	Prior to public access being permitted	Contractor
		Permanent fencing to be constructed as per CoW specification for conservation style fencing, Standard Drawing TS01-7.	Prior to public access permitted to site	Contractor
		Formalise access to the wetland buffer through appropriate placement of Dual-use Path in accordance with WAPC conditions.	During construction	Landscape Architect
		Level residential lots in development area.	During design and construction	Contractor
Hydrology	Stormwater	Residents will be encouraged to adopt water wise practices to assist in reducing scheme water use, stormwater generation and nutrient application.	During sale of lots	Developer
		Stormwater will be managed as per the Urban Water Management Plan (JDA 2010).	Construction and post-construction	Developer
		Stormwater for storm events up to 1 in 5 year Annual Recurring Interval (ARI) will be retained and infiltrated on site. Stormwater from events greater than 1 in 5 year ARI will be indirectly discharged via upland vegetation and treatment to Walluburnup Swamp.	Construction and post-construction	Developer
	Water quality	The POS area will include a bio-retention area to retain and infiltrate incoming water from events up to 1 in 5 year ARI.	Construction and post-construction	Developer
	Groundwater	Prior to the commencement of any dewatering, the construction contractor will obtain from Department of Water the relevant licences under the <i>Rights in Water and Irrigation Act 1914</i> .	During construction	Construction contractor
		All dewatering will be carried out in accordance with the conditions of the licence issued under the <i>Rights in Water and Irrigation Act 1914</i> .	During construction	Construction contractor
Vegetation and flora	Weed control	Engage a qualified weed control contractor to undertake initial and ongoing weed control over the area.	Prior to summer 2010/11 and ongoing	Revegetation contractor
		As a minimum, the weed control contractor's qualifications will consist of a Pesticide Operator's Licence issued through the Department of Health.	At all times	Revegetation contractor
		Undertake <i>Typha</i> control 6 months prior to planting.	Summer 2010/11	Revegetation contractor

Factor	Topic	Action	Timing	Responsibility
Fauna		Undertake summer and autumn weed control prior to planting.	Summer 2010/11 – autumn 2011	Revegetation contractor
		Undertake weed control immediately prior to planting.	Late autumn – early winter 2011	Revegetation contractor
		Undertake ongoing weed control post-planting as required.	Ongoing until 2014	Revegetation contractor
	Revegetation	Engage a NIASA-accredited nursery or nurseries to propagate sufficient amount and species of tubestock to achieve performance targets.	October 2010	Revegetation contractor
		Undertake site preparation works such as soil ripping if required.	Prior to planting May – June 2011	Revegetation contractor
		Engage an appropriately qualified contractor to plant seedlings and undertake direct seeding at densities sufficient to achieve performance targets.	June – August 2011	Revegetation contractor
	Infill planting	Undertake infill planting to achieve performance targets.	For three years following initial planting	Revegetation contractor
	Fire	Fire management shall be undertaken in accordance with the Fire Management Plan.	During construction	Contractor
	Inductions	Conduct site inductions for all personnel which shall outline: <ul style="list-style-type: none"> onsite speed limit restrictions rubbish disposal procedures fauna encounter procedures onsite prohibitions (e.g. firearms, pets, feeding animals). 	At time of induction	Contractor
	Native fauna protection	Prohibit the feeding of fauna, hunting, or keeping of firearms or pets onsite.	During construction	Contractor
		Enforce a maximum speed limit within the construction area of 40 km/hr.	During construction	Contractor
		Deposit food scraps and other domestic waste into covered waste disposal bins.	During construction	Contractor
		Dispose domestic waste offsite at a licensed landfill facility.	During construction	Contractor
		Prevent dogs off leads through appropriate signage informing public and policing of policy.	Ongoing	City of Wanneroo Ranger
	Native fauna encounter	Allow native animals encountered onsite the opportunity to move on if there is no threat to personnel safety in doing so.	As required	Contractor
		Contact the DEC Wildcare 24 hour emergency hotline on (08) 9474 9055 if sick or injured animals are encountered.	As required	Contractor
	Fauna habitat	Erect permanent fencing to restrict access to wetland areas.	Prior to public access permitted through area	Developer
Amenity (community use and appreciation)	Access	Construct designated access paths through the wetland buffer and POS.	During first year of rehabilitation works	Landscape architect
		Access paths to be constructed to DEC specifications (Section 6.1.1).	During first year of rehabilitation works (i.e. by mid-2011)	Construction contractor
	Fencing	Construct a permanent fence between the wetland buffer and the POS (Figure 5).	Prior to completion of development	Landscape architect

Factor	Topic	Action	Timing	Responsibility
General		Permanent fences to be constructed per CoW specification for conservation style fencing, Standard Drawing TS01-7.	Prior to completion of development	Construction contractor
	Fauna	Prevent dogs off leads outside designated areas through appropriate signage informing public and policing of policy.	Ongoing	City of Wanneroo
	Signage	Install interpretive signage addressing environmental and heritage values of Walluburnup Swamp, in consultation with DEC and other land owners.	Prior to completion of development	Developer in consultation with DEC
	Waste removal	Remove existing dumped rubbish and waste from the site.	Ongoing and prior to handover of site to DEC and City of Wanneroo (2014)	Revegetation contractor

7. MONITORING

Monitoring actions have been developed to enable an assessment of the effectiveness of the management actions in place.

Formal and informal monitoring will be undertaken within areas subject to rehabilitation (Table 4).

Informal monitoring will consider the same parameters as formal monitoring, however it will comprise a more subjective and brief site assessment (i.e. based on visual observations/estimates rather than monitoring specific parameters in quadrats/transects) by either the revegetation contractor or the landscape architect. The purpose of the informal monitoring is to determine the need for additional rehabilitation works (i.e. to determine if contingency actions need to be enacted – Table 5). Informal monitoring of the rehabilitation areas will be undertaken quarterly, as a minimum. No formal reporting will be required for the informal monitoring, however dates, observations, and photos will be recorded.

The results of the informal monitoring will be reported to Plan E, (the Landscape Architects) so that they can keep track of progress.

Formal monitoring will be undertaken prior to the handover of the rehabilitation areas and their associated management to the DEC and City of Wanneroo in order to assess the achievement of the targets established in Table 2. An independent consultant/botanist shall be engaged to undertake the formal monitoring of the rehabilitation areas. The monitoring methodology (i.e. number of quadrats/transects) shall be determined by the independent consultant/botanist prior to commencing work. The methodology adopted should be appropriate to provide a representative assessment of the rehabilitation areas and assess the achievement of the targets established in Table 2. Monitoring parameters to be considered include:

- establishment of photo monitoring sites and general photos of rehabilitation progress
- species list for native and exotic flora
- native flora species richness and percentage cover
- exotic flora species richness and percentage cover
- general comments on the revegetation areas (e.g. success of revegetation and weed control methods, health of plants etc.)
- recommendations for any work that required to be undertaken and/or statement of achievement of performance targets, thus allowing handover.

Informal and formal monitoring results will be reported to the Landscape Architect and will provide the basis for determining the requirement for further rehabilitation works (as per contingencies in Table 5). A short summary report/proforma shall be completed for each informal monitoring event and a detailed rehabilitation progress and monitoring report shall be provided to DEC and City of Wanneroo for their information prior to management handover.

Table 4 Monitoring

Factor	Purpose	Parameter	Frequency	Location	Responsibility
Geology, geomorphology and soils	To ensure the construction site boundaries are clearly marked and that there is no unauthorised access beyond these boundaries.	Visual assessment of the integrity of the boundary demarcations (e.g. fences)	Weekly during construction	Along the boundary of the wetland buffer and POS.	Contractor
	To ensure no erosion or sedimentation has occurred in the wetland or wetland buffer areas as a result of construction	Visual assessment of wetland and buffer areas	Weekly during construction	Within the wetland and buffer area and along boundaries between construction site and buffer	Contractor
	To ensure no unauthorised access into wetland and buffer areas	Visual assessment of integrity of permanent fencing	6 monthly	Along the boundary of the wetland buffer and POS	City of Wanneroo/ DEC
Hydrology	To monitor groundwater levels	Groundwater level	Monthly for two years	Monitoring bores MW9, 10 and 11	Developer
	To monitor groundwater quality	Ph, EC, nitrogen, phosphorus	Quarterly for two years	Monitoring bores MW9, 10 and 11	Developer
	To assess performance of infiltration basin in accordance with design levels	Water level	Ongoing measurement from continuous water level logger	SW1 in infiltration basin	Developer for three years City of Wanneroo
Vegetation and flora	To ensure the rehabilitation objectives and performance targets are achieved	Native flora species richness and percentage cover Weed species richness and percentage cover	Informally: quarterly. Formally: prior to management handover to the City of Wanneroo (three years after initial planting effort)	Rehabilitation areas in the Parks and Recreation Reserve.	Informal: Landscape Architect or Revegetation Consultant. Formal: Consultant botanist (engaged by Landscape Architect)
	To determine if additional rehabilitation works are required to be undertaken.	Presence and extent of dieback infected areas Vegetation condition/health within the rehabilitation areas and surrounding remnant vegetation			
	To ensure wetland area is not unduly disturbed	Unauthorised access beyond the designated paths	Quarterly	Along fences	Developer for three years City of Wanneroo
Fauna	To ensure that no domestic waste is left where animals may access it	Visual inspection of waste disposal area/s to ensure that rubbish is contained within the bin and lids secured, and that rubbish is removed	Weekly site inspections during construction	Construction area perimeter and waste disposal area/s	Contractor
Amenity (community use and appreciation)	To ensure integrity of fencing is maintained	Fence integrity	Quarterly	Along fences	Developer for three years City of Wanneroo

Factor	Purpose	Parameter	Frequency	Location	Responsibility
General	To ensure site and rehabilitation areas remain rubbish-free	Presence/absence of rubbish	Weekly site inspections during construction	Within development area and rehabilitation areas	Contractor
			Prior to handover to DEC and CoW		Developer

8. CONTINGENCY MEASURES

Contingency measures will be implemented to respond to unauthorised or unpredicted adverse environmental impacts. The precise nature of the contingency measures will depend on the nature of the event. In broad terms, the following management response will be utilised:

1. Identify cause.
2. Prepare appropriate remedy.
3. Implement remedy.
4. Monitor success of remedy.
5. If monitoring indicates the remedy is not successful, return to Step 1 and continue until a successful outcome is achieved.

While the above approach is designed to cover all eventualities, specific potential contingency actions relevant to each factor have been developed to cover the most likely scenarios (Table 5). Each of these actions will be addressed under the same cycle of cause identification, action preparation and implementation and monitoring of success as above.

Table 5 Potential contingency measures

Factor	Trigger	Potential contingency action	Responsibility
Geology, geomorphology and soils	Erosion and/or sediment runoff identified in wetland and/or wetland buffer	<ol style="list-style-type: none"> 1. Review drainage plans. 2. Stabilisation of soil with erosion matting, mulch (only outside wetlands and their 50 m buffers) and revegetation. 	Landscape Architect/Revegetation Consultant.
Hydrology	Groundwater levels significantly exceed Controlled Groundwater Level (CGL)	<ol style="list-style-type: none"> 1. Review design and operation of stormwater drainage system. 2. Perform maintenance on system as required. 	Developer
	Nutrient concentrations in shallow bores exceed pre-development nutrient levels	1. Identify and remove any point sources.	Developer
		2. Review operation and maintenance (e.g. fertilising) practices.	
		3. Consider alternatives to POS areas including landscape regimes and soil amendment.	
	Elevated water levels and extended times of ponding of water within POS compared to expected design performance	4. Consider modifications to the stormwater system.	Developer
		5. Consider initiation of community based projects.	
		1. Identify and remove any point sources.	
		2. Review operation and maintenance (e.g. fertilising) practices.	
		3. Consider alternatives to POS areas including landscape regimes and soil amendment.	
		4. Consider modifications to the stormwater system.	
		5. Consider initiation of community based projects.	

Factor	Trigger	Potential contingency action	Responsibility
Flora and vegetation	Inappropriate flora species (i.e. not included in Landscaping Management Plan or species of local provenance) used in landscaping and rehabilitation areas	1. Remove inappropriate flora species and replace with appropriate species.	Landscape Architect/Revegetation Consultant.
		2. Ensure inappropriate species are not used in future.	
	Inadequate native flora species richness and/or cover	1. Plant areas with tubestock grown from locally collected seed to compensate for insufficient native plant species richness and/or cover. (Supplementary direct seeding may only to be considered for the Dryland vegetation community and then only at the discretion of CoW).	Landscape Architect/Revegetation Consultant.
	Unacceptable weed infestations	1. Identify the weeds, their location and coverage and obtain quotations from contractors to control them.	Landscape Architect/Revegetation Consultant.
		2. Undertake targeted weed control.	Landscape Architect/Revegetation Consultant.
Fauna	Domestic waste identified outside of designated waste disposal facilities	1. Remove rubbish regularly.	Contractor
		2. Alert all staff to the required procedure for disposing of domestic waste and the need to prevent animals accessing food and other wastes.	
		3. Review induction procedures to ensure that all staff are adequately informed of requirements.	
Amenity (community use and appreciation)	Unauthorised access to the wetland area	1. Install more robust physical access barriers.	City of Wanneroo
		2. Erect signs to highlight reserve status.	

9. IMPLEMENTATION AND REVIEW

ABN Developments is responsible for implementation of the WMP during development/construction of the Project and maintenance works for three years following initial planting.

9.1 STAKEHOLDER CONSULTATION

Consultation during the preparation of this Plan included liaison with City of Wanneroo and DEC in regards to recommended content of the WMP as well as liaison with adjacent landowners for consistency of management. This Plan has also been subject to review and endorsement by CoW and DEC prior to finalisation.

9.2 MANAGEMENT HANDOVER

The management of the rehabilitation areas (wetland, wetland buffer and POS) will revert to the authority in which the reserve is vested after the three year maintenance period. The dual-use path will define the boundary between future management zones, with all areas located to the west to be vested with the DEC and all areas to the east (including the dual-use path) with CoW. Prior to handover, monitoring of the rehabilitation areas will be undertaken to determine whether the performance targets have been adequately met. Upon meeting the targets, consultation with the CoW and DEC will be undertaken to determine the manner in which management handover will occur.

9.3 REVIEW AND REVISION

This Plan shall be reviewed and revised as required based on any adaptive management requirements, until the City of Wanneroo and DEC assumes management responsibility for the Project area. ABN Developments will forward a copy of the Plan with any significant revisions as these occur to the DEC and the City of Wanneroo.

DEC shall be forwarded a copy of a detailed progress and monitoring report prepared prior to management handover (three years after initial planting).

10. REFERENCES

- Ace Environmental 2010, *Lots 1 and 200 Wanneroo Road Woodvale Western Australia Preliminary and Detailed Site Investigation*, Prepared for Hargate Properties Pty Ltd, May 2010.
- Bureau of Meteorology 2010, *Climate Statistics for Australia Locations – Perth Regional Office* [online], Available from http://www.bom.gov.au/climate/averages/tables/cw_009034_All.shtml, [8 April 2010].
- Cardno 2006, *Wetland Boundary Review and Management Category Re-evaluation – Wetland 8168 Woodvale*, Prepared for Watson Property Group Northern Aspects Ltd.
- Cardno 2009, Woodvale LSP 64 Local Water Management Strategy, March 2009.
- Colmar Brunton 2001, *CALM Regional Parks Usage Survey 2001*, Research Report prepared for the Department of Conservation and Land Management.
- CSIRO and Bureau of Meteorology 2007, *Climate Change in Australia* [online]. Technical Report, 140pp. Available at: www.climatechangeinaustralia.gov.au, [20 June 2008].
- Department of Conservation and Land Management (CALM) 2003, *Yellagonga Regional Park Management Plan 2003-2013*, Management Plan 48, CALM.
- Department of Environment and Conservation (DEC) 2008, *Guidelines checklist for preparing a wetland management plan*, Government of Western Australia, Perth.
- Keighery B.J. 1994, *Bushland Plant Survey, A Guide to Plant Community Survey for the Community*. Wildflower Society of WA (Inc), Nedlands, Western Australia.
- JDA Consulting Ecologists 2010, *Lots 1,200 & 300 Wanneroo Rd Woodvale Urban Water Management Plan*, Prepared for Hargate Pty Ltd, June 2010.
- Mitchell, D., Williams, K. and Desmond, A. 2002, “Swan Coastal Plain 2 (SWA2 – Swan Coastal Plain subregion)”, *A Biodiversity Audit of Western Australia’s 53 Biogeographical Subregions in 2002*, Department of Conservation and Land Management, January 2002.
- Plan E 2010, *Chianti Private Estate Landscape Management Plan for ABN Group*, Prepared for ABN Developments, Perth.
- Strategen 2010a, *Woodvale Lots 1, 200 & 300 Dieback Management Plan*, Prepared for ABN Developments, July 2010.
- Strategen 2010b, *Woodvale Lots 1, 200 & 300 Fire Management Plan*, Prepared for ABN Developments, August 2010.
- Strategen 2010c, *Woodvale Lots 1, 200 & 300 Midge Management Plan*, Prepared for ABN Developments, November 2010.
- WC Engineering 2010, *Hydrant Plan*, Prepared for ABN Developments.

Appendix 1

Species lists for rehabilitation areas

Community Type	Species	Common name	Growth Form
<i>Baumea articulate</i> / <i>Schoenoplectus validus</i> Sedgeland (Community Type 1)	<i>Baumea articulata</i>	Jointed Twig Rush	Rush or Sedge
	<i>Schoenoplectus validus</i>	Lake Club Sedge	Rush or Sedge
<i>Melaleuca raphiophylla</i> Open Forest (Community Type 2)	<i>Acacia pulchella</i>	Prickly Moses	Shrub
	<i>Banksia littoralis</i>	Swamp Banksia	Tree
	<i>Baumea preissii</i>	Broad Twig Rush	Rush or Sedge
	<i>Bolboschoenus caldwellii</i>	Marsh Club Rush	Rush or Sedge
	<i>Eleocharis acuta</i>	Common Spike Rush	Rush or Sedge
	<i>Eleocharis sphacelata</i>	Tall Spike Sedge	Rush or Sedge
	<i>Ficinia nodosa</i>	Knotted Club Rush	Rush or Sedge
	<i>Juncus pallidus</i>	Pale Rush	Rush or Sedge
	<i>Kennedia prostrata</i>	Scarlet Runner	Shrub
	<i>Melaleuca raphiophylla</i>	Swamp Paperbark	Tree
	<i>Melaleuca preissiana</i>	Moonah	Tree
<i>Melaleuca raphiophylla</i> / <i>Eucalyptus rudis</i> Open Forest (Community Type 3)	<i>Acacia pulchella</i>	Prickly Moses	Shrub
	<i>Banksia littoralis</i>	Swamp Banksia	Tree
	<i>Eucalyptus rudis</i>	Flooded Gum	Tree
	<i>Ficinia nodosa</i>	Knotted Club Rush	Rush or Sedge
	<i>Juncus pallidus</i>	Pale Rush	Rush or Sedge
	<i>Kennedia prostrata</i>	Scarlet Runner	Shrub
	<i>Kunzea glabrescens</i>	Spearwood	Shrub
	<i>Lechenaultia floribunda</i>	Free flowering Lechenaultia	Shrub
	<i>Lepidosperma longitudinale</i>	Pithy-Sword Sedge	Rush or Sedge
	<i>Lobelia anceps</i>	Angled Lobelia	Herb
	<i>Melaleuca raphiophylla</i>	Swamp Paperbark	Tree
	<i>Melaleuca preissiana</i>	Moonah	Tree
	<i>Melaleuca teretifolia</i>	Marsh Honey Myrtle	Shrub or Tree
	<i>Melaleuca thymoides</i>		Shrub or Tree
	<i>Pericalymma ellipticum</i>	Swamp Tea Tree	Shrub
	<i>Rhagodia baccata</i>	Berry Saltbush	Shrub
	<i>Viminaria juncea</i>	Swishbush	Shrub