GARDEN STREET, SOUTHERN RIVER

REVEGETATION MANAGEMENT PLAN

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pgv ENVIRONMENTAL

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1 INTRODUCTION

1.1 Background

The City of Gosnells proposes to extend Garden Street 0.8km from Harpenden Street to the intersection of Balfour and Holmes Streets (the site). Construction of the road is proposed to start in 2018-2019. The proposed Garden Street extension between Harpenden Street and Southern River Road will enable Garden Street to become a key arterial road serving both regional and local traffic in the Southern River area.

A Clearing Permit Application was submitted for the works (Reference CPS 7038/1). This plan is being prepared as a result of discussions with DWER in anticipation of the City lodging an application in early 2018. The project is also being assessed by the Department of the Environment and Energy (DotEE) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (EPBC 2016/7735).

The proposed road extension will result in the clearing of 4.35ha of native vegetation. This Revegetation Management Plan has been prepared to guide the revegetation of bushland areas within the vicinity of the proposed road section as part of the offsets proposed for the clearing.

1.2 Scope of Works

The City of Gosnells has commissioned the Revegetation Management Plan for the replanting and management of vegetation in Degraded and Completely Degraded areas in four parcels of land that form part of the City of Gosnells natural asset portfolio. Three of the sites are currently being managed by the City in a 'Maintenance' mode and one is currently the subject of no natural area maintenance and partially owned and under the management of the Western Australian Planning Commission (WAPC). The City has received in-principle support from the WAPC for the inclusion of their land in the offset proposal, which would ultimately see the transfer of the subject land to the City (Appendix 1). The Revegetation Management Plan will detail works additional to the scheduled maintenance works to improve the condition of the vegetation of the offset sites. The revegetation will improve the environmental values and resilience of natural assets in the City.

The Revegetation Management Plan is formatted with a Section outlining each of the following:

- The existing environment on each of the sites, comparing larger scale attributes with those in the Garden Street Road Reserve to demonstrate the offset sites have values that are considered to be 'like for like' to the impacted area for the proposed Garden Street Extension;
- Outline management that is common to all of the sites to establish common practices;
- Specific revegetation plans for each site including detailed description of the areas to be revegetated, baseline weed studies, weed control activities additional to planned maintenance, revegetation species lists for different areas within the offsets sites and any other actions required for a particular site;
- Monitoring requirements that will be undertaken;
- Schedule of works;

- Completion Criteria that will be attained with specific targets for improving environmental values; and
- Commitments for funding, including indicative cost schedules.

1.3 Relevant Principles and Policies.

The Revegetation Management Plan has been prepared with due regard for the following policies and principles:

- Guidance Statement No.6 Rehabilitation of Terrestrial Ecosystems (EPA, 2006);
- City of Gosnells Policy No. 6.2.2 - Rehabilitation and Revegetation of Natural Areas; and
- City of Gosnells Natural Areas Rehabilitation and Revegetation Guidelines.

2 EXISTING ENVIRONMENT

2.1 Site Locations

The revegetation areas are all within a 3.6km radius of where the clearing is to be undertaken for the purposes of extending Garden Street (Figure 1). Revegetation is proposed in four sites, including:

- Hume Road Wildlife Reserve (Figure 2) which is 2.9km to the north of the proposed extension of Garden Street;
- Nicholson Road Wetlands Site 1A (Figure 3) which is 3.5km to the west of the proposed extension of Garden Street;
- Sandmartin Drive Reserve (Figure 4) which is 1.5km to the south-west of the proposed extension of Garden Street; and
- Burslem Drive Bush Forever Site 246 (Figure 5) which is 3.6km to the north-east of the proposed extension to Garden Street.

2.2 Site Zoning and Existing Management

The Hume Road Wildlife Reserve is zoned 'Urban' under the MRS and 'Local Open Space' in the TPS. The site is currently managed by the City of Gosnells with weeding and some revegetation activities.

The Nicholson Road Wetlands Site 1A is zoned 'Urban' under the MRS and 'Residential Development' in the TPS and is part of the West Canning Vale Outline Development Plan area. The Nicholson Road site is currently being managed by the City for weeds.

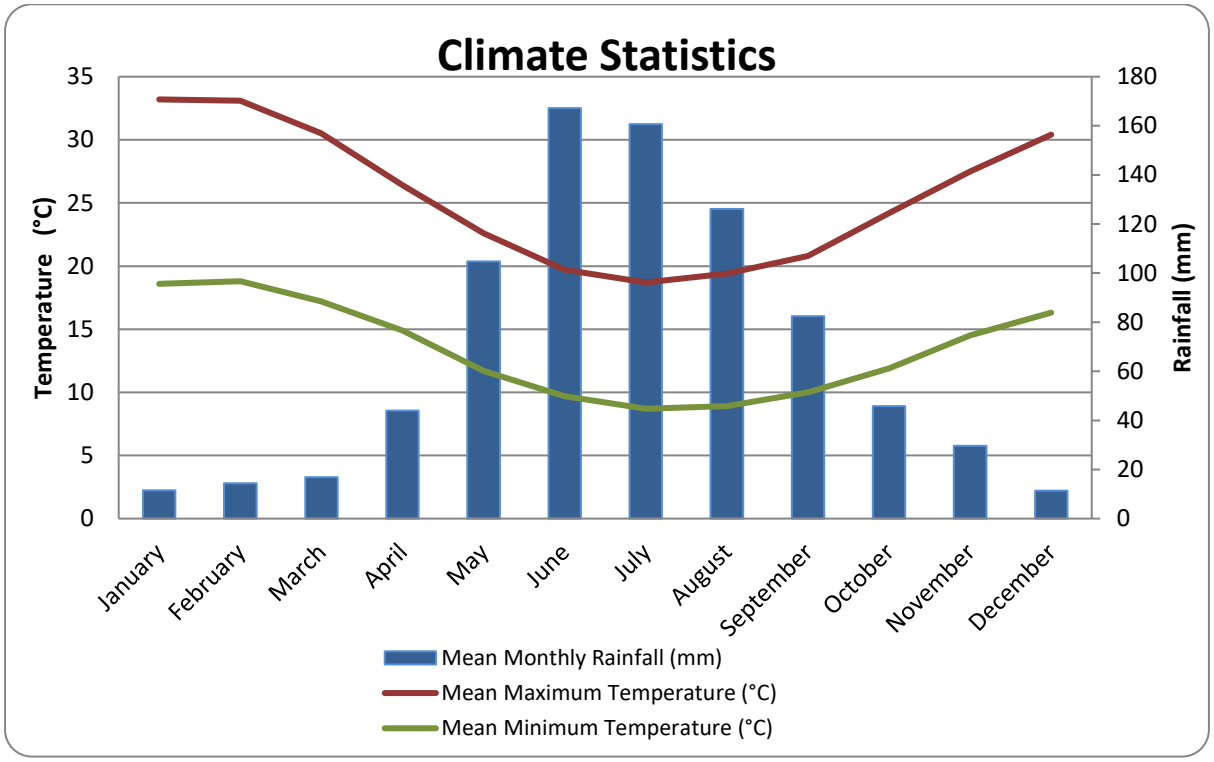
The Sandmartin Drive site is zoned 'Urban' under the MRS and 'Residential Development' under the TPS. The Sandmartin Drive site is contiguous with Bush Forever Site 125 Holmes Street Bushland, Southern River/Huntingdale. Currently the site is scheduled for weed management by the City.

The Burslem Drive site is part of Bush Forever Site 246, which is the Canning and Southern Rivers, Beckenham to Martin/Kelmscott Bush Forever Site. The site is zoned Parks and Recreation under the MRS and TPS and is currently managed by the City (Crown Reserve 37270) and the Western Australian Planning Commission (WAPC) (Lot 201 Burslem Drive). The City of Gosnells has in-principle support from the WAPC for the offset proposal, which includes the transfer of Management responsibility to the City to take over the management of the Completely Degraded areas of the identified site for revegetation purposes.

2.3 Climate

Climate statistics from the Bureau of Meteorology (BOM, 2016) have been collected from Gosnells City (BOM Site Number 009106) which has been collecting data from 1961 (Graph 1). The highest average maximum temperature is 33.2^{o}C and highest average minimum temperature is 18.8^{o}C, in January and February respectively. July records the lowest temperatures with the lowest average maximum and minimum of 18.7^{o}C and 8.7^{o}C. Rainfall is mainly from April to October with 685.2mm of the total rainfall of 814.9mm (approximately 85% of the total), with 129.7mm falling in the summer months (November to March) (Graph 1).

Graph 1: Climate Statistics for Gosnells (Site Number: 009106)



2.4 Topography

Three of the revegetation sites are relatively flat. The Hume Road Wildlife Reserve is between 15 and 16 mAHD, Nicholson Road is 24 to 25m AHD and Sandmartin Drive is approximately 22 to 23mAHD (DoW, 2017a).

The Burslem Drive Site includes Southern River and its upper banks and therefore has a lot more variation in topography, generally sloping from 8mAHD down to Southern River at 3.5mAHD.

2.5 Geology and Soils

The sites are mapped as part of the Bassendean System, the oldest of the three dune systems on the Swan Coastal Plain (Bolland, 1998), and the Pinjarra Plain System. The Bassendean System consists of very low relief, leached, grey siliceous Pleistocene sand dunes, intervening sandy and clayey swamps and gently undulating plains. These occur immediately west of, and partly overlie, the Pinjarra Plain. These soils are very leached, infertile and mildly acidic (DAFWA, 2014).

The Pinjarra Plain extends from the eastern side of the Bassendean Dunes to the western edge of the Darling Scarp, which joins the Ridge Hill Shelf and forms the denuded slope of the Darling Fault (Beard 1990). The Pinjarra Plain System consists of a broad low relief plain west of the foothills, comprising predominantly Pleistocene fluvial sediments and some Holocene alluvium associated with major current drainage systems. The major soils are naturally poorly drained and many swamps occur.

The soils on the Hume Road and Sandmartin Drive sites are very similar to those of the Garden Street Reserve. The Nicholson Road site is sandier. The Burslem Drive site has typical riverine soils in the river bed and banks and then sandy soils as for the Garden Street Road Extension site (Table 1).

Table 1: Soil descriptions for areas to be rehabilitated

Soil Type	Description	Drainage	Areas in which soils occur
Bassendean S8 Phase (212Bs_S8)	Sand that is very light grey at the surface, yellow at depth, fine to medium-grained, sub-rounded quartz, moderately well sorted of eolian origin.	100% of the map unit consisting of this soil type has a nil to moderate risk of waterlogging.	Garden Street Extension Road Reserve, Hume Road, Burslem Drive
Pinjarra Sp1 Phase (213Pj_Sp1)	Peaty Sand - grey to black, fine to medium-grained, moderately sorted quartz sand, slightly peaty, of lacustrine origin	100% of the map unit has a High to Very High risk of waterlogging	Garden Street Extension Road Reserve, Hume Road
Pinjarra S10 Phase (213Pj_S10)	Sand as a relatively thin veneer over sandy clay to clayey sand of eolian origin.	0% of the map unit has a Very High risk of water logging, 40% is High and 60% is nil to moderate or not rated.	Garden Street Extension Road Reserve
Bassendean B2 Phase (212Bs_B2)	Located on flat to very gently undulating sandplain with well to moderately well drained deep bleached grey sands with a pale-yellow B horizon or a weak iron-organic hardpan 1-2m	3-10% of the map unit consisting of this soil type has a moderate to very high risk of waterlogging.	Nicholson Road
Bassendean B4 Phase (212Bs_B4)	Broad poorly drained sandplain. The soils are described as deep grey siliceous sands or bleached sands, underlain at depths generally greater than 1.5 m by clay or less frequently a strong iron-organic hardpan (DPIRD, 2016).	>70% of the map unit consisting of this soil type has a moderate to very high risk of waterlogging.	Nicholson Road
Pinjarra P1b Phase (213Pj_P1b)	Flat to very gently undulating plain with deep acidic mottled yellow duplex (or "effective duplex") soils	Imperfectly drained but 0% of the map unit has a Very High risk of waterlogging, 30% is High and 70% is nil to moderate or not rated.	Sandmartin Drive
Pinjarra EnvGoel Cms Phase (213Pj_cms)	SAND SILTY CLAY – pale brown	On the banks of the river and 30-50% of the map unit has a moderate to very high to risk of waterlogging	Burslem Drive
Pinjarra EnvGoel Ms4 Phase (213Pj_Ms4)	SANDY SILT - light yellow brown, blocky, mottled, some fine to medium-grained sand, soft when moist, variable clay content	Associated with the River so >70% of the map unit has a moderate to very high to risk of waterlogging	Burslem Drive

2.6 Hydrology

2.6.1 Groundwater

The groundwater under all of the sites has geological formations that have been grouped into three distinct aquifers:

- Superficial Swan Aquifer (unconfined);
- Leederville Aquifer (confined); and
- Yarragadee north (confined) (DoW, 2017b)

The Superficial Aquifer is part of the Jandakot Mound and the Kardinya Shale Member of the Osborne Formation separates this from the Leederville Aquifer (DoW, 2017b).

The Garden Street extension site has groundwater approximately 2.8 to 8.5m below ground level at 18mAHD (DoW, 2017a). The Hume Road site has groundwater which is approximately 1.8 to 2.3m from the surface at 13mAHD. Nicholson Road also has a shallow depth to groundwater between 2.0 and 3.5m at 22mAHD. The Sandmartin Drive Reserve has groundwater at 21 mAHD which is 1.3 to 2.0m from the surface (DoW, 2017a). The Burslem Drive site has groundwater at 3mAHD at a depth of 1 to 6m below ground level (DoW, 2017a)

2.6.2 Surface Water

The proposed road extension site and the offset sites have low-lying areas to which surface water drains.

2.6.3 Wetlands

An area of winter inundation exists in the centre of the Garden Street site, coinciding with a 'sumpland' wetland. The wetland is classified as a Conservation Category with the Unique Feature Identifier (UFI) 15423.

The Hume Road Offset site contains a Resource Enhancement Dampland (UFI 7500); the Nicholson Road site contains a Conservation Category Dampland (UFI 14519) and Multiple Use Category Dampland (UFI 14523), although it is evident that the Multiple Use portion should be more correctly identified as Conservation Category; the Sandmartin Drive site is mostly covered by Conservation Category Dampland (UFI 15555) and a Multiple Use Dampland (UFI 13855). All wetlands that form part of these offsite offset areas are all part of the Bennett Brook Suite.

The Burslem Drive site contains Southern River (UFI 15768) which is classified as a Multiple Use Palusplain and is part of the Swan River consanguineous suite.

2.7 Vegetation

2.7.1 Vegetation Complexes

The vegetation on the Gardens Street extension site and the offset sites is part of the Southern River Vegetation Complex. The Southern River Vegetation Complex is described as "open woodland of *Corymbia calophylla-Eucalyptus marginata-Banksia* species with fringing woodland of *Eucalyptus rudis-Melaleuca rhaphiophylla* along creek beds" (Heddle *et al.,* 1980). This general description is

considered to be reasonably accurate and describes the vegetation on the site apart from the fact that the areas containing *Eucalyptus rudis* and *Melaleuca* species occur in basin and flat-type wetlands in some areas rather than creek beds.

2.7.2 Vegetation Types

The vegetation in the Garden Street Road Reserve consists of:

- *Banksia attenuata*, *Kunzea glabrescens*, *Melaleuca preissiana* Low open woodland in the northern 230m of the site;
- *Melaleuca preissiana* woodland over *Astartea affinis* in the central part of the site;
- *Banksia attenuata* and *Eucalyptus todtiana* Low Open Woodland, also in the central part of the site;
- *Melaleuca preissiana* Low Open Woodland and *Regelia* Shrubland in the wetland part of the site;
- *Melaleuca viminea* closed tall scrub in the core wetland area;
- *Phlebocarya ciliata* and *Dasypogon bromeliifolius* closed Sedgeland on the wetland boundary; and
- *Banksia*, *Allocasuarina fraseriana* Woodland in the southern 230m of the site.

The vegetation in each offset site is described in the following sections specific to the sites.

2.7.3 Vegetation Condition

The vegetation condition of the Garden Street Road reserve is in predominately Good to Excellent condition, according to the condition scale of Keighery (1994) published in Bush Forever (Government of Western Australia, 2000) as outlined in Table 2.

Table 2: Vegetation Condition Rating Scale.

Condition	Description
Pristine	Pristine or nearly so, no obvious signs of disturbance.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good	Vegetation structure altered, obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbance. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

Source: Government of Western Australia, 2000.

The condition of the vegetation in the offset sites was assessed in 2016 (Syrinx 2016) (Table 3). The vegetation condition was used as the basis to determine areas for weeding and revegetation in this revegetation management plan (see Sections 4-7).

Table 3: Vegetation Condition in Offset Sites

On-site and Offsite Offset Areas	Condition					
	Excellent (m^2)	Very Good (m^2)	Good (m^2)	Degraded (m^2)	Degraded – Reveg (m^2)	Completely Degraded (m^2)
Hume Road	0	8732	8991	3008	5361	2315
Nicholson Road	0	10975	404	221	0	3674
Sandmartin Drive	0	8879	2697	4988	0	7795
Burslem Drive	0	0	0	85000	0	18000

Each of the offset sites contains large Completely Degraded areas that have very little native vegetation (Plates 1,2,3 and 4).

Plate 1: Bare area on the Hume Road site



Plate 2: Bare area on the Nicholson Road site



Plate 3: Bare area on the Sandmartin Drive site



Plate 4: Grassed Area on Burslem Drive



2.8 *Phytophthora* Dieback

The *Common Indicator Species for the Presence of Disease caused by Phytophthora cinnamomi* list compiled by the Department of Parks and Wildlife (DPaW, 2013) (then the Department of Environment and Conservation, DEC) gives a number of species that are impacted by *Phytophthora* Dieback. The Hume Road Site was assessed in 1999 by Glevan and was found to be mostly Infested. The Nicholson Road sites contain a number of species that are on this list and therefore would not be present on the site if *Phytophthora* Dieback was present.

The Sandmartin Drive site and Burslem Drive sites did not have many indicator species present and may be infected by dieback, however at this time is considered to be 'Uninterpretable'. All sites will be mapped prior to revegetation commencing by a suitably qualified and experienced dieback interpreter.

3 ALL SITES REVEGETATION MANAGEMENT PLAN

3.1 Soil Management

3.1.1 Objective

To maintain the soil health in the Revegetation Areas and provide a substrate for rehabilitation.

3.1.2 Augering

The soil on some of the tracks that are designated for revegetation is compacted. In these areas holes will be augured for each revegetation stem. The Hume Road Site contains two orchid species (*Thelymitra crinita* and *Caladenia paludosa* – Plate 5 and 6) and as these plants are not able to be seen in autumn, auguring on the edge of tracks should be avoided to ensure no orchid tubers are damaged or removed.

Plate 5: *Thelymitra crinita*



Plate 6: *Caladenia paludosa*



3.1.3 Management Actions

M1 Augurs will be used to plant tubestock in compacted areas except on the edge of track on the Hume Road Site to avoid orchid species.

3.2 Dieback

3.2.1 Dieback Management

The sites are potentially infected with Jarrah Dieback (*Phytophthora cinnamomi*) with this being confirmed for the Hume Road Site. Prior to revegetation or any other physical intervention, the sites will be mapped by a suitably qualified and experienced dieback interpreter and site-specific Dieback Hygiene Plans prepared. Site Supervisor will have responsibility for application of DHPs, and site

inductions will include Dieback Hygiene Plans and briefings. No vehicle or personnel movement will be permitted in any of the sites before dieback mapping is completed and identified on ground.

Hygiene protocols will be applied to protect un-infested zones within Revegetation Areas during rehabilitation works. No vehicles or shoes that are visibly covered in soil will be permitted into un-infested Revegetation Areas. All tools that come in contact with soil will be washed prior to entering un-infested areas. No soil will be transported onto the site from outside the Revegetation Areas, or between infested and un-infested areas.

If watering is required at any stage the water to be applied will be taken from a *Phytophthora* free or treated source.

3.2.2 Access

Signage will be installed to demarcate any dieback front recorded and to restrict access from infested to un-infested areas.

3.2.3 Monitoring

Vegetation species vulnerable to Jarrah Dieback such as Jarrah, *Xanthorrhoea* and proteoid species health will be monitored by visual assessment by a Dieback Interpreter to look for symptoms of *Phytophthora cinnamomi* on an annual basis in winter as this is when symptoms should be most evident.

3.2.4 Management Actions

M2 Prior to revegetation the areas on each site will be assessed by a Dieback Consultant.

M3 No vehicles will enter the revegetation areas and dieback hygiene for machinery and footwear prior to entry.

M4 All tools that come in contact with soil will be washed prior to entering un-infested areas.

M5 No free soil is to be transported onto the sites. Tubestock will be sourced from certified dieback-free nurseries.

M6 If watering is required at any stage the water to be applied will be taken from a *Phytophthora* free or treated source

M7 A visual Dieback Assessment will be undertaken once a year in winter by a Dieback Interpreter.

3.3 Weed Control

3.3.1 Objective

Weed control in the Revegetation Areas will be undertaken to decrease weed coverage, support establishment of revegetation and improve both biodiversity and condition of the native vegetation.

3.3.2 Priorities

Weed management will seek to prevent the establishment or seeding of any colonising exotic species in the construction footprint. Target species will include, but not be limited to:

- Weeds declared under the Biosecurity Agriculture Management Act, 2007 (BAM Act);
- Weeds listed in the in the top 30 priority environmental weeds in the Swan Coastal Plain NRM Region Environmental Weeds census and prioritisation (Bettink and Keighery, 2008) as recommended by the Department of Parks and Wildlife (DPaW); and
- Weeds considered to be local priority species by the City of Gosnells, such as Love Grass and Paddy Melons.

Weed management will be specifically targeted to avoid damage to native seedlings that are expected to arise from any natural regeneration. Weed management will be undertaken by a suitably qualified and experienced bushland weed manager, who can readily identify native species and weeds.

3.3.3 Baseline Weed Survey

Baseline weed surveys were undertaken in September and October 2017 in areas proposed for additional works under the Revegetation Management Plan. The sites were traversed on foot and the following was recorded for each priority weed species:

- Date;
- Field observers;
- Overall coverage of weeds in each quadrat using the Braun-Blanquet scale;
- Each weed species present; and
- The coverage of each separate weed species using Braun-Blanquet scale.

The Braun-Blanquet scale is:

- 1 = <5% coverage;
- 2 = 6–75% coverage; or
- 3 = 76–100% coverage.

3.3.4 Weed Management Plan

The Baseline survey identified significant environmental weeds present in each of the revegetation sites, the results of which are discussed for each Area in the following sections. A weed management plan, where it is additional to the City's scheduled works for the sites, has been prepared to guide control measures and ensure appropriate targeting of species.

Initial weed management prior to revegetation works will seek to achieve a relatively weed-free area for subsequent planting in the following winter and weed management.

3.3.5 Completion Criteria

The completion criteria for the weeds within the Revegetation Areas is to have:

- No Declared Weeds within the Revegetation Areas; and
- Overall cover estimate of <5% (1 on the Braun-Blanquet Scale) across the Revegetation Areas of identified priority weeds as determined by annual monitoring in quadrats.

3.3.6 Maintenance

Maintenance will be required to ensure effective control of weeds in the Revegetation Areas. To prevent excessive weed growth, the timing of subsequent herbicide applications or hand removal will

need to be assessed on a quarterly basis. Each priority weed species will be selectively targeted utilising the most appropriate method to control the weed species as per the Weed Management Plan. Management shall continue for three years or until the completion criterion is met, whichever is longer.

3.3.7 Management Actions

M8 Baseline weed surveys undertaken as part of the Revegetation Plans.

M9 Weed management plans for works additional to the scheduled operational works for each site to be included in the Revegetation Plans.

M10 Quarterly weed inspections will be undertaken to inform weed management activities.

M11 Management of weeds, additional to scheduled works to be reviewed on a quarterly basis for three years or until the completion criterion is met, whichever is longer.

3.4 Revegetation

3.4.1 Objective

Revegetation and rehabilitation of Completely Degraded and Degraded areas within the offset sites.

3.4.2 Flora Species

The Offset sites and surrounding intact vegetation were surveyed in September and October 2017 to develop comprehensive flora species lists and revegetation zones and prescriptions for each site. The results are shown in following sections for each site. The surrounding vegetation in the same or similar soils were recorded as reference sites to be used as the species list for each revegetation area.

3.4.3 Seed and Cutting Material Collection

Local provenance is a critical criterion for revegetation of the subject sites. Seed and cuttings to be used for growing tubestock will be sourced locally, or within nearby bushland. Reconnaissance visits will be made to nearby bushland to harvest seed to determine the species diversity and seed quantity that can be sourced in time for orders to be placed with local seed merchants or nurseries as required.

3.4.4 Planting Tubestock

All tubestock will be sourced from collected seed, cutting material or will be local provenance if procured from suppliers. Tubestock will be planted after one year of weed control has been undertaken. Plants will be placed in a random fashion in identified 'zones' to mimic natural distribution. Infill planting will occur in subsequent years as necessary to ensure the revegetation completion criteria are met.

3.4.5 Density

The densities for each revegetation area to be revegetated have been developed based on surrounding bushland strata. Burslem Drive has a large area that is proposed to have the overstorey reinstated, over the current grassed area and has densities that will establish a parkland with interspersed trees.

While it is expected that natural recruitment will occur once the weeds have been controlled, this is to be treated as a bonus, and planting densities are designed to achieve revegetation objectives.

If the density of native vegetation does not reach the completion criteria additional tubestock will be installed in subsequent winters.

3.4.6 Infill Planting

Infill planting will occur one year after initial planting and, as needed, in the subsequent year where monitoring identifies plant mortality or where the density of plantings (plants/m^2) is below the plant density completion criterion.

3.4.7 Watering

As watering can increase the survival of new seedlings by reducing water stress over the summer months. This can be achieved through periodic watering visits using a mobile watering vehicle which has the advantage of being a cost-effective method of delivering water, when needed, to required locations. To reduce the risk of mortality, watering should occur directly on planting (if planting occurs on a dry day) and once every month during the first two summers (November - February) at a rate of 2 L per plant. However, if plants are suffering drought stress, additional watering may be required.

3.4.8 Follow-up Maintenance

Areas that have been revegetated will be monitored by visual assessment each quarter and quadrat monitoring in spring. Any areas of evident plant sparsity or evidently below the density completion criterion will be infill planted with tubestock or more mature plants, whichever is appropriate.

3.4.9 Management Actions

M12 Species have been determined from surrounding areas and reference sites and are detailed in the Revegetation Plans.

M13 Seed collection and cuttings will be used to gain material for tubestock as much as possible.

M14 Any additional tubestock or seed will be local provenance.

M15 Planting will be undertaken in a random fashion within identified vegetation type zones at each revegetation site to mimic natural distribution.

M16 Densities and species diversity and proportions have been determined for each revegetation plan from surrounding vegetation and reference sites.

M17 Infill planting will occur one year after initial planting and, as needed, in subsequent years until the completion criteria are met.

M18 Irrigation will be undertaken if/when required.

3.5 Fauna Herbivory

3.5.1 Seedling protection

There is a likelihood of predation of planted tubestock by rabbits. An assessment of each site will be undertaken prior to revegetation to determine if rabbits are present. If found to be present, baiting with Pindone will be undertaken as a pre-emptive measure. Herbivory will be assessed during the course of quarterly weed management inspections. The need for ongoing rabbit management will be

determined from herbivory observations for the period of the revegetation program, and all control measures will be undertaken by an appropriately qualified contractor.

3.5.2 Management Actions

M19 Assessment of rabbit presence will be made of each site. Rabbit control by baiting will be undertaken where presence is confirmed, and maintained as required based on quarterly assessments of predation of revegetation stock.

M20 The scope of works for quarterly weed management inspections will include assessment of tubestock herbivory.

4 HUME ROAD SITE SPECIFIC REVEGETATION PLAN

4.1 Existing Vegetation

The Hume Road Wildlife Reserve contains a central area of *Melaleuca preissiana* (Paperbark) Low Woodland over *Lepidosperma longitudinale* Sedgeland within the area mapped as a wetland. Swamp Banksia (*Banksia littoralis*) is common in the wetland. The western part of the reserve, that is not wetland, contains Marri (*Corymbia calophylla*) Woodland over *Dasypogon bromeliifolius* and *Beaufortia squarrosa* understorey. Some evidence was observed of Black Cockatoos foraging use of the site. The reserve was largely burnt as a result of an arson incident in November 2016. Natural regeneration in some area is proposed to be enhanced by revegetation

The City is engaged in the revegetation of specific areas within the reserve, however several completely degraded, cleared areas remain and have not been revegetated.

4.2 Current Scheduled Works

Routine weed management is already scheduled for the entire site. Discrete areas of revegetation works have also been undertaken by the City, and are managed as such.

4.3 Additional Revegetation Planting Plan

4.3.1 Revegetation Objectives and Outcomes

There are six areas within the reserve proposed for additional works under the Revegetation Management Plan (Figure 6).

Area H1 is located on the central part of the northern boundary of the site and is 765m^2 in size. Area H1 as shown on Figure 6 is a sparsely vegetated area in the northern part of the site (Plate 7). Weed control has been undertaken by the City previously. Currently the large part of the site is bare, with some natural recruitment. The vegetation was most likely dryland vegetation prior to being degraded.

Area H1 will have infill planting of an overstorey containing Black Cockatoo foraging habitat and an understorey that will improve the habitat values in the area and connect other more vegetated parts of the Reserve.

Plate 7: Area H1



Area H2 is 207m^2. Area H3 (263m^2) is to the south (Figure 6). Areas H4 and H5 (286m^2) are two areas that will have the same treatment. Areas H4, H5 and H6 are located within low-lying parts of the site and the existing vegetation has wetland characteristics. The revegetation in these areas will enhance the wetland environments by establishing an understorey in Degraded areas and thereby improving habitat values. All three areas will be planted with species that provide habitat for Black Cockatoos. Area H6 (171m^2) contains drainage infrastructure that will remain cleared.

4.3.2 Revegetation Species

The planting plan has been designed to select appropriate species, dependent on the position in the landscape and surrounding vegetation. The species list and densities are outlined in Table 4.

Table 4: Species list Hume Road

Area	Strata	Species	Density
H1	Tree	*Banksia attenuata*	1 per 10m^2
		Banksia menziesii	
		Banksia grandis	
	Shrub	*Acacia pulchella*	1 per 1m^2
		Hibbertia hypericoides	
		Hibbertia racemosa	
		Bossiaea eriocarpa	
		Gompholobium tomentosum	
	Other (sedge, herb, climber)	*Patersonia occidentalis*	2 per 1m^2
		Kennedia prostrata	
		Conostylis aculeata	
	Shrub	*Pericalymma ellipticum*	1 per 1m^2
		Hakea varia	

Area	Strata	Species	Density
H2	Shrub	*Acacia pulchella*	1 per 1m^2
		Hakea varia	
		Jacksonia furcellata	
		Pericalymma ellipticum	
		Regelia ciliata	
	Other (sedge, herb, climber)	*Conostylis aculeata*	2 per 1m^2
		Dasypogon bromeliifolius	
H3	Shrub	*Gompholobium tomentosum*	1 per 1m^2
		Bossiaea eriocarpa	
	Other (sedge, herb, climber)	*Kennedia prostrata*	2 per 1m^2
		Conostylis aculeata	
		Dasypogon bromeliifolius	
H4	Tree	*Corymbia calophylla*	1 per 10m^2
	Shrub	*Acacia pulchella*	1 per 1m^2
		Regelia ciliata	
		Hypocalymma angustifolium	
H5	Tree	*Corymbia calophylla*	1 per 10m^2
	Shrub	*Acacia pulchella*	1 per 1m^2
		Regelia ciliata	
		Hypocalymma angustifolium	
H6	Tree	*Melaleuca preissiana*	1 per 10m^2
		Banksia littoralis	
	Shrub	*Hakea varia*	1 per 1m^2

4.4 Baseline Weed Survey

The weeds in all areas were generally low in density (1-5% coverage). Species recorded, and densities are outlined in Table 5.

Table 5: Hume Road Weeds

Area	Species	Common Name	Density (Braun Blanquet Scale)
H1	*Avena fatua*	Wild Oats	1
	Bromus diandrus	Great Brome	1
	Ehrharta longiflora	Annual Veldt Grass	1
	Gladiolus caryophyllaceus	Wild Gladiolus	1
	Oxalis pes-caprae	Sour-sob	1
	Sonchus oleraceus	Common Sowthistle	1
	Ursinia anthemoides	Solar Fire	1
H2	*Briza maxima*	Blow-fly Grass	1
	Ehrharta longiflora	Veldt Grass	1
	Gladiolus caryophyllaceus	Wild Gladiolus	1
	Hypochaeris glabra	Smooth Cats Ear	1
	Ursinia anthemoides	Solar Fire	1
	Wahlenbergia capensis	Cape Bluebell	1

Area	Species	Common Name	Density (Braun Blanquet Scale)
H3	*Avena fatua*	Wild Oats	1
	Sonchus oleraceus	Common Sowthistle	1
	Hypochaeris glabra	Smooth Cats Ear	1
	Ursinia anthemoides	Solar Fire	1
H4	*Avena fatua*	Wild Oats	2
	Fumaria capreolata	Whiteflower Fumitory	3
	Sonchus oleraceus	Common Sowthistle	1
H5	*Avena fatua*	Wild Oats	2
	Fumaria capreolata	Whiteflower Fumitory	3
	Sonchus oleraceus	Common Sowthistle	1
H6	*Avena fatua*	Wild Oats	1
	Wahlenbergia capensis	Cape Bluebell	1
	Hypochaeris glabra	Smooth Cats Ear	1
	Gladiolus caryophyllaceus	Wild Gladiolus	1
	Euphorbia terracina	Geraldton Carnation Weed	1
	Sonchus oleraceus	Common Sowthistle	1
	Ursinia anthemoides	Solar Fire	1

4.5 Additional Weed Management

Current Weed management on the site is extensive and effective. While there are a number of weeds on the site they are mostly in low densities. No additional weed management is proposed as part of this offsets package.

4.6 Additional Management

There is no management, other than the specific management actions outlined in this report, that is additionally proposed for the Hume Road Site.

5 NICHOLSON ROAD SITE SPECIFIC REVEGETATION PLAN

5.1 Existing Vegetation

The vegetation on the Nicholson Road site is mostly scattered *Melaleuca preissiana* over a low heath of *Patersonia occidentalis, Dasypogon bromeliifolius, Hypocalymma angustifolium, Lyginia barbata* and *Xanthorrhoea preissii.* Several Christmas Trees (*Nuytsia floribunda*) also occur on the site. The vegetation types indicate that vegetation is transitional between a Dampland and a dryland. The southern part of the site contains Banksia (*Banksia attenuata*) and Sheoak (*Allocasuarina fraseriana*) over Grass Trees (*Xanthorrhoea preissii*) with some Christmas Trees present (Plate 8).

Plate 8: Nicholson Road Vegetation



African Lovegrass (*Eragrostis curvula*) is present along some tracks and a few bare areas occur around the perimeter. Forest Red-tailed Black Cockatoos have been observed foraging on the Sheoak trees on the site.

5.2 Current Scheduled Works

Currently the Nicholson Road site undergoes fortnightly rubbish collection and weed control every three weeks. No revegetation is currently scheduled for the site.

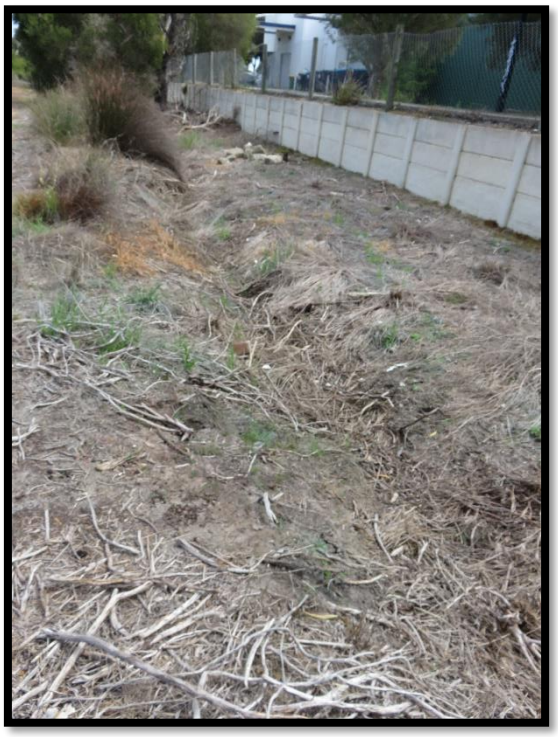
5.3 Additional Revegetation

5.3.1 Revegetation Objectives and Outcomes

There are two areas within the reserve proposed for additional works under the Revegetation Management Plan (Figure 7).

Area N1 is located on the northern boundary of the site (Figure 7) and has some function as a drainage swale (Plate 9). Area N1 is 654m^2 in size and contains several scattered *Acacia saligna* and *Melaleuca* trees. This part of the site will be rehabilitated to create a functioning ecosystem as well as maintaining a drainage function. The focus will be on wetland species that enhance the drain while not increasing the fire hazard to surrounding development.

Plate 9: Area N1



There is a redundant fire access track on the southern boundary of the site that comprises Area N2 (1573m^2) (Figure 7). The site is sparsely vegetated in areas due to some natural recruitment (Plate 10) and bare in others.

Plate 10: Area N2



Area N2 contains an informal BMX track that has been constructed to include small jumps (Plate 11).

Plate 11: BMX track on the Nicholson Road site



Area N2 will be revegetated to reflect upland vegetation. The revegetation of the site will provide an additional 1573m^2 of foraging habitat for Black Cockatoos and improved environmental values.

5.3.2 Revegetation Species

The planting plan has been designed to select appropriate species, dependent on the position in the landscape and surrounding vegetation. The species list and densities are outlined in Table 6.

Table 6: Species list for the Nicholson Road Site

Area	Strata	Species	Density
N1	Shrub	*Adenanthos obovatus*	1 per 1m^2
		Hakea varia	
		Astartea affinis	
		Acacia pulchella	
		Hypocalymma angustifolium	
	Other (sedge, herb, climber)	*Dasypogon bromeliifolius*	2 per 1m^2
		Juncus pallidus	
N2	Tree	*Banksia attenuata*	1 per 10m^2
		Banksia menziesii	
	Shrub	*Acacia pulchella*	1 per 1m^2
		Hemiandra pungens	
		Gompholobium tomentosum	
		Jacksonia furcellata	
	Other (sedge, herb, climber)	*Patersonia occidentalis*	2 per 1m^2
		Dasypogon bromeliifolius	

5.4 Baseline Weed Survey

The weeds in all areas of the Nicholson Road Site were generally low in density (1-5% coverage). Species recorded, and densities are outlined in Table 7.

Table 7: Nicholson Road Weeds

Area	Species	Common Name	Density (Braun Blanquet Scale)
N1	*Ehrharta longiflora*	Annual Veldt Grass	1
	Sonchus oleraceus	Common Sowthistle	1
	Solanum nigrum	Blackberry Nightshade	1
	Arctotheca calendula	Capeweed	1
N2	*Briza minor*	Shivery Grass	1
	Ehrharta calycina	Veldt Grass	1
	Arctotheca calendula	Capeweed	1
	Gladiolus caryophyllaceus	Wild Gladiolus	1
	Hypochaeris glabra	Smooth Cats Ear	1
	Sonchus oleraceus	Common Sowthistle	1
	Ehrharta longiflora	Annual Veldt Grass	1

5.5 Additional Weed Management

Weed management on the site is extensive and well executed. No additional weed management is proposed under this offset plan.

5.6 Additional Management

5.6.1 Rubbish removal

The Nicolson Road site in Area N1 has a large amount of debris including dead tree matter and rubbish (Plate 12 and 13).

Plate 12: Dead Tree in Area N1



Plate 13: Rubbish dumped in N1



The debris will be removed prior to the commencement of revegetation activities.

5.6.2 Recontouring

The BMX track is located on a redundant fire access track that is to be included in the revegetation areas and contains small undulations. This area will be sensitively recontoured to remove the jumps, avoiding impacting on any native species prior to being revegetated.

5.6.3 Access Restriction

The presence of the BMX track on the south-western boundary will mean that Area N2 will require further access restriction. If the revegetation is being impacted by access, star-picket and ringlock fencing will be installed on the perimeter of the revegetation area to try and discourage access that damages the establishing plants.

5.6.4 Management Actions

M21 Remove debris from Area N1 prior to revegetation, including dumped rubbish and excessive woody biomass

M22 Recontour BMX jumps in Area N2 to reinstate natural levels, avoiding impacts on native vegetation.

M23 If revegetation of Area N2 is affected by ongoing access, a star-picket and ringlock fence will be installed around the perimeter of the revegetated track to protect the revegetated area.

6 SANDMARTIN DRIVE SITE SPECIFIC REVEGETATION PLAN

6.1 Existing Vegetation

The Sandmartin Drive site mostly contains wetland vegetation with an inner area of *Hypocalymma angustifolium* Heath (Plate 14) surrounded by taller thickets of Spearwood (*Kunzea glabrescens*) and Paperbark (*Melaleuca preissiana*). Dense *Acacia saligna* stands occur along the northern boundary.

Plate 14: Sandmartin Drive Vegetation.



6.2 Current Scheduled Works

Current maintenance in Sandmartin Drive Reserve includes weed control every three months. Other works include brush-cutting of weedy edges and the hand removal of weeds. There is a small amount of Victorian tea tree in the north-east corner that requires removal which is within the scope of the City's current maintenance regime. No revegetation works are scheduled for the site under the City's maintenance regime.

6.3 Additional Revegetation

6.3.1 Revegetation Objectives and Outcomes

There are ten areas in the Sandmartin Drive Site that have been designated for additional weed control and/or revegetation (Figure 8).

Area S1 is located on the southern corner of the site and is 820m^2 (Figure 8). The area contains the environmental woody weeds *Acacia iteaphylla* and *A. longifolia*. The woody weeds will be removed and the area recontoured to more natural levels. The area is dryland and will be revegetated with Black Cockatoo foraging species in the overstorey. Monitoring of this area will include surveillance for *A. iteaphylla and A. longifolia* seeding regrowth.

Area S2 is made up of two small areas totalling 729m^2 and are wetland areas (Figure 8). The eastern parcel is located near a stormwater drain that contains water for much of the year. The revegetation of Area S2 will result in an area of wetland that is Completely Degraded to be restored to a functioning ecosystem and provide fauna habitat.

Area S3 is located on the western corner of the site (Figure 8) and is 239m^2. This is an upland area and will be revegetated to provide foraging and, in the future, potential breeding habitat for Black Cockatoos.

Area S4 and S5 are 460m^2 and 333m^2 respectively and have an intact overstorey and will have weed control only. These areas are in Good condition and weeds will be managed to encourage natural revegetation. Area S5 is adjacent to Area S4 and is also a wetland area.

Area S6 had evidence of bandicoots and the additional understory will provide an enhanced 200m^2 of habitat for this species. Area S6 is located in wetland vegetation in the northern central part of the site (Figure 8). Area S7 is 448m^2 in in the northern corner of the site and contains a large amount of wild oats. These weeds will be removed from the area improving the ability for the understory to grow. Area S8 (168m^2)is located in the eastern corner of the site and contains a number of woody weeds that will be managed and then revegetated with native species, improving the vegetation in this area.

Areas S9 and S10 are in the central part of the Sandmartin Drive Site (Figure 8) and are 57.8 and 50.5m^2 respectively. Area S9 will be weeded and revegetated with wetland species. Area S10 has some weeds which will be removed.

6.3.2 Revegetation Species

The planting plan has been designed to select appropriate species, dependent on the position in the landscape and surrounding vegetation. The species list and densities are outlined in Table 8.

Table 8: Species list for the Sandmartin Drive Site

Area	Strata	Species	Density
S1	Tree	*Melaleuca preissiana*	1 per 10m^2
	Shrub	*Hypocalymma angustifolium*	1 per 1m^2
		Pericalymma ellipticum	
		Acacia pulchella	
		Kunzea glabrescens	
	Other (sedge, herb, climber)	*Dasypogon bromeliifolius*	1 per 1m^2
S2	Tree	*Banksia attenuata*	1 per 10m^2
		Banksia menziesii	
		Corymbia calophylla	
	Shrub	*Acacia pulchella*	1 per 1m^2
		Kunzea glabrescens	
S3	Tree	*Banksia attenuata*	1 per 10m^2
		Eucalyptus marginata	
		Banksia menziesii	
	Shrub	*Acacia pulchella*	1 per 1m^2
		Calothamnus quadrifidus	

Area	Strata	Species	Density
		Jacksonia furcellata	
S5	Tree	*Melaleuca preissiana*	1 per 10m^2
	Shrub	*Acacia pulchella*	1 per 1m^2
		Kunzea glabrescens	
		Hypocalymma angustifolium	
S6	Shrub	*Astartea affinis*	1 per 1m^2
		Hypocalymma angustifolium	
S8	Tree	*Melaleuca preissiana*	1 per 10m^2
	Shrub	*Astartea affinis*	1 per 1m^2
		Hypocalymma angustifolium	
		Jacksonia furcellata	
	Other (sedge, herb, climber)	*Dasypogon bromeliifolius*	1 per 1m^2
S9	Tree	*Melaleuca preissiana*	1 per 10m^2
	Shrub	*Astartea affinis*	1 per 1m^2
		Hypocalymma angustifolium	
		Kunzea glabrescens	

6.4 Baseline Weed Survey

Weeds occur along tracks and next to the drain that runs through the southern part of the site. Weeds include Fleabane, Blackberry Nightshade (*Solanum nigrum*), Prickly Lettuce (*Lactuca serriola*), Melon (*Citrullus lanatus*), Bushy Stinkwort (*Dittrichia graveolens*), and the woody weeds Flinders Range Wattle (*Acacia iteaphylla*) (Plate 15), Sydney Golden Wattle (*Acacia longifolia*) and Victorian Teatree *Leptospermum laevigatum*.

Plate 15: Flinders Range Wattle (*Acacia iteaphylla*) on the Sandmartin Drive site



The weed species recorded, and densities are outlined in Table 9.

Table 9: Sandmartin Drive Weeds

Area	Species	Common Name	Density (Braun Blanquet Scale)
S1	*Avena fatua*	Wild Oats	1
	Acacia longifolia	Sydney Golden wattle	2
	Wahlenbergia capensis	Cape Bluebell	1
	Solanum nigrum	Blackberry Nightshade	1
	Brassica tournefortii	Mediterranean Turnip	2
	Trifolium sp.	Clover	2
	Arctotheca calendula	Capeweed	1
	Lupinus cosentinii	Blue Lupins	1
	Euphorbia terracina	Geraldton Carnation Weed	2
	Sonchus oleraceus	Common Sowthistle	1
	Ursinia anthemoides	Solar Fire	1
S2	*Carpobrotus edulis*	Pigface	1
	Ehrharta longiflora	Veldt Grass	2
	Gladiolus caryophyllaceus	Wild Gladiolus	1
	Wahlenbergia capensis	Cape Bluebell	1
	Euphorbia terracina	Geraldton Carnation Weed	2
	Eragrostis curvula	African Love Grass	2
	Lupinus cosentinii	Blue Lupins	1
	Lolium rigidum	Ryegrass	2
S3	*Sonchus oleraceus*	Common Sowthistle	1
	Trifolium sp.	Clover	2
	Ehrharta longiflora	Veldt Grass	2
	Fumaria capreolata	Whiteflower Fumitory	2
S4	*Fumaria capreolata*	Whiteflower Fumitory	2
	Sonchus oleraceus	Common Sowthistle	1
	Ehrharta longiflora	Veldt Grass	2
S5	*Fumaria capreolata*	Whiteflower Fumitory	2
	Acacia longifolia	Sydney Golden Wattle	2
	Leptospermum laevigatum	Victorian Tea Tree	2
	Sonchus oleraceus	Common Sowthistle	1
	Trifolium sp.	Clover	1
S6	*Avena fatua*	Wild Oats	2
	Hypochaeris glabra	Smooth Cats Ear	1
	Sonchus oleraceus	Common Sowthistle	1
	Ursinia anthemoides	Solar Fire	1
S7	*Avena fatua*	Wild Oats	2
S8	*Avena fatua*	Wild Oats	2
	Fumaria capreolata	Whiteflower Fumitory	3
	Acacia longifolia	Sydney Golden Wattle	2
	Leptospermum laevigatum	Victorian Tea Tree	2

Area	Species	Common Name	Density (Braun Blanquet Scale)
	Sonchus oleraceus	Common Sowthistle	1
S9	*Avena fatua*	Wild Oats	1
	Acacia iteaphylla	Finders Range Wattle	2
	Acacia longifolia	Sydney Golden Wattle	2
	Leptospermum laevigatum	Victorian Tea Tree	2
	Euphorbia terracina	Geraldton Carnation Weed	2
	Fumaria capreolata	Whiteflower Fumitory	1
	Gladiolus caryophyllaceus	Wild Gladiolus	1
	Hypochaeris glabra	Smooth Cats Ear	1
	Sonchus oleraceus	Common Sowthistle	1
	Ursinia anthemoides	Solar Fire	1
	Wahlenbergia capensis	Cape Bluebell	1
S10	*Cyperus tenuiflorus*	Scaly Sedge	2
	Eragrostis curvula	African Lovegrass	2

6.5 Weed Management

6.5.1 Weed Management Objectives and Outcomes

The Sandmartin Drive site has areas of weed infestation that are impacting on the vegetation condition, particularly on the boundary of the site. The removal of woody weeds and increased weed management regime will decrease the weed coverage on the site. Decreased weed coverage will improve the chances of successful revegetation as well as allowing for natural recruitment of native species from the surrounding area.

6.5.2 Additional Weed Management

The City currently schedules a basic three-monthly weed management regime that will include the Victoria Tea tree removal in 2018. This regime will not, though, be sufficient to improve the environmental values of the site. To enhance the environmental values on the site, it is proposed under this Plan to double the frequency of weed management on the site prior to, and during, the three-year period of revegetation activities. The additional weed control will ensure that once the revegetation is complete the site will be able to be maintained in its improved condition using the City's routine maintenance regime.

Area S4 identified on the western boundary of the site (Figure 8) is 164m^2 and will have weed management only. Area S7, located in the norther corner of the site (Figure 8) will also be subject to weed management only. These areas are densely vegetated with native overstorey over weeds. The management of the weeds has the goal of promoting natural recruitment of native species and improve the wetland values of this area.

Area S8 is 164m^2 located in the eastern corner of the site (Figure 8) has woody weeds present, of which the Victorian Tea-tree is scheduled for removal. As part of the revegetation plan the introduced *Acacia* species will also be removed to allow for native species to re-establish in the area.

The Sydney Golden Wattle (*Acacia longifolia*) on the site will be removed by hand pulling seedlings. The mature shrubs will be felled and treated with 250 ml Access® in 15 L of diesel to basal 50 cm of trunk, or cut and paint or drill and fill with 50% glyphosate as recommended by Parks and Wildlife Service (PaWS) on Florabase (PaWS, 2017). The Flinders Range Wattle (*Acacia iteaphylla*) does not sprout or produce root suckers so this species requires only felling (PaWS, 2017). All branches from felled shrubs will be removed from the site.

Any seedlings that may establish on the site subsequently will be hand pulled as recommended by PaWS (PaWS, 2017).

6.5.3 Management Actions

M24 The frequency of weed control on the Sandmartin Drive site will be doubled (to every six weeks) for the duration of the revegetation program, using the City's scheduled regime.

M25 Prior to revegetation the Sydney Golden Wattle and Flinders Range Wattle will be felled.

M26 Mature shrubs of the Sydney Golden Wattle will be treated as recommended by PaWS.

M27 All branches from felled weedy wattle shrubs will be removed from the site.

M28 Any seedlings that may establish on the site subsequently will be hand pulled during subsequent weed control efforts.

6.6 Additional Management

The City proposes under this Plan to provide additional management that will enhance the environmental values of the Sandmartin Drive site.

6.6.1 Topographical Re-instatement

The northern part of the site contains several piles of sand that are not naturally occurring. The areas are Completely Degraded and generally bare (Plate 16). The piles will be recontoured prior to revegetation activities to resemble the natural ground level. Soil may be removed from the site if it is not able to be redistributed to areas that have been excavated in the past. The recontouring will be executed by small machinery such as a Kanga or Bobcat to ensure the surrounding native vegetation is not impacted by the works.

Plate 16: Sand pile on the Sandmartin Drive site



6.6.2 Management Actions

M29 Recontour filled areas prior to revegetation activities to resemble the natural ground level

M30 Recontouring to be done by small machinery to avoid damaging existing native vegetation

M31 Any vegetation inadvertently cleared during the recontouring will be replaced during revegetation works

7 BURSLEM DRIVE SITE SPECIFIC REVEGETATION PLAN

7.1 Existing Vegetation

The Burslem Drive site consists of two areas. Area B1 is Completely Degraded lawn area (Plate 17) located in the northern part of the site adjacent to Burslem Drive (Figure 9). The B1 grassed area contains scattered Marri trees.

Plate 17: Area B1



Vegetation in the riverbank part of the Burslem Drive site (Area B2) (Figure 9) is dominated by an overstorey of Flooded Gum (*Eucalyptus rudis*) and Paperbark (*Melaleuca rhaphiophylla*) but has a high coverage of weeds, including Declared weeds and woody weeds in the understorey (Plate 18).

Plate 18: Flooded Gum overstorey over weeds on the Burslem Drive site



7.2 Current Scheduled Works

The Burslem Drive site is currently under the management of the WAPC and the City. Management largely comprises slashing of perimeter weeds and maintenance of the extensive dry grassed area. The City does not have any scheduled enhancement works for the site.

7.3 Fencing

7.3.1 Objective

Installation and maintenance of fencing of revegetation areas to control access to establishing plants.

7.3.2 Fencing Type

As per City Guidelines (Appendix 2) Rural Style Fencing is used to protect environmental assets. In accordance with the City's specification a fence will be installed around the revegetation area of the Burslem Drive site consisting of a treated Pine and 7-Line Ringlock or equivalent fence. A gate will be included to provide access for maintenance works.

7.3.3 Fencing Installation

The fence will be installed in accordance with the City's Specification (Appendix 2) prior to the commencement of planting. The fencing alignment will be designed on the boundary of the B2 area and will be placed so that there is no disturbance to any native vegetation.

7.3.4 Monitoring and Maintenance

Maintenance by the City of the fence around the Burslem Drive Site will include:

- Inspection every two months (with relevant inspections timed for after school holidays when the bulk of the damage is done);
- Recording the locations of the damage; and
- If required organising repairs by the fencing contractor.

7.3.5 Completion Criteria

The fence will be maintained for a period of at least 3 years, or until the completion criteria for the B1 areas are reached, following which it will be removed.

7.3.6 Management Actions

M32 Installation of fencing around the revegetation area prior to planting (B1) as per the City's specification and removal after 3 years or when completion criteria are satisfied.

M33 Two monthly inspection of the fence and undertake all repairs as necessary.

7.4 Revegetation

7.4.1 Revegetation Objectives and Outcomes

Area B1 (Figure 9) in the Burslem Drive site is Completely Degraded. The parkland setting will be enhanced with the planting of an overstorey consisting of native endemic tree species that will provide habitat for Black Cockatoos. The grass will be partially maintained under the trees, with mulched areas

around tree groups and slashed grass in between. The outcome of the revegetation in this area will be an additional 1.8ha of Black Cockatoo foraging habitat, roosting habitat and future potential breeding habitat.

7.4.2 Revegetation Species

The species list and densities are outlined in Table 10.

Table 10: Species list for the Burslem Drive Site

Area	Strata	Species	Density
B1	Tree	*Corymbia calophylla*	1 per 7.5m^2
		Banksia attenuata	
		Eucalyptus rudis	
		Banksia menziesii	
		Allocasuarina fraseriana	

7.5 Watering

7.5.1 Watering Requirement

Irrigation can increase the survival of new seedlings by reducing water stress over the summer months. This can be achieved through periodic watering visits using a mobile watering vehicle which has the advantage of being a cost-effective method of delivering water, when needed, to required locations. To reduce the risk of mortality within the B1 Area, watering will occur directly on planting (if planting occurs on a dry day) and once every month during the first two summers (November - February) at a rate of 2 L per plant. However, if plants are suffering drought stress, additional watering may be required.

7.5.2 Management Actions

M34 Watering will be undertaken if/when required for trees planted in the B1 Area.

7.6 Baseline Weed Survey

Area B1 is completely covered in lawn with weed species present (Table 11).

Table 11: Area B1 Burslem Drive Weeds

Area	Species	Common Name	Density (Braun Blanquet Scale)
B1	*Lotus subbiflorus*	Hairy Bird's-foot Trefoil	2
	Hypochaeris glabra	Smooth Cats Ear	1
	Eragrostis curvula	African Love Grass	2
	Avena fatua	Wild Oats	1
	Lolium rigidum	Ryegrass	1

Area B2 has a dense understorey of weeds, particularly Arum Lily (Plate 19) and some woody weeds make up part of the canopy (Table 12).

Plate 19: Arum Lily in Area B2



Table 12: Area B2 Burslem Drive Weeds

Area	Species	Common Name	Prioritisation	Density
B2	*Zantedeschia aethiopica*	Arum Lily	Declared Weed	2
	Schinus terebinthifolius	Brazilian Pepper	Woody Weed	2
	Ficus carica	Edible Fig	Woody weed	1
	Watsonia meriana var. *bulbillifera*	Bugle Lily	Swan NRM	2
	Gomphocarpus fruticosus	Narrow-leaf cotton bush	Declared Weed	1
	Eragrostis curvula	African Love Grass	Local Priority Weed	1

7.7 Weed Management

7.7.1 Weed Management Objectives and Outcomes

The management of weeds in Area B1 will reduce unwanted weeds within the Parkland area and retain the lawn of Kikuyu (*Cenchrus clandestinus*). The Burslem Drive site has quite extensive weed infestations including Declared weeds in Area B2. Weed control will be undertaken to decrease weed coverage and improve both biodiversity and condition of the native vegetation within the vegetated watercourse.

7.7.2 Priorities

There are many weed species in both Area B1 and B2. Area B1 will be cleared of weeds prior to revegetation which will require the topical application of appropriate selective herbicides to ensure the retention of the Kikuyu. Area B2 however is thickly vegetated and is unlikely to be completely cleared of weeds. The weeding efforts will be focused on identified priority species.

7.7.3 Weed Treatments

The majority of the recommended methods for controlling the identified priority weeds are published on Florabase. The optimum timing for treatment is also shown. Weed control methods for Declared Weeds and priority weeds as outlined in Swan NRM Region Environmental Weeds census and prioritisation and identified by the City as Local Priority Weeds are outlined in Table 13.

Table 13: Priority Weed Treatment Matrix

Species	Methods	Timing
Arum lily (*Zantedeschia aethiopica*)	Spot spray metsulfuron methyl 0.4 g/15 L of water (or 5g /ha) + 225 mL glyphosate + Pulse®	July to September
Narrow-leaf cotton bush (*Gomphocarpus fruticosus*)	Foliar spray with 1.5% glyphosate or try cut and paint using 50% glyphosate	September to December
Brazilian Pepper (*Schinus terebinthifolius*)	Stem inject older plants using 50% glyphosate or basal bark with 250 ml Access® in 15 L of diesel to bottom 50 cm of trunk	December to March
Edible Fig (*Ficus carica*)	Stem inject with 50% glyphosate and foliar spray regrowth with 10% glyphosate. For stems less than 30 cm diameter apply 250 ml Access® in 15 L of diesel to basal 50 cm of trunk (basal bark)	December to February
Bugle Lily (*Watsonia meriana* var. *bulbillifera*)	Wipe individual leaves with glyphosate 10% or spray dense infestations 2,2-DPA 10 g/L + Pulse®. Apply just as flower spikes emerge at corm exhaustion	September
African Love Grass (*Eragrostis curvula*)	Spray with 1-2% glyphosate when plants are green and actively growing. Following fire spray regrowth when 5-10 cm high	November to May

Woody weeds within the B2 area will be treated as per Table 13 using stem injection and basal bark treatments however due to the large amount of biomass of woody weeds in the area the majority of the stems will remain *in situ*.

7.7.4 Management Actions

M35 Area B1 to be treated with a topical application of appropriate selective herbicides to ensure the retention of the Kikuyu.

M36 Area B2 to have priority weeds managed in accordance with PaWS recommendations.

M37 Woody weeds will be treated as per PaWS recommendations and the biomass will remain *in situ*.

8 MONITORING

8.1 Monitoring Requirements

Monitoring will be undertaken to assess the success of weed control in eradicating significant environmental weeds across the whole Revegetation Areas, reduction of cover of non-declared weeds in the Revegetation Areas to <5% and promotion of the recovery of native species.

Weeds will be visually assessed every quarter in areas designated for additional weed control, for the first two years to directly inform weed management. This assessment will be undertaken by traversing broad transects to record what is emerging and where to direct weed control contractors to areas and species that require maintenance.

Weed coverage will also be recorded during the monitoring of quadrats for rehabilitation and existing vegetation.

Areas that are planted with tubestock will be visually assessed every three months in Summer, Autumn, Winter and Spring until the completion criteria are met. This assessment will be undertaken by traversing transects to record what is emerging and/or tubestock survival and health, any evidence of herbivory and where to direct infill planting the following Autumn.

Annual monitoring in each designated area within the offset sites will include the visual assessment as outlined above and will also include:

- One permanent 10mx10m quadrat to be monitored annually in each offset area; and
- One permanent photo point to be monitored annually over each of the offset areas.

The following will be recorded in the quadrats:

- All species present (seeded, tubestock or established naturally);
- Stem count for native species;
- Weed coverage;
- Percentage bare soil;
- Species frequency (numbers of individuals of each species present);
- All weed species present; and
- Any observations regarding plant health and evidence of herbivory.

8.2 Management Actions

M38 Visual assessment of weeds every quarter in areas designated for weed control

M39 Quarterly assessments of tubestock health and herbivory

M40 One quadrat and one photo point to be monitored in each Area annually

9 SUMMARY OF MANAGEMENT ACTIONS

Table 14 outlines the management actions to be undertaken to implement the Revegetation Management Plan.

Table 14: Summary of Management Actions

No.	Management Action
Augering	
M1	Augurs will be used to plant tubestock in compacted areas except on the edge of track on the Hume Road Site to avoid orchid species.
***Phytophthora* Dieback**	
M2	Prior to revegetation the areas on each site will be assessed by a Dieback Consultant.
M3	No vehicles will enter the revegetation areas and dieback hygiene for machinery and footwear prior to entry.
M4	All tools that come in contact with soil will be washed prior to entering un-infested areas.
M5	No free soil is to be transported onto the sites. Tubestock will be sourced from certified dieback-free nurseries.
M6	If watering is required at any stage the water to be applied will be taken from a *Phytophthora* free or treated source
M7	A visual Dieback Assessment will be undertaken once a year in winter by a Dieback Interpreter.
Weed Control	
M8	Baseline weed surveys undertaken as part of the Revegetation Plans.
M9	Weed management plans for works additional to the scheduled operational works for each site to be included in the Revegetation Plans.
M10	Quarterly weed inspections will be undertaken to inform weed management activities.
M11	Management of weeds, additional to scheduled works to be reviewed on a quarterly basis for three years or until the completion criterion is met, whichever is longer.
Revegetation	
M12	Species have been determined from surrounding areas and reference sites and are detailed in the Revegetation Plans.
M13	Seed collection and cuttings will be used to gain material for tubestock as much as possible.
M14	Any additional tubestock or seed will be local provenance.

No.	Management Action
M15	Planting will be undertaken in a random fashion within identified vegetation type zones at each revegetation site to mimic natural distribution.
M16	Densities and species diversity and proportions have been determined for each revegetation plan from surrounding vegetation and reference sites.
M17	Infill planting will occur one year after initial planting and, as needed, in subsequent years until the completion criteria are met.
M18	Irrigation will be undertaken if/when required.
Fauna Herbivory	
M19	Assessment of rabbit presence will be made of each site. Rabbit control by baiting will be undertaken where presence is confirmed, and maintained as required based on quarterly assessments of predation of revegetation stock.
M20	The scope of works for quarterly weed management inspections will include assessment of tubestock herbivory.
Nicholson Road	
M21	Remove debris from Area N1 prior to revegetation, including dumped rubbish and excessive woody biomass
M22	Recontour BMX jumps in Area N2 to reinstate natural levels, avoiding impacts on native vegetation.
M23	If revegetation of Area N2 is affected by ongoing access, a star-picket and ringlock fence will be installed around the perimeter of the revegetated track to protect the revegetated area.
Weed Management Sandmartin Drive	
M24	The frequency of weed control on the Sandmartin Drive site will be doubled (to every six weeks) for the duration of the revegetation program, using the City's scheduled regime.
M25	Prior to revegetation the Sydney Golden Wattle and Flinders Range Wattle will be felled.
M26	Mature shrubs of the Sydney Wattle will be treated as recommended by PaWS.
M27	All branches from felled weedy wattle shrubs will be removed from the site.
M28	Any seedlings that may establish on the site subsequently will be hand pulled during subsequent weed control efforts.
Additional Management Sandmartin Drive	
M29	Recontour filled areas prior to revegetation activities to resemble the natural ground level
M30	Recontouring to be done by small machinery to avoid damaging existing native vegetation

No.	Management Action
M31	Any vegetation inadvertently cleared during the recontouring will be replaced during revegetation works
Fencing Burslem Drive	
M32	Installation of fencing around the revegetation area prior to planting (B1) as per the City's specification
M33	Two monthly inspection of the fence and undertake all repairs as necessary.
Watering Burslem Drive	
M34	Watering will be undertaken if/when required for trees planted in the B1 Area.
Weed Management Burslem Drive	
M35	Area B1 to be treated with a topical application of appropriate selective herbicides to ensure the retention of the Kikuyu.
M36	Area B2 to have priority weeds managed in accordance with PaWS recommendations.
M37	Woody weeds will be treated as per PaWS recommendations and the biomass will remain *in situ*.
Monitoring	
M38	Visual assessment of weeds every quarter in areas designated for weed control
M39	Quarterly assessments of tubestock health and herbivory
M40	One quadrat and one photo point to be monitored in each Area annually

10 SCHEDULE OF WORKS

This project is scheduled for three years with monitoring and works being undertaken for three years as per the schedule outlined in Table 15 and 16. Once the completion criteria are met the final years' works schedule will be implemented (Table 17).

Table 15: Implementation schedule: Preliminary Activities

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Green stock procurement												
Cuttings collection												
Seed collection												
Plant propagation												
Weed control – As per scheduled works or outlined in the revegetation plans												
Glyphosate												
Selective grass												
Manual removal												
Additional weed control as required												

Table 16: Implementation Schedule Years 1 to 3 (actual revegetation)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Weed control – As per scheduled works or outlined in the revegetation plans												
Glyphosate												
Selective grass												
Manual removal												
Additional weed control as required												
Revegetation												
Planting												
Watering												
All revegetation areas except wetland areas												
Wetland areas (If required)												
Monitoring												
All revegetation areas												
Maintenance												
All revegetation areas												
Green Stock Procurement - infill planting if required												
Cuttings collection												
Seed collection												
Plant propagation												
Tubestock procurement												

Table 17: Implementation Schedule – Final Year

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Weed control – As per scheduled works or outlined in the revegetation plans												
Glyphosate												
Selective grass												
Manual removal												
Additional weed control as required												
Monitoring												
All revegetation areas												
Maintenance												
All revegetation areas												

11 COMPLETION CRITERIA

The following targets will be used to assess the performance of the rehabilitation and identify areas that require additional seeding/planting:

- Species representation (establishment of at least 85% of species planted in each area);
- Survival of seedlings (85% survival of tube-stock);
- A native vegetation achieving a minimum average of 2 stems per square metre (reflective of surrounding vegetation); and
- Potential ability to achieve maturity in the future (a subjective measure based on visual assessment of species composition, plant density and plant health) documented through the quarterly visual monitoring.

Infill planting and additional weed control in accordance with the detailed revegetation plan will be undertaken until the criteria have been met in each site.

12 OUTCOMES

Reaching the Completion Criteria for each of the areas on each site will result in improved environmental values over each of the offset sites. The improved vegetation and decreased bare areas will have a positive impact on the habitat values for terrestrial fauna species and avifauna.

Table 18 outlines the specific outcomes for each of the areas.

Table 18: Outcomes for the Offset Sites

Site	Area	Total Area (m^2)	Current Condition	Final Condition	Weed Control Area (m^2)	Revegetation Area (m^2)	Wetland Vegetation (m^2)	Upland Vegetation (m^2)	Black Cockatoo Habitat (m^2)
Hume Road	H1	765.1	Degraded	Good to Very Good	0.0	765.1	0.0	765.1	765.1
	H2	206.9	Degraded	Good to Very Good	0.0	206.9	206.9	0.0	206.9
	H3	262.9	Degraded	Good to Very Good	0.0	262.9	262.9	0.0	0.0
	H4 and H5	286.4	Degraded	Good to Very Good	0.0	286.4	286.4	0.0	286.4
	H6	170.9	Degraded	Good to Very Good	0.0	170.9	170.9	0.0	170.9
Nicholson Road	N1	653.7	Completely Degraded	Good to Very Good	0.0	653.7	653.7	0.0	0.0
	N2	1573.1	Degraded	Good to Very Good	0.0	1573.1	0.0	1573.1	1573.1

Site	Area	Total Area (m^2)	Current Condition	Final Condition	Weed Control Area (m^2)	Revegetation Area (m^2)	Wetland Vegetation (m^2)	Upland Vegetation (m^2)	Black Cockatoo Habitat (m^2)
Sandmartin Drive	S1	819.7	Completely Degraded	Good to Very Good	819.7	819.7	0.0	819.7	819.7
	S2	728.7	Completely Degraded	Good to Very Good	728.7	728.7	728.7	0.0	0.0
	S3	238.8	Completely Degraded	Good to Very Good	238.8	238.8	0.0	238.8	238.8
	S4	459.7	Degraded	Good to Very Good	459.7	0.0	0.0	0.0	0.0
	S5	332.7	Good	Good to Very Good	332.7	332.7	332.7	0.0	0.0
	S6	200.4	Degraded	Good to Very Good	200.4	200.4	200.4	0.0	0.0
	S7	448.8	Good	Very Good	448.8	0.0	0.0	0.0	0.0
	S8	163.8	Degraded	Very Good	163.8	163.8	163.8	0.0	0.0
	S9	57.8	Very Good	Very Good	57.8	57.8	57.8	0.0	0.0
	S10	50.5	Very Good	Very Good	50.5	0.0	0.0	0.0	0.0
Burslem Drive	B1	19001.8	Completely Degraded	Degraded (Parkland Overstorey)	0.0	19001.8	0.0	19001.8	19001.8
	B2	87912.5	Degraded to Good	Good to Very Good	87912.5	0.0	0.0	0.0	0.0
Total (ha)		**11.43**			**9.14**	**2.54**	**0.31**	**2.23**	**2.31**

13 FUNDING, REPORTING AND REVIEW

13.1 Funding and Management

Funding for the implementation of the Revegetation Management Plan is the responsibility of the City of Gosnells, as is the management of the implementation of the Plan.

Cost estimates for the implementation of the management plan are outlined in Table 19. Costs do not include any GST and are indicative only. Seasonal conditions and other variables have the ability to impact significantly on the costs of the revegetation. The funding in Table 19 is additional to any current management expenditure on the sites.

Table 19: Cost estimates

Task	Year 1	Year 2-3 (total of 2 years)
Green stock procurement	$56,394.50	$33,836.70
Weed control	$11,041.80	$16,562.70
Planting (Year 1) and Infill planting all areas	$39,476.15	$23,685.70
Fertiliser tablet supply and install	$11,278.90	$6,767.34
Pindone Baiting (Nominal)	$10,000.00	$10,000.00
Watering	$10,000.00	$20,000.00
Monitoring	$5,000.00	$10,000.00
Additional management - Nominal fee	$50,000.00	$40,000.00
Total	$193,191.35	$160,852.44
TOTAL (Excluding any additional years of management)		**$354,043.79**

13.2 Reporting

Results from all monitoring will be recorded and compared to the completion criteria. Results will be reviewed on an annual basis. The City will report to the DWER and/or PaWS as required.

13.3 Review

If after five years the Revegetation Management Plan has not been implemented the strategy may be reviewed.