ANNUAL COMPLIANCE REPORT

Vasse Diversion Drain

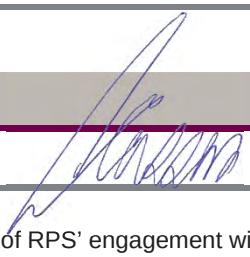
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1 INTRODUCTION

The Vasse Diversion Drain (VDD) is a 100-year-old infrastructure (drainage) corridor, originally constructed in the 1920s to create more arable land. Now, its primary function is to prevent flooding of the Busselton township and surrounds. The drain diverts flows from the catchments of the Vasse and Sabina rivers, extending approximately 6.3 kilometres (km) from Geography Bay to the Busselton golf course, flowing through agricultural, light industrial, urban land uses and sensitive ecological environments.

The drain did not meet the flood mitigation requirement determined by the Busselton Flood Management Steering Committee and state cabinet; hence Water Corporation has upgraded the VDD to improve flood protection outcomes. The VDD upgrade works included:

- Construction of an overflow structure upstream of the Vasse River Diversion Dam (VRDD), identified as the Vasse River Overflow Structure (VROS)
- Widening and full reconstruction of the VDD levee banks
- Duplication of the existing culverts, increasing flow capacity into the Lower Vasse River (per Department of Water and Environmental Regulation (DWER) specifications)
- Installation of an improved gauging station (per DWER specification and requirements).

The VDD upgrade works were referred to the then Commonwealth Department of Agriculture, Water and the Environment[1] (DAWE) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) in May 2017. The Water Corporation received approval of EPBC 2017/7932 in September 2020 (Appendix A).

A clearing permit application for the VDD upgrade works was prepared in September 2018. Clearing permit (CPS 8191/1) was subsequently approved by DWER in July 2020 (Appendix B). CPS 8191/1 allowed for the clearing of up to 2.16 hectares (ha) of native vegetation within the approved clearing area. Section 40 Ministerial Authorisations for the taking and/or disturbing of Threatened fauna under the state *Biodiversity Conservation Act 2016* (BC Act) were also granted.

1.1 Scope of the report

This Annual Compliance Report (ACR) has been prepared by RPS on behalf of Water Corporation (the Permit Holder) to address the annual reporting requirements under the clearing permit (CPS 8191/1) and EPBC Act (EPBC 2017/7932) approvals.

The civil construction works for the VDD upgrade commenced in November 2020 and were completed by the end of June 2021. No native vegetation clearing occurred in 2023 under the approved clearing permit (CPS 8191/1).

This annual compliance report addresses the required reporting period for the approved clearing permit (CPS 8191/1) from 1 January to 31 December 2023. In March 2022, Water Corporation requested approval from the DAWE to align the EPBC 2017/7932 compliance reporting dates with those of the approved clearing permit. Permission was granted to align EPBC 2017/7932 compliance reporting with the approved clearing permit on 8 April 2022 (Appendix C). Therefore, this annual compliance report addresses the EPBC Act (EPBC 2017/7932) approval compliance reporting requirements from 1 January to 31 December 2023.

Condition 19 (a) of the approved clearing permit (CPS 8191/1) states:

a. The Permit Holder must provide to the CEO on or before 30 June of each year, a written report:
   i. Of records required under condition 18 of this Permit; and
   ii. Concerning activities done by the Permit Holder under this Permit between 1 January to 31 December of the proceeding calendar year.

[1] Known as the Department of Climate Change, Energy, and the Environmental and Water (DCCEEW) from 1 July 2022.

Condition 16 of the EPBC Act (EPBC 2017/7932) approval states:

16. The approval holder must prepare a compliance report for each 12-month period following the date of commencement of the action, or otherwise in accordance with an annual date that has been agreed to in writing by the Minister. The approval holder must:
    a. publish each compliance report on the website within 60 business days following the relevant 12-month period;
    b. notify the Department by email that a compliance report has been published on the website and provide the weblink for the compliance report within five business days of the date of publication;
    c. keep all compliance reports publicly available on the website until this approval expires;
    d. exclude or redact sensitive ecological data from compliance reports published on the website; and
    e. where any sensitive ecological data has been excluded from the version published, submit the full compliance report to the Department within 5 business days of publication.

1.2 Methodology

In preparing this ACR, RPS:

- Reviewed the approved clearing permit (CPS 8191/1) and the EPBC Act (EPBC 2017/7932) approval to confirm the scope of the report
- Reviewed the record-keeping and reporting requirements for the approved clearing permit (CPS 8191/1) and the conditions of approval for the EPBC Act (EPBC 2017/7932) approval to assess environmental performance
- Verified the environmental performance using the available evidence
- Assigned a compliance rating for each record-keeping and reporting requirement of approved clearing permit (CPS 8191/1); and the conditions of approval for the EPBC Act (EPBC 2017/7932) approval.

A site inspection was beyond the scope of the brief.

1.3 Structure of report

This ACR has been structured in the following order to specifically address the reporting requirements of the approved clearing permit (CPS 8191/1) and the conditions of approval for EPBC Act (EPBC 2017/7932):

- CPS 8191/1: Condition 18: Record Keeping
  - Condition 18a (i), (ii), (iii), (iv), (v) and (vi) is presented in Table 1
  - Condition 18a (v) specific to flora management under conditions 9 and 10 is detailed in Table 2
  - Condition 18a (vi) specific to fauna management – Carter's freshwater mussel under conditions 11 and 12 is detailed in Table 3
  - Condition 18a (vi) specific to fauna management – Western ringtail possum under conditions 13, 14 and 15 is detailed in Table 4
  - Conditions 18b is presented in Table 5
- EPBC 2017/7932: Condition 16: Annual Compliance Reporting
  - Part A: Conditions specific to the action (Conditions 1–10) are presented in Table 6
  - Part B: Standard administrative conditions (Conditions 11–22) are presented in Table 7.

1.4 Compliance assessment framework

The environmental performance against the reporting requirements of the approved clearing permit (CPS 8191/1) and the conditions of approval for the EPBC Act (EPBC 2017/7932) approval has been assessed using the available evidence to determine a compliance rating.

1.4.1 Compliance information sources

This ACR has been underpinned by various information sources (available evidence) prepared to support the planning and implementation of the VDD upgrade works, including:

- Subject matter specific information sources
- Regulator liaison.

1.4.1.1 Subject matter specific information

Subject matter specific information has been generated for the VDD upgrade works to specifically address fauna management (western ringtail possum) and revegetation and rehabilitation requirements identified in the approved clearing permit (CPS 8191/1) and EPBC Act (EPBC 2017/7932) approval. These subject matter specific information sources have been collated in respect to the particular matters as follows:

- Western ringtail possum information is provided in Appendix D
- Revegetation and rehabilitation information is provided in Appendix E.

1.4.1.2 Regulator liaison

Liaison by Water Corporation with DWER and DAWE regarding the reporting information or results required to be provided to the regulators under the clearing permit (CPS 8191/1) and EPBC Act (EPBC 2017/7932) approvals includes:

- Email: 2017/7932, CPS 8191/1, CD00116 – Vasse Diversion Drain Upgrade – Annual Environmental Compliance Report (30 June 2023)
- Email: 2017/7932, CPS 8191/1, CD00116 – Vasse Diversion Drain Upgrade – Annual Environmental Compliance Report - published on website (22 August 2023).

A copy of this correspondence is provided in Appendix F.

1.4.2 Compliance rating determination

Compliance ratings have been allocated to each condition according to the following set of measures:

- Achieved: Available evidence identities the condition has been met
- Partially achieved: Available evidence demonstrates the condition has been partially met
- Not achieved: Available evidence shows that the condition has not been met
- Not applicable: Available evidence shows the condition is no longer applicable
- Implementation ongoing: Available evidence shows that the implementation of the condition remains ongoing.

2 CLEARING PERMIT: CPS 8191/1

2.1 Condition 18a: Recording-keeping

Table 1: Environmental performance against record keeping and reporting requirements for CPS 8191/1 condition 18a

Condition no.	Condition	Evidence	Discussion	Compliance rating
8191/1: 18 (a) (i)	The boundaries of clearing undertaken on each date, recorded using a Global Positioning System GPS unit set to GDA94, expressing the geographical coordinates in eastings and northings or decimal degrees	Previous annual compliance report (RPS 2021)	• No clearing works were undertaken during the current reporting period (i.e. between 1 January 2023 and 31 December 2023) • Clearing works were completed between October and November 2020 and reported on as part of a previous Annual Compliance Report 2020 (RPS 2021).	Not applicable
8191/1: 18 (a) (ii)	The size of the area cleared (in hectares)	Previous annual compliance report (RPS 2021)		Not applicable
8191/1: 18 (a) (iii)	Actions taken to avoid, minimise and reduce the impacts and extent of clearing in accordance with condition 7 of this Permit	Previous annual compliance report (RPS 2021)		Not applicable
8191/1: 18 (a) (iv)	Actions taken to minimise the risk of the introduction and spread of weeds and dieback in accordance with condition 8 of this Permit	Previous annual compliance report (RPS 2021)		Not applicable
8191/1: 18 (a) (v)	Details required in accordance with flora management conditions 9 and 10 of this Permit	Refer to Table 2		Condition 9 – Not applicable Condition 10 – Not applicable
8191/1: 18 (a) (vi)	Details required in accordance with fauna management conditions 11, 12, 13, 14 and 15 of this Permit	• Refer to Table 3 for conditions 11 and 12 • Refer to Table 4 for conditions 13, 14, 15.		Condition 11 (a) – Not applicable Condition 11 (b) – Not applicable Condition 12 – Not applicable Condition 13 – Not applicable Condition 14 – Implementation ongoing Condition 15 – Implementation ongoing

2.2 Condition 18a (v): Flora management – conditions 9 and 10

Table 2: Environmental performance against record keeping and reporting requirements for CPS 8191/1 condition 18a (v): conditions 9 and 10

Condition no.	Condition	Evidence	Discussion	Compliance rating
8191/1: 9 (a)	Prior to undertaking any clearing, the Permit Holder must engage a botanist to conduct a targeted flora survey within suitable habitat(a) within the areas cross-hatched yellow on attached Plan 8191/1a for the presence of *Caladenia procera*	Previous annual compliance report (RPS 2021)	• No clearing works were undertaken during the current reporting period (i.e. between 1 January 2023 and 31 December 2023) • Clearing works were completed between October and November 2020 and reported on as part of a previous annual compliance report (RPS 2021).	Not applicable
8191/1: 9 (b)	The Permit Holder shall ensure no clearing of any *Caladenia procera* individuals identified through the surveys required by condition 9(a)	Previous annual compliance report (RPS 2021)	• No clearing works were undertaken during the current reporting period (i.e. between 1 January 2023 and 31 December 2023) • Clearing works were completed between October and November 2020 and reported on as part of a previous annual compliance report (RPS 2021).	Not applicable
8191/1: 9 (c)	The Permit Holder shall ensure that no clearing occurs within ten metres of *Caladenia procera* individuals identified through the surveys required by condition 9(a), unless the clearing is done in accordance with condition 9(d) of this Permit	Previous annual compliance report (RPS 2021)	• No clearing works were undertaken during the current reporting period (i.e. between 1 January 2023 and 31 December 2023) • Clearing works were completed between October and November 2020 and reported on as part of a previous annual compliance report (RPS 2021).	Not applicable
8191/1: 9 (d)	Where clearing within ten metres of individuals of *Caladenia procera* is unavoidable, the Permit Holder must: (i) Install clearly demarked temporary fencing around the individuals of *Caladenia procera* prior to undertaking any clearing and maintain the fencing until the project activities have ceased (ii) Adhere to the Flora Management Plan required under condition 10, which has been approved by the CEO.	Previous annual compliance report (RPS 2021)	• No clearing works were undertaken during the current reporting period (i.e. between 1 January 2023 and 31 December 2023) • Clearing works were completed between October and November 2020 and reported on as part of a previous annual compliance report (RPS 2021).	Not applicable
8191/1: 9 (e)	Within two months of undertaking any clearing authorised under this Permit within the areas cross-hatched yellow on Plan 8191/1a, the Permit Holder must provide the results of the targeted flora survey, as required by condition 9(a), in a report to the CEO	Previous annual compliance report (RPS 2021)	• No clearing works were undertaken during the current reporting period (i.e. between 1 January 2023 and 31 December 2023) • Clearing works were completed between October and November 2020 and reported on as part of a previous annual compliance report (RPS 2021).	Not applicable
8191/1: 9 (f)	If *Caladenia procera* are identified within ten metres of the areas cross-hatched yellow on Plan 8191/1a, the targeted flora survey report must include the following: (i) The location of each *Caladenia procera* identified under condition 9(a), either as the location of individual plants, or where this is not practical, the areal extent of the population and an estimate of the number of plants, recorded using a global positioning system (GPS) unit set to Geocentric Datum Australia 1994 (GDA94), expressing the geographical coordinates in eastings and northings or decimal degrees (ii) Map/s showing the location of any identified population of *Caladenia procera* cleared and the remaining population (iii) The methodology used to survey the Permit area.	Previous annual compliance report (RPS 2021)	• No clearing works were undertaken during the current reporting period (i.e. between 1 January 2023 and 31 December 2023) • Clearing works were completed between October and November 2020 and reported on as part of a previous annual compliance report (RPS 2021).	Not applicable
8191/1: 10	Where clearing within ten metres of individuals of *Caladenia procera* is unavoidable, the Permit Holder must submit a Flora Management Plan to the CEO for approval, prior to clearing commencing. The management plan must contain the following: (i) Details of the Permit Holder's attempts to avoid and minimise impacts to *Caladenia procera* (ii) Proposed methods of minimising and mitigating any indirect impacts to *Caladenia procera.*	Previous annual compliance report (RPS 2021)	• No clearing works were undertaken during the current reporting period (i.e. between 1 January 2023 and 31 December 2023) • Clearing works were completed between October and November 2020 and reported on as part of a previous annual compliance report (RPS 2021).	Not applicable

2.3 Condition 18a (vi): Fauna management conditions 11, 12, 13, 14 and 15

2.3.1 Conditions 11 – other approvals and 12 – Carter's freshwater mussel

Table 3: Environmental performance against record-keeping and reporting requirements for CPS 8191/1 condition 18a (vi): conditions 11 and 12

Condition no.	Condition	Evidence	Discussion	Compliance rating
8191/1: 11 (a)	Prior to clearing, the Permit Holder must provide to the CEO a copy of the fauna licence(s) obtained under the *Biodiversity Conservation Act 2016* for the relocation and/or translocation of Carter's freshwater mussel (*Westralunio carteri*) and the dispersion of western ringtail possum (*Pseudocheirus occidentalis*) individuals	Previous annual compliance report (RPS 2021)	• No clearing works were undertaken during the current reporting period (i.e. between 1 January 2023 and 31 December 2023) • Clearing works were completed between October and November 2020 and reported on as part of a previous annual compliance report (RPS 2021).	Not applicable
8191/1: 11 (b)	Prior to clearing, the Permit Holder must provide to the CEO a copy of the approved exemption from the Department of Primary Industries and Regional Development under the *Fish Resources Management Act 1994* and Fish Resources Management Regulations 1995 for the collection of Carter's freshwater mussel for translocation	Previous annual compliance report (RPS 2021)	• No clearing works were undertaken during the current reporting period (i.e. between 1 January 2023 and 31 December 2023) • Clearing works were completed between October and November 2020 and reported on as part of a previous annual compliance report (RPS 2021).	Not applicable
8191/1: 12 (a)	Prior to commencement of any clearing activities authorised under this Permit, the Permit Holder must submit a Carter's freshwater mussel (*Westralunio carteri*) Management Plan to the CEO for approval. The management plan must contain the following: (i) Removal, transportation and relocation method, and where required, temporary storage method (ii) Location of the relocation-site, including a field assessment confirming the suitability of the relocation-site (iii) Stocking densities (iv) The success rate monitoring plan.	Previous annual compliance report (RPS 2021)	• No clearing works were undertaken during the current reporting period (i.e. between 1 January 2023 and 31 December 2023) • Clearing works were completed between October and November 2020 and reported on as part of a previous annual compliance report (RPS 2021).	Not applicable

2.3.2 Condition 13, 14 and 15 – western ringtail possum

Table 4: Environmental performance against record-keeping and reporting requirements for CPS 8191/1 condition 18a (vi): conditions 13, 14 and 15

Condition no.	Condition	Evidence	Discussion	Compliance rating
8191/1: 13 (a)	In relation to the area cross-hatched yellow on attached Plans 8191/1a and 8191/1b, the Permit Holder must engage a fauna specialist to inspect that area, including all trees and tree hollows present, within 24 hours prior to, and for the duration of clearing, for the presence of western ringtail possum(s) (*Pseudocheirus occidentalis*)	Previous annual compliance report (RPS 2021)	• No clearing works were undertaken during the current reporting period (i.e. between 1 January 2023 and 31 December 2023) • Clearing works were completed between October and November 2020 and reported on as part of a previous annual compliance report (RPS 2021).	Not applicable
8191/1: 13 (b)	Clearing must cease in any area where fauna referred to in condition 13(a) above are identified until the western ringtail possum(s) has moved out of the development area to adjoining suitable habitat(b)		• No clearing works were undertaken during the current reporting period (i.e. between 1 January 2023 and 31 December 2023) • Clearing works were completed between October and November 2020 and reported on as part of a previous annual compliance report (RPS 2021).	Not applicable
8191/1: 13 (c)	Where fauna is identified under condition 13(a) of this Permit, the Permit Holder must provide the following records to the CEO as soon as practicable: (i) The number of individuals identified (ii) The date each individual was identified (iii) The location where each individual was identified recorded using a Global Positioning System (GPS) unit set to Geocentric Datum Australia 1994 (GDA94), expressing the geographical coordinates in eastings and northings or decimal degrees (iv) The number of individuals displaced (v) The relevant qualifications of the fauna specialist undertaking the displacement (vi) The date each individual was displaced (vii) The method of dispersal (viii) The date each individual was dispersed (ix) The location where each individual dispersed to, recorded using a GPS unit set to GDA94, expressing the geographical coordinates in eastings and northings or decimal degrees (x) Details pertaining to the circumstances of any death of, or injury sustained by, an individual.	Previous annual compliance report (RPS 2021)	• No clearing works were undertaken during the current reporting period (i.e. between 1 January 2023 and 31 December 2023) • Clearing works were completed between October and November 2020 and reported on as part of a previous annual compliance report (RPS 2021).	Not applicable

Condition no.	Condition	Evidence	Discussion	Compliance rating
8191/1: 14	Prior to commencement of any clearing activities authorised under this Permit, the Permit Holder must at a minimum install six rope bridges within the area cross-hatched red on the attached Plan 8191/1c, in accordance with the following requirements: (i) The end of each rope bridge must be connected to at least two mature trees, or two different locations in the canopy of a single mature tree, at a height of at least three metres above ground level (ii) The rope bridges must be placed in areas that provide canopy connectivity for western ringtail possum movement across the local area, i.e. across roadways and other gaps in the canopy (iii) Be monitored annually and maintained for a period of at least ten years. (iv) Within two months of undertaking any clearing authorised under this Permit within the combined areas cross-hatched yellow on Plan 8191/1a and 8191/1b, the Permit Holder must provide to the CEO, the locations where each rope bridge was placed using a Global Positioning System (GPS) unit set to Geocentric Datum Australia 1994 (GDA94), expressing the geographical coordinates in eastings and northings or decimal degrees.	• Subject matter specific information – Revegetation and rehabilitation information (Appendix E) ○ Vasse Diversion Drain Update Revegetation – Water Corporation Post Activity Report #17 – Western ringtail possum (Appendix D) ○ Monitoring of the Western Ringtail Possum following Clearing along the Vasse Diversion Drain, Busselton: Year Two, January 2022 – February 2023 (Bamford Consulting Ecologists 2023) ○ Monitoring of the Western Ringtail Possum following Clearing along the Vasse Diversion Drain, Busselton: Year Three, February 2023 – March 2024 (Bamford Consulting Ecologists 2024).	• No clearing works were undertaken during the current reporting period (i.e. between 1 January 2023 and 31 December 2023) • Clearing works were completed between October and November 2020 and reported on as part of a previous annual compliance report (RPS 2021) • Tranen reported that possum infrastructure maintenance was undertaken on 19 January 2023. This involved adjustments to the rope bridges by tightening them up to their original lengths, as the natural fibres stretch over time (M. Bamford, personal communication, 20 June 2023) • Bamford Consulting Ecologists have been commissioned to conduct ongoing monitoring of the rope bridges for ten years (Bamford Consulting Ecologists 2023 and 2024): – Bamford Consulting Ecologists undertook possum monitoring for Year Two in February 2023 and Year Three in November 2023 – Motion sensitive cameras were positioned to monitor rope bridge usage. One night-time camera session was held in February 2023 (Year Two) and one night-time camera session was held in November 2023 (Year Three). In addition, observations and opportunistic searches for scat underneath rope bridges were undertaken during other monitoring events to search for evidence of use – Many western ringtail possums and some brushtail possums were recorded using the rope bridges in February and November 2023, indicating the design is successful and are suitable to keep possums off the ground and improve connectivity – It was noted that Bamford Consulting Ecologists (2024) recommended to consider replacing bridges in the long-term with permanent structures as the rope bridges have shown considerable wear in Year Three, resulting in several failures and the need for repair under the supervision of Tranen.	Implementation ongoing
8191/1: 15	Prior to commencement of any clearing activities authorised under this Permit, the Permit Holder must, at a minimum, install 12 nest boxes within the area cross-hatched red on the attached Plan 8191/1c, in accordance with the following requirements: (i) Be designed and placed in accordance with the specifications detailed in the Project Revegetation Plan required by condition 17(a) (ii) Be placed at least three metres above ground level in a mature tree facing the shadiest side of the tree (iii) Be monitored annually and maintained for a period of at least ten years (iv) Within two months of undertaking any clearing authorised under this Permit within the combined areas cross-hatched yellow on Plan 8191/1a, the Permit Holder must provide to the CEO, the locations where each nest box was placed using a Global Positioning System (GPS) unit set to Geocentric Datum Australia 1994 (GDA94), expressing the geographical coordinates in Eastings and Northings or decimal degrees.	• Subject matter specific information – Western ringtail possum (Appendix D) ○ Monitoring of the Western Ringtail Possum following Clearing along the Vasse Diversion Drain, Busselton: Year Two, January 2022 – February 2023 (Bamford Consulting Ecologists 2023) ○ Monitoring of the Western Ringtail Possum following Clearing along the Vasse Diversion Drain, Busselton: Year Three, February 2023 – March 2024 (Bamford Consulting Ecologists 2024).	• No clearing works were undertaken during the current reporting period (i.e. between 1 January 2023 and 31 December 2023) • Clearing works were completed between October and November 2020 and reported on as part of a previous annual compliance report (RPS 2021) • Bamford Consulting Ecologists has been commissioned to conduct ongoing monitoring of the installed shelters for ten years (Bamford Consulting Ecologists 2023 and 2024): – There were 77 artificial shelters were checked by Bamford Consulting Ecologists on one occasion in February 2023 for Year Two and 83 artificial shelters checked on one occasion in November 2023 for Year Three. The number of viable relocated natural dreys has reduced from the original 24 relocated natural dreys installed prior to January 2021 to six relocated natural dreys by November 2023. This is because many of them had fallen down or become unusable. Fourteen artificial shelters were installed in February 2023 to replace those that had been lost – There were 28 new natural dreys recorded in the study area in February 2023 and 10 new dreys recorded in the study area in November 2023, which have been added to future monitoring events – Bamford Consulting Ecologists (2024) found that 2023 monitoring has shown a substantial increase in the possum population, suggesting a good survival of juveniles following breeding seasons with the provision of additional shelters and rope bridges – The relocated natural dreys were considered important initially, however became disused as possums built new natural dreys or adopted artificial dreys. February and November 2023 monitoring found none of the relocated dreys appeared to still be in use – Artificial shelters have continued to be used in all sampling periods, with 20% of possums using artificial shelters in February 2023 and 38% of possums using artificial shelters in November 2023.	Implementation ongoing

2.4 Condition 18b: Record-keeping

Table 5: Environmental performance against record-keeping and reporting requirements for CPS 8191/1 condition 18b

Condition no.	Condition	Evidence	Discussion	Compliance rating
8191/1 18 (b) "The Permit Holder must maintain the following records in relation to revegetation activities undertaken pursuant to conditions 16 and 17 of this Permit:"				
8191/1: 18 (b) (i)	The date(s) each area was revegetated	• Subject matter specific information – Revegetation and rehabilitation information (Appendix E) ○ Vasse Diversion Drain Update Revegetation – Water Corporation Post Activity Report #19 and #20.	• Revegetation works were undertaken by Tranen on the following dates: – 11–27 July 2023: 15,067 seedlings installed (including augering and fertiliser) to Quindalup Dune (QD), Western PEC, Central PEC and Eastern PEC – 2 October 2023: Infill planting of 16 mature peppermint trees in Central PEC.	Implementation ongoing
8191/1: 18 (b) (ii)	The location of each area revegetated recorded using a GPS unit set to GDA94, expressing the geographical coordinates in eastings and northings or decimal degrees	• Subject matter specific information – Revegetation and rehabilitation information (Appendix E) ○ Revegetation Plan (Tranen 2020) ○ Vasse Diversion Drain Update Revegetation – Water Corporation Post Activity Report #19.	Areas within the QD, Western PEC, Central PEC and Eastern PEC zones were revegetated between 11 to 27 July 2023. The revegetation zones are illustrated in Appendix 2 of the Revegetation Plan (Tranen 2020). Shapefiles for these revegetation zones can be provided to DWER in GDA94 format (if required).	Implementation ongoing
8191/1: 18 (b) (iii)	At least two photographs of each area revegetated taken on an annual basis at the same location each year	• Subject matter specific information – Revegetation and rehabilitation information (Appendix E) ○ Vasse Diversion Drain Upgrade Revegetation Autumn 2023 Vegetation Monitoring Report (Tranen 2023).	Photo monitoring was undertaken by Tranen on 23–24 May 2023 at 34 quadrats across the revegetation zones, as shown in Appendix 6 of the Autumn 2023 Vegetation Monitoring Report (Tranen 2023). At least two photo monitoring quadrats for each zone revegetated have been established. A photo was captured for each quadrat as follows: • Zone 1 – Quindalup Dune (Q1–Q4) • Zone 2 – VDD Embankments (Q5–Q8) • Zone 3 – Queen Elizabeth Avenue Swale (Q9–Q11) • Zone 4 –PEC Upland: – Zone 4.2 – Western PEC (Q12–Q14) – Zone 4.3 – Central PEC (Q18–Q20) – Zone 4.4 – Eastern PEC (Q21–Q31) • Zone 5 – Drainage PEC – Zone 5.1 – Western Basin PEC (Q32).	Implementation ongoing
8191/1: 18 (b) (iv)	A description of the revegetation activities undertaken each year for each area revegetated	• Subject matter specific information – Revegetation and rehabilitation information (Appendix E) ○ Vasse Diversion Drain Update Revegetation – Water Corporation Post Activity Report #17 to #22	Post activity reports have been prepared by Tranen identifying the rehabilitation actions undertaken during the current reporting period (i.e. between 1 January 2023 and 31 December 2023). Activities undertaken for the whole project and at specific revegetation zones are summarised in the table below.	Implementation ongoing

Location	Rehabilitation activities in 2023
Whole of project	• Revegetation sign installation • Levee weed control on all external levee embankments • Spring 2022 monitoring report submitted (25 January 2023) • Weed control • Watering of mature trees and active revegetation zones • Possum infrastructure maintenance • Fencing installation • Seedling delivery • Weed control across upcoming (2024) revegetation-sites • Plant orders for 2024 • Ordered and received levee revegetation materials • Revegetation monitoring • Seed and cutting collection / processing.
Zone 1 – Quindalup Dune	• Mulch installation • Seedling planting.
Zone 2 – VDD Embankments	• Brush wall installation • Slashing VDD levees • Levee vegetation removal.

Condition no.	Condition	Evidence	Discussion		Compliance rating
			Zone 3 – QE Ave Swale	• Watering of QE Ave swale (tanker) • Mulch installation.	
			Zone 4 – PEC Upland	• Woody weed control in Possum Corridor (Zone 4.1) and Southern PEC (Zone 4.5) • Tree guard removal from Eastern PEC (Zone 4.4) • Removal and slashing of levees • Seedling planting • Infill planting of mature peppermint trees in Central PEC • Levee matting • Watering of mature trees.	
8191/1: 18 (b) (v)	A description of the tree density and native understorey vegetation cover for each area revegetated recorded on an annual basis	• Subject matter specific information – Revegetation and rehabilitation information (Appendix E) ○ Revegetation Plan (Tranen 2020) ○ Vasse Diversion Drain Upgrade Revegetation Autumn 2023 Vegetation Monitoring Report (Tranen 2023).	Condition 17 of the clearing permit approval (CPS 8191/1) requires that Water Corporation achieve established completion criteria for revegetation and rehabilitation within the ten-year monitoring period. These completion criteria were incorporated into the Revegetation Plan (Tranen 2020), assessed in spring 2020 (baseline), in spring 2021 (Year One) when the ten-year monitoring program commenced, in autumn and spring 2022 (Year Two) and autumn 2023 (Year Three) (Tranen 2023). Tranen (2023) visited 34 quadrats across all key revegetation zones on 23–24 May 2023. A summary of the results against each completion criterion is provided below: • Native vegetation cover – Average native vegetation cover across all quadrats was 33%, up from 27% cover in spring 2022. All Revegetation Zones showed an increase in cover or remain unchanged, with the QE Ave Swale and Central PEC zones recording the most significant increases (28% and 17% respectively). The only revegetation zone currently meeting the criteria is the VDD Embankment Zone, with cover recorded at an average of 83% across the quadrats, which exceeds the completion criteria – Average native vegetation cover across the site remains significantly below the Completion Criteria of 70%, which is a result of the immaturity of seedlings in many of the revegetation zones – Autumn monitoring produced a more moderated cover increase due to some plant losses, particularly for vegetation experiencing its second summer (typically highest rate of losses expected). Drier than average conditions year-round contributed to some plant losses and the subsequent reduction in cover experienced in some distinct areas of the site – A key factor influencing overall native cover is the progress of active revegetation works, which are being staged over multiple seasons due to site constraints and allowing for adequate site preparation. Some smaller zones are yet to be revegetated and will contribute to cover increases once planted and established in subsequent years – The results did not include existing mature canopy cover, as this can provide a skewed representation of rehabilitation success in the early stages of establishment. • Weeds – Average weed cover across the quadrats is 12%, an increase of 2% since spring 2022. Thirteen revegetation zones demonstrated an increase in weed cover, six showing a reduction and 15 with no measurable change. The highest average cover recorded was 50% recorded in the Southern Swale PEC zone. Average weed cover recorded in the quadrats has remained effectively the same, with weed cover criteria still being met across the site on average and in 80% of quadrats individually – Primary areas where weed cover remains significantly above the completion criteria is in the Possum Corridor and Western and Southern Swale PEC zones. These areas have not been subject to any intensive revegetation works to date and only represent a very minor proportion of the overall site – As the previous monitoring period occurred in spring, a direct comparison of weed cover from the previous assessment is not particularly informative, as weed species composition and growth conditions are significantly different. The minor change in weed cover over the last three assessments is likely a result of seasonal and annual variations in weather conditions resulting in minor variations in weed abundance and growth behaviour. The timing of weed control events immediately before the monitoring also has a significant impact on the data with this event occurring over a month since the previous weed control event, resulting in higher than typical weed abundance – Both declared weeds known to occur on-site (*Zantedeschia aethiopica* and *Asparagus asparagoides*) were not visible during the autumn 2023 monitoring period and therefore not assessed as part of this event. • Bare ground cover – Bare ground cover varied significantly across the quadrats, with an overall average cover of 13%, down from 17% recorded in spring 2022. The decrease in bare ground is primarily a result of the increase in native vegetation cover and natural litter accumulation across the site more generally. • Species richness – Overall species richness decreased slightly from 61 species in spring 2022 to 58 species in autumn 2023. All revegetation zones recorded the same number of species as the spring 2022 assessment. This is generally attributed to no planting works occurring between events and no widespread loss or gain of any particular individual species. • Vegetation condition – Overall, 98% of the total area was assessed as being in good condition or above, the same as assessed in spring 2022 – No material changes in vegetation condition were noted during the assessment, such as vegetation composition, weed abundance or signs of disturbance. The criterion for *Conospermum caeruleum* var. *Busselton* was not assessed at this time. This species is currently in production at nurseries and was not ready for planting in 2023. This will be assessed in future events once the plants have been installed.	Implementation ongoing

3 EPBC ACT 2017/7932

3.1 Condition 16: Annual compliance reporting

3.1.1 EPBC 2017/7932: Part A – conditions specific to the action

Table 6: Summary of environmental performance of Vasse Diversion Drain upgrade works with EPBC 2017/7932: Part A – Conditions specific to the action

Condition no.	Condition	Evidence	Discussion	Compliance rating
1.	To minimise impacts to EPBC Act listed species, the approval holder must:			
a.	Clear no more than 2.16 hectares (ha) of western ringtail possum habitat within the project area (hatched yellow in Attachment A and Attachment B)	Previous annual compliance report (RPS 2021)	• No clearing works were undertaken during the current reporting period (i.e. between 1 January 2023 and 31 December 2023) • Clearing works were completed between October and November 2020 and reported on as part of a previous annual compliance report (RPS 2021).	Not applicable
b.	Comply with and implement the conditions of the clearing permit CPS 8191/1 or as varied from time to time	This annual compliance report	Refer to Table 1, Table 2, Table 3, Table 4 and Table 5	Implementation ongoing
c.	Notify the Department in writing of any variations of the conditions of clearing permit CPS 8191/1 within ten business days of such a change being approved by the state government	No variation of the conditions of clearing permit CPS 8191/1 occurred		Not applicable
2.	To avoid and mitigate impacts to the Western Ringtail Possum, the approval holder must:			
a.	Implement condition 14 of the clearing permit CPS 8191/1 by installing a minimum of six rope bridges. The installation of the rope bridges must be in accordance with advice from a suitably qualified ecologist	• Subject matter specific information – Western ringtail possum (Appendix D) ○ Monitoring of the Western Ringtail Possum following Clearing along the Vasse Diversion Drain, Busselton: Year Two, January 2022 – February 2023 (Bamford Consulting Ecologists 2023) ○ Monitoring of the Western Ringtail Possum following Clearing along the Vasse Diversion Drain, Busselton: Year Three, February 2023 – March 2024 (Bamford Consulting Ecologists 2024).	Refer to Table 4, 8191/1: 14	Implementation ongoing
b.	Implement condition 15 of the clearing permit CPS 8191/1 by installing a minimum of 12 nest boxes suitable for western ringtail possum. If the action results in the removal of more than six dreys, the approval holder must install two nest boxes for each additional drey being removed. Installation of the nest boxes must be in accordance with advice from a suitably qualified ecologist	• Subject matter specific information – Western ringtail possum (Appendix D) ○ Monitoring of the Western Ringtail Possum following Clearing along the Vasse Diversion Drain, Busselton: Year One, January 2022 – February 2023 (Bamford Consulting Ecologists 2023) ○ Monitoring of the Western Ringtail Possum following Clearing along the Vasse Diversion Drain, Busselton: Year Three, February 2023 – March 2024 (Bamford Consulting Ecologists 2024).	• Refer to Table 4, 8191/1: 15 • There were 88 artificial shelters installed prior to January 2021, which exceeded the 2:1 ratio requirement for the removal of 41 natural dreys • During the 2023 monitoring periods of Year Two and Year Three, Bamford Consulting Ecologists checked 77 and 83 artificial shelters inclusive of 14 replaced artificial shelters (Bamford Consulting Ecologists 2023 and 2024) • Only 77 originally installed artificial shelters were present in February 2023, which was less than the 2:1 ratio requirement of artificial shelters installed to natural dreys removed (i.e. at least 82 artificial shelters are required). • The number of viable relocated natural dreys has reduced from the original 24 relocated natural dreys installed prior to January 2021 to six relocated natural dreys by November 2023. This is because many of them had fallen down or become unusable. Fourteen artificial shelters were installed in February 2023 to replace those that had been lost. • In February 2023, 14 additional artificial dreys were installed. By November 2023, the number of artificial shelters was 83, exceeding the 2:1 ratio requirement of artificial shelters installed to natural dreys removed	Implementation ongoing
c.	Reposition rope bridges and nest boxes in accordance with advice from a suitably qualified ecologist if they are not being utilised by western ringtail possum within six months of installation	• Subject matter specific information – Revegetation and rehabilitation information (Appendix E) ○ Vasse Diversion Drain Update Revegetation – Water Corporation Post Activity Report #17 – Western ringtail possum (Appendix D) ○ Monitoring of the Western Ringtail Possum following Clearing along the Vasse Diversion Drain, Busselton: Year Two, January 2022 – February 2023 (Bamford Consulting Ecologists 2023) ○ Monitoring of the Western Ringtail Possum following Clearing along the Vasse Diversion Drain, Busselton: Year Three, February 2023 – March 2024 (Bamford Consulting Ecologists 2024).	• Tranen reported that possum infrastructure maintenance was undertaken on 19 January 2023. This involved adjustments to the rope bridges by tightening them up to their original lengths, as the natural fibres stretch over time (M. Bamford, personal communication, 20 June 2023) • Bamford Consulting Ecologists conducted a survey in February and November 2023 to make a preliminary assessment of the shelters and the possum population following displacement. • They also checked the shelters on both occasions for Year Two and year Three out of a ten-year monitoring program – No recommendations were made to reposition the rope bridges in either report (Bamford Consulting Ecologists 2023 or 2024) – No recommendations were made to reposition the shelters (Bamford Consulting Ecologists 2023 and 2024).	Not applicable

Condition no.	Condition	Evidence	Discussion	Compliance rating
3.	The approval holder must maintain the following records and provide them to the Department within two months of the installation or repositioning of rope bridges and nesting boxes:			
a.	The date(s) and the location where the rope bridges and nest boxes for western ringtail possum (conditioned under 2 and the clearing permit CPS 8191/1) were installed or repositioned	• Previous annual compliance report (RPS 2021)	• Refer to Table 6, 2.b and c • Location, date installed and photographs of rope bridges and nest boxes confirmed part of a previous annual compliance report (RPS 2021).	Achieved
b.	An in-situ photograph of each rope bridge and nest box installed or repositioned	• Previous annual compliance report (RPS 2021) • Subject matter specific information – Western ringtail possum (Appendix D) ○ Monitoring of the Western Ringtail Possum following Clearing along the Vasse Diversion Drain, Busselton: Year Two, January 2022 – February 2023 (Bamford Consulting Ecologists 2023) ○ Monitoring of the Western Ringtail Possum following Clearing along the Vasse Diversion Drain, Busselton: Year Three, February 2023 – March 2024 (Bamford Consulting Ecologists 2024).	• Refer to Table 6, 3.a • No repositioning of rope bridges or nest boxes was undertaken during the current reporting period (i.e. between 1 January 2023 and 31 December 2023).	Achieved
c.	Evidence that a suitably qualified ecologist has approved the design and placement of each rope bridge and nest box	• Subject matter specific information – Western ringtail possum (Appendix D) ○ Monitoring of the Western Ringtail Possum following Clearing along the Vasse Diversion Drain, Busselton: Year Two, January 2022 – February 2023 (Bamford Consulting Ecologists 2023) ○ Monitoring of the Western Ringtail Possum following Clearing along the Vasse Diversion Drain, Busselton: Year Three, February 2023 – March 2024 (Bamford Consulting Ecologists 2024).	• There were 88 artificial shelters installed prior to January 2021, inclusive of 24 relocated natural dreys, which have been monitored by Bamford Consulting Ecologists (2024) • Bamford Consulting Ecologists conducted a survey in January 2021 to make a preliminary assessment of the shelters and the possum population following displacement. They also checked the shelters on one occasion in February 2023 for Year Two, and on one occasion in November 2023 for Year Three – No recommendations were made to reposition the rope bridges in either report (Bamford Consulting Ecologists 2023 or 2024) – No recommendations were made to reposition the shelters (Bamford Consulting Ecologists 2023 and 2024).	Implementation ongoing
d.	Provide the Department with an annual monitoring and maintenance report for the installed and repositioned rope bridges and nest boxes for at least ten years from the date of approval	• Subject matter specific information – Western ringtail possum (Appendix D) ○ Monitoring of the Western Ringtail Possum following Clearing along the Vasse Diversion Drain, Busselton: Year Three, February 2023 – March 2024 (Bamford Consulting Ecologists 2024).	The annual monitoring report by Bamford Consulting Ecologists (2024) is attached to this compliance report under Appendix D. It is anticipated that this annual compliance report will be sent to the DCCEEW, prior to being published on Water Corporation's project website	Implementation ongoing
4.	The approval holder must notify the Department within two business days if any western ringtail possum is killed as a result of the action	• Subject matter specific information – Western ringtail possum (Appendix D) ○ Monitoring of the Western Ringtail Possum following Clearing along the Vasse Diversion Drain, Busselton: Year Two, January 2022 – February 2023 (Bamford Consulting Ecologists 2023 ○ Monitoring of the Western Ringtail Possum following Clearing along the Vasse Diversion Drain, Busselton: Year Three, February 2023 – March 2024 (Bamford Consulting Ecologists 2024).	One dead possum was found in November 2023. This death is likely due to predation and not because of the VDD upgrade works.	Not applicable
5.	To minimise impacts to the Carbunup King Spider Orchid, the approval holder:			
a.	Must implement condition 9 of the clearing permit CPS 8191/1. The targeted flora survey as required by condition 9 (a) of the clearing permit CPS 8191/1, must be conducted between September and October 2020	Previous annual compliance report (RPS 2021)	Refer to Table 2, 8191/1: 9 (a-f)	Not applicable
b.	Must not clear any Carbunup King Spider Orchid individuals identified through the targeted flora survey required by condition 5a	Previous annual compliance report (RPS 2021)	Refer to Table 2, 8191/1: 9 (b)	Not applicable
c.	Develop and implement a translocation proposal for all Carbunup King Spider Orchid individuals identified through the targeted flora survey required under condition 5a located within the clearing area. This translocation proposal must be endorsed in writing by a suitably qualified biologist as appropriate to ensure the successful survival of the translocated individuals without posing a risk to the receiving area(s) prior to implementation of the proposal. The translocation proposal must be implemented once endorsed by a suitably qualified biologist as appropriate	Previous annual compliance report (RPS 2021)	Refer to Table 2, 8191/1: 9 (b)	Not applicable

Condition no.	Condition	Evidence	Discussion	Compliance rating
d.	Documentary evidence of the endorsement of the translocation proposal and implementation of the translocation proposal must be provided to the Department within 14 business days of the endorsement	Previous annual compliance report (RPS 2021)	Refer to Table 2, 8191/1: 9 (b)	Not applicable
6.	Within two months of conducting a targeted flora survey for Carbunup King Spider Orchid and as required by condition 5a, the approval holder must provide the Department the results of the targeted flora survey which must contain the following information	Previous annual compliance report (RPS 2021)	The Targeted *Caladenia procera* Flora Survey report was provided to DWER on 6 October 2020, prior to commencement of clearing on October 2020	Not applicable
a.	The date(s) targeted flora survey was conducted and the methodology used	Previous annual compliance report (RPS 2021)	Refer to Table 6, 5	Not applicable
b.	A photograph of each individual of Carbunup King Spider Orchid identified during the targeted flora survey and map/s showing their location	Previous annual compliance report (RPS 2021)	Refer to Table 6, 5	Not applicable
7.	Prior to the commencement of the action, the approval holder must implement the weed management and soil hygiene management measures as mentioned in the Construction Environmental Management Framework provided to the Department on 2 July 2020	Previous annual compliance report (RPS 2021)	Refer to Table 1, 8191/1: 18(a) (iv)	Achieved
8.	The approval holder must implement the fauna management plan provided to the Department on 10 September 2020	• Subject matter specific information – Western ringtail possum (Appendix D) ○ Monitoring of the Western Ringtail Possum following Clearing along the Vasse Diversion Drain, Busselton: Year Two, January 2022 – February 2023 (Bamford Consulting Ecologists 2023) ○ Monitoring of the Western Ringtail Possum following Clearing along the Vasse Diversion Drain, Busselton: Year Three, February 2023 – March 2024 (Bamford Consulting Ecologists 2024).	• Bamford Consulting Ecologists has been commissioned to conduct ongoing monitoring of the installed shelters for ten years (Bamford Consulting Ecologists 2022, 2023 and 2024) – There were 77 artificial shelters were checked by Bamford Consulting Ecologists on one occasion in February 2023 for Year Two and 83 artificial shelters checked on one occasion in November 2023 for Year Three. The number of viable relocated natural dreys has reduced from the original 24 relocated natural dreys installed prior to January 2021 to six relocated natural dreys by November 2023. This is because many of them had fallen down or become unusable. Fourteen artificial shelters were installed in February 2023 to replace those that had been lost. – There were 28 new natural dreys recorded in the study area in February 2023 and 10 new dreys recorded in the study area in November 2023, which have been added to future monitoring events – Bamford Consulting Ecologists (2024) found that 2023 monitoring has shown a substantial increase in the possum population, suggesting a good survival of juveniles following breeding seasons with the provision of additional shelters and rope bridges – The relocated natural dreys were considered important initially, however became disused as possums built new natural dreys or adopted artificial dreys. February and November 2023 monitoring found none of the relocated dreys appeared to still be in use. – Artificial shelters have continued to be used in all sampling periods, with 20% of possums using artificial shelters in February 2023 and 38% of possums using artificial shelters in November 2023.	Implementation ongoing
9.	The approval holder must implement a flora management plan as required by condition 10 of the clearing permit CPS 8191/1	Previous annual compliance report (RPS 2021)	Refer to Table 1, 8191/1: 18(a) (v)	Achieved
10.	To compensate for the residual significant impacts on the Western Ringtail Possum, the approval holder must implement condition 17 of the clearing permit CPS 8191/1	• Subject matter specific information – Revegetation and rehabilitation information (Appendix E) ○ Revegetation Plan (Tranen 2020)	Refer to Table 5	Implementation ongoing

3.1.2 EPBC 2017/7932; Part B – standard administrative conditions

Table 7: Summary of environmental performance of Vasse Diversion Drain upgrade works with EPBC 2017/7932: Part B – Standard administrative conditions

Condition no.	Condition	Evidence	Discussion	Compliance rating
11.	The approval holder must notify the Department in writing of the date of commencement of the action within 10 business days after the date of commencement of the action	Previous annual compliance report (RPS 2021)	DAWE was advised in writing by Water Corporation of the intended commencement date (26 October 2020) on 6 October 2020	Not applicable
12.	The approval holder must maintain accurate and complete compliance records	• This annual compliance report • Previous annual compliance reports (RPS 2021, 2022 and 2023)	This annual compliance report and the three previous annual compliance reports (RPS 2021, 2022 and 2023) provides evidence that Water Corporation has maintained accurate and complete compliance records	Implementation ongoing
13.	If the Department makes a request in writing, the approval holder must provide electronic copies of compliance records to the Department within the time frame specified in the request	Not applicable	DCCEEW has not requested in writing for the Water Corporation to provide electronic copies of compliance to the DCCEEW	Not applicable
14.	The approval holder must:			
a.	Submit plans electronically to the Department for approval by the Minister	Previous annual compliance report (RPS 2021)	All plans were previously submitted to DAWE for approval. No new plans were prepared during the during the current reporting period (i.e. between 1 January 2023 and 31 December 2023)	Not applicable
b.	Publish each plan on the website within 20 business days of the date the plan is approved by the Minister or of the date a revised action management plan is submitted to the Minister or the Department, unless otherwise agreed to in writing by the Minister	Water Corporation VDD upgrade works project website: https://www.watercorporation.com.au/Outages-and-works/Ongoing-Works/Vasse-diversion-drain-upgrade	The plans for the VDD upgrade works are available on Water Corporation's project website	Not applicable
c.	Exclude or sensitive ecological data from plans published on the website or provided to a member of the public	Water Corporation VDD upgrade works project website: https://www.watercorporation.com.au/Outages-and-works/Ongoing-Works/Vasse-diversion-drain-upgrade	Sensitive ecological data within the VDD upgrade includes: • Confirmed locations of *Caladenia procera* – GPS locations of *Caladenia procera* provided in Dixon 2020 were redacted in the report provided on the website • Identified locations of western ringtail possum and the location of fauna shelters – Figures and GPS locations showing fauna shelter or possum locations were redacted in the Bamford Consulting Ecologists 2021 report provided on the website.	Not applicable
d.	Keep plans published on the website until the end date of this approval	Water Corporation VDD upgrade works project website: https://www.watercorporation.com.au/Outages-and-works/Ongoing-Works/Vasse-diversion-drain-upgrade	The plans for the VDD upgrade works are available on Water Corporation's project website.	Implementation ongoing
15.	The approval holder must ensure that any monitoring data (including sensitive ecological data), surveys, maps, and other spatial and metadata required under condition 5 of this approval, is prepared in accordance with the Department's Guidelines for biological survey and mapped data (2018) and submitted electronically to the Department	• Previous annual compliance reports (RPS 2021, 2022 and 2023) • Subject matter specific information – Western ringtail possum (Appendix D) ○ Monitoring of the Western Ringtail Possum following Clearing along the Vasse Diversion Drain, Busselton: Year Two, January 2022 – February 2023 (Bamford Consulting Ecologists 2023) ○ Monitoring of the Western Ringtail Possum following Clearing along the Vasse Diversion Drain, Busselton: Year Three, February 2023 – March 2024 (Bamford Consulting Ecologists 2024).	• All plans previously submitted to DAWE and DCCEEW for approval were reported on as part of previous annual compliance reports (RPS 2021, 2022 and 2023) • No new plans were prepared during the current reporting period (i.e. between 1 January 2023 and 31 December 2023) – The two reports, Monitoring of the Western Ringtail Possum following Clearing along the Vasse Diversion Drain, Busselton: Year Two, January 2022 – February 2023 (Bamford Consulting Ecologists 2023) and Monitoring of the Western Ringtail Possum following Clearing along the Vasse Diversion Drain, Busselton: Year Three, February 2023 – March 2024 (Bamford Consulting Ecologists 2024), are provided in Appendix D) of this compliance report.	
16.	The approval holder must prepare a compliance report for each 12-month period following the date of commencement of the action, or otherwise in accordance with an annual date that has been agreed to in writing by the Minister. The approval holder must:			
a.	Publish each compliance report on the website within 60 business days following the relevant 12-month period	Water Corporation VDD upgrade works project website: https://www.watercorporation.com.au/Outages-and-works/Ongoing-Works/Vasse-diversion-drain-upgrade	• The previous three annual compliance reports (RPS 2021, 2022 and 2023) are available on Water Corporation's project website • This annual compliance report addresses the required reporting period from 1 January 2023 to 31 December 2023 for the approved clearing permit (CPS 8191/1) and EPBC Act (EPBC 2017/7932). It is anticipated this annual compliance report will be published on the Water Corporation's VDD Upgrade website https://www.watercorporation.com.au/Outages-and-works/Ongoing-Works/Vasse-diversion-drain-upgrade	Implementation ongoing
b.	Notify the Department by email that a compliance report has been published on the website and provide the weblink for the compliance report within five business days of the date of publication	Not applicable	This annual compliance report is pending website publication	Not applicable
c.	Keep all compliance reports publicly available on the website until this approval expires	Water Corporation VDD upgrade works project website: https://www.watercorporation.com.au/Outages-and-works/Ongoing-Works/Vasse-diversion-drain-upgrade	See Table 7, 16a	Implementation ongoing

Condition no.	Condition	Evidence	Discussion	Compliance rating
d.	Exclude or redact sensitive ecological data from compliance reports published on the website	Water Corporation VDD upgrade works project website: https://www.watercorporation.com.au/Outages-and-works/Ongoing-Works/Vasse-diversion-drain-upgrade	• The 2022 Annual Compliance Report (RPS 2023) that is available on the Water Corporation's project website has redacted sensitive ecological data within the VDD upgrade – Text, figures and GPS locations showing fauna shelter or possum locations provided in the Management of the Western Ringtail Possum and other Vertebrates during Clearing along the Vasse Diversion Drain, Busselton: October 2020- January 2021 (Bamford Consulting Ecologists 2021) report have been redacted from Appendix H of the 2020 Annual Compliance Report (RPS 2021) – Text, figures and GPS locations showing fauna shelter or possum locations provided in the Monitoring of the Western Ringtail Possum following Clearing along the Vasse Diversion Drain, Busselton: Year One, January 2021 – January 2022 (Bamford Consulting Ecologists 2022) report have been redacted from Appendix E of the 2021 Annual Compliance Report (RPS 2022) – Text, figures and GPS locations showing fauna shelter or possum locations provided in the Monitoring of the Western Ringtail Possum following Clearing along the Vasse Diversion Drain, Busselton: Year Two, January 2022– February 2023 (Bamford Consulting Ecologists 2024) report have been redacted from Appendix D of the 2022 Annual Compliance Report (RPS 2023) • Prior to publication of this compliance report on the Water Corporation's project website, it is anticipated that sensitive ecological information will be redacted from the Bamford Consulting Ecologists (2023 and 2024) reports in Appendix D.	Achieved
e.	Where any sensitive ecological data has been excluded from the version published, submit the full compliance report to the Department within five business days of publication	• Regulator liaison (Appendix F) – Email: 2017/7932, CPS 8191/1, CD00116 - Vasse Diversion Drain Upgrade - Annual Environmental Compliance Report (30 June 2023) – Email: 2017/7932, CPS 8191/1, CD00116 - Vasse Diversion Drain Upgrade – Annual Environmental Compliance Report – published on website (22 August 2023)	• The full 2022 Annual Compliance Report (RPS 2023) was sent to the DAWE on 30 June 2023. Water Corporation advised that the compliance report was available on the project website on 22 August 2023 • This annual compliance report is pending website publication.	Achieved
17.	The approval holder must notify the Department in writing of any: incident; non-compliance with the conditions; or non-compliance with the commitments made in plans. The notification must be given as soon as practicable, and no later than two business days after becoming aware of the incident or non-compliance. The notification must specify:			
a.	Any condition which is or may be in breach	• Water Corporation liaison – Email: RE: CD00116 Busselton VDD Upgrade - Annual Compliance Report 2023 - PO4200726556 (27 May 2024)	Water Corporation advised that there have been no reported incidents or non-compliances with the conditions or associated management plans during the current reporting period (i.e. between 1 January 2023 and 31 December 2023)	Not applicable
b.	A short description of the incident and/or non-compliance			
c.	The location (including co-ordinates), date, and time of the incident and/or non-compliance. In the event the exact information cannot be provided, provide the best information available			
18.	The approval holder must provide to the Department the details of any incident or non-compliance with the conditions or commitments made in plans as soon as practicable and no later than 10 business days after becoming aware of the incident or non-compliance, specifying:			
a.	Any corrective action or investigation which the approval holder has already taken or intends to take in the immediate future	Not applicable	Refer Table 7, 17	Not applicable
b.	The potential impacts of the incident or non-compliance			
c.	The method and timing of any remedial action that will be undertaken by the approval holder			
19.	The approval holder must ensure that independent audits of compliance with the conditions are conducted as requested in writing by the Minister	Not applicable	No independent audits of compliance with the conditions have been requested in writing by the Minister	Not applicable
20.	For each independent audit, the approval holder must:			
a.	Provide the name and qualifications of the independent auditor and the draft audit criteria to the Department	Not applicable	Refer Table 7, 19	Not applicable
b.	Only commence the independent audit once the audit criteria have been approved in writing by the Department			
c.	Submit an audit report to the Department within the time frame specified in the approved audit criteria			
21.	The approval holder must publish the audit report on the website within ten business days of receiving the Department's approval of the audit report and keep the audit report published on the website until the end date of this approval	Not applicable	Refer Table 7, 19	Not applicable
22.	Within 30 days after the completion of the action, the approval holder must notify the Department in writing and provide completion data	Not applicable	Completion of the action means all specified activities associated with the action have permanently ceased. The VDD upgrade works were completed on schedule in July 2021, however management and monitoring activities associated with the action are ongoing	Not applicable

4 DISCUSSION

The environmental performance assessment against the record-keeping and reporting requirements for CPS 8191/1 (Condition 19 (a)) (i.e. Tables 1–5) found:

- No clearing works were undertaken during the current reporting period (i.e. between 1 January 2023 and 31 December 2023), hence Conditions 9, 10, 11, 12 (a) (i) – (v) were not applicable
- Bamford Consulting Ecologists (2023 and 2024) undertook the third event of the ten-year monitoring program of the rope bridges and artificial shelters for Year 2 in February 2023 and Year 3 in November 2023. They found that:
  - The possum population had shown a substantial increase, which remained relatively stable throughout Year 3 monitoring
  - There were 77 artificial shelters checked by Bamford Consulting Ecologists on one occasion in February 2023 for Year 2 and 83 artificial shelters checked on one occasion in November 2023 for Year 3. The number of viable relocated natural dreys has reduced from the original 24 relocated natural dreys installed prior to January 2021 to six relocated natural dreys by November 2023. This is because many of them had fallen down or become unusable. Fourteen artificial shelters were installed in February 2023 to replace those that had been lost
  - There were 28 new natural dreys recorded in February 2023 and ten new natural dreys recorded in the study area in November 2023, which have been added to future monitoring events
  - The relocated natural dreys were considered important initially, however became disused as possums built new natural dreys or adopted artificial dreys. None of the relocated natural dreys appeared to be in use during the 2023 monitoring periods of Year 2 and Year 3
  - Artificial shelters have continued to be used in all sampling periods, with 20% of possums using artificial shelters in February 2023 and 38% of possums using artificial shelters in November 2023. The availability of additional shelter is likely to have supported the population of possums following displacement and may have contributed to the substantial increase in numbers of possums at the ends of breeding seasons by providing additional shelter for newly independent juveniles.
- Revegetation works were undertaken by Tranen from 11 to 27 July and 2 October 2023 to Quindalup Dune, Western PEC, Central PEC (infill) and Eastern PEC zones. In 2023, 15,067 seedlings and 16 mature trees were installed.
- Tranen (2023) visited 34 quadrats across all key revegetation zones on 23–24 May 2023 for the third assessment since the ten-year program commenced. They captured photos at each quadrat, and assessed the native vegetation cover, weed cover, presence of declared weeds, bare ground cover, species richness and vegetation condition. They did not address the completion criterion for *Conospermum caeruleum* var. *Busselton* as it was not ready to be planted yet.
- Water Corporation's environmental performance addressed the requirements of all the clearing permit conditions, with implementation ongoing to address Conditions 14, 15 and 18

The environmental performance assessment against conditions of approval for the EPBC Act (EPBC 2017/7932) approval (Condition 16) (i.e. Tables 6–7) found:

- Bamford Consulting Ecologists undertook a survey in January 2021 to make a preliminary assessment of the shelters and the possum population following displacement. They also checked the shelters on one occasion in February 2023 for Year Two and on one occasion in November 2023 for Year Three out of a ten-year monitoring program. These reports did not make any recommendations to reposition the rope bridges or nest boxes.
- The number of remaining installed artificial shelters recorded in February 2023 was less than the 2:1 ratio requirement of artificial shelters installed to natural dreys removed (i.e. at least 82 artificial shelters are required). Only 77 of the 88 originally installed artificial shelters were present in February 2023. In February 2023, 14 additional artificial dreys were installed. By November 2023, the number of artificial shelters was 83, exceeding the 2:1 ratio requirement of artificial shelters installed to natural dreys.

- The annual monitoring report by Bamford Consulting Ecologists (2023) is attached to this compliance report under Appendix D. It is anticipated that this Annual Compliance Report will be sent to the DCCEEW, prior to being published on Water Corporation's project website.
- No western ringtail possum was killed as a result of the VDD upgrade works.
- Water Corporation's environmental performance addressed the requirements of all but one of the EPBC Act approval conditions that were applicable to the reporting period, with implementation ongoing to address Conditions 1. b., 2. a. and b., 3. c. and d., 8., 10., 12., 14. d., 16. a. and c
  - Prior to publication of this compliance report on the Water Corporation's project website, it is anticipated that sensitive ecological information will be redacted from the Bamford Consulting Ecologists' (2023 and 2024) reports in Appendix D.

5 REFERENCES

Bamford Consulting Ecologists. 2023. Monitoring of the Western Ringtail Possum following Clearing along the Vasse Diversion Drain, Busselton Year Two, January 2022 – February 2023. Report prepared for the Water Corporation.

Bamford Consulting Ecologists. 2024. Monitoring of the Western Ringtail Possum following Clearing along the Vasse Diversion Drain, Busselton Year Two, February 2023 – March 2024. Report prepared for the Water Corporation.

RPS. 2021. Annual compliance report, Vasse Diversion Drain. Report prepared for Water Corporation.

RPS. 2022. Annual compliance report, Vasse Diversion Drain. Report prepared for Water Corporation.

RPS. 2023. Annual compliance report, Vasse Diversion Drain. Report prepared for Water Corporation.

Tranen. 2020. Vasse Diversion Drain Upgrade Revegetation Plan. Report prepared for Water Corporation.

Tranen. 2023. Vasse Diversion Drain Upgrade Revegetation Autumn 2023 Vegetation Monitoring Report. Report prepared for Water Corporation.

Appendix A
EPBC Act (2017/7932) approval

Australian Government
Department of Agriculture, Water and the Environment

APPROVAL

Vasse Diversion Drain Upgrade, Busselton, Western Australia (EPBC 2017/7932)

This decision is made under sections 130(1) and 133(1) of the *Environment Protection and Biodiversity Conservation Act 1999 (Cth).* Note that section 134(1A) of the **EPBC Act** applies to this approval, which provides in general terms that if the approval holder authorises another person to undertake any part of the action, the approval holder must take all reasonable steps to ensure that the other person is informed of any conditions attached to this approval, and that the other person complies with any such condition.

Details

Person to whom the approval is granted (approval holder)	Water Corporation WA
ACN or ABN of approval holder	ABN: 28003434917
Action	To upgrade the Vasse diversion drain within the City of Busselton approximately 220 km south of Perth, WA (EPBC 2017/7932) subject to the variation of the action accepted by the Minister under section 156B of the EPBC Act on Wednesday, 18 July 2018.

Approval decision

My decision on whether or not to approve the taking of the action for the purposes of the controlling provision for the action is as follows.

Controlling Provisions

Listed Threatened Species and Communities	
Section 18	Approve
Section 18A	Approve

Period for which the approval has effect

This approval has effect until 28 July 2035

Decision-maker

Name and position	Kylie Calhoun Assistant Secretary Environment Assessments West (WA, SA, NT) Branch Department of Agriculture, Water and the Environment
Signature	
Date of decision	**24 September 2020**

Conditions of approval

This approval is subject to the conditions under the EPBC Act as set out in ANNEXURE A.

ANNEXURE A – CONDITIONS OF APPROVAL

Part A – Conditions specific to the action

1. To minimise impacts to **EPBC Act listed species**, the approval holder must:
   a. **clear** no more than 2.16 hectares (ha) of **Western Ringtail Possum habitat** within the **project area** (hatched yellow in Attachment A and Attachment B);
   b. comply with and implement the conditions of the **clearing permit CPS 8191/1** or as varied from time to time; and
   c. notify the **Department** in writing of any variations of the conditions of **clearing permit CPS 8191/1** within 10 business days of such a change being approved by the **State Government**.
2. To avoid and mitigate impacts to the **Western Ringtail Possum**, the approval holder must:
   a. implement condition 14 of the **clearing permit CPS 8191/1** by installing a minimum of six rope bridges. The installation of the rope bridges must be in accordance with advice from a **suitably qualified ecologist**;
   b. implement condition 15 of the **clearing permit CPS 8191/1** by installing a minimum of 12 nest boxes suitable for **Western Ringtail Possum**. If the **action** results in the removal of more than six **dreys**, the **approval holder** must install two nest boxes for each additional **drey** being removed. Installation of the nest boxes must be in accordance with advice from a **suitably qualified ecologist**; and
   c. reposition rope bridges and nest boxes in accordance with advice from a **suitably qualified ecologist** if they are not being utilised by **Western Ringtail Possum** within six months of installation.
3. The approval holder must maintain the following records and provide them to the **Department** within two months of the installation or repositioning of rope bridges and nesting boxes:
   a. the date(s) and the **location** where the rope bridges and nest boxes for **Western Ringtail Possum** (conditioned under 2 and the **clearing permit CPS 8191/1**) were installed or repositioned;
   b. an in-situ photograph of each rope bridge and nest box installed or repositioned;
   c. evidence that a **suitably qualified ecologist** has approved the design and placement of each rope bridge and nest box; and
   d. provide the **Department** with an annual monitoring and maintenance report for the installed and repositioned rope bridges and nest boxes for at least ten years from the date of approval.
4. The approval holder must notify the **Department** within two **business days** if any **Western Ringtail Possum** is killed as a result of the **action**.
5. To minimise impacts to the **Carbunup King Spider Orchid,** the approval holder:
   a. must implement condition 9 of the **clearing permit CPS 8191/1**. The **targeted flora survey** as required by condition 9 (a) of the **clearing permit CPS 8191/1,** must be conducted between September and October 2020;
   b. must not **clear** any **Carbunup King Spider Orchid** individuals identified through the **targeted flora survey** required by condition 5a; and
   c. develop and implement a **translocation proposal** for all **Carbunup King Spider Orchid** individuals identified through the **targeted flora survey** required under condition 5a located within the **clearing area**. This **translocation proposal** must be endorsed in writing by a **suitably qualified biologist** as appropriate to ensure the successful survival of the translocated individuals without posing a risk to the receiving area(s) prior to implementation

of the proposal. The **translocation proposal** must be implemented once endorsed by a **suitably qualified biologist** as appropriate.

d. documentary evidence of the endorsement of the **translocation proposal** and implementation of the **translocation proposal** must be provided to the **Department** within 14 business days of the endorsement.

6. Within two months of conducting a **targeted flora survey** for **Carbunup King Spider Orchid** and as required by condition 5a, the approval holder must provide the **Department** the results of the **targeted flora survey** which must contain the following information:
   a. the date(s) **targeted flora survey** was conducted and the methodology used; and
   b. a photograph of each individual of **Carbunup King Spider Orchid** identified during the **targeted flora survey** and map/s showing their **location**.

7. Prior to the **commencement of the action**, the approval holder must implement the weed management and soil hygiene management measures as mentioned in the **Construction Environmental Management Framework** provided to the **Department** on 2 July 2020.

8. The approval holder must implement the **fauna management plan** provided to the **Department** on 10 September 2020.

9. The approval holder must implement a **flora management plan** as required by condition 10 of the **clearing permit CPS 8191/1.**

10. To compensate for the **residual significant impacts** on the **Western Ringtail Possum**, the approval holder must implement condition 17 of the **clearing permit CPS 8191/1**.

Part B – Standard administrative conditions

Notification of date of commencement of the action

11. The approval holder must notify the **Department** in writing of the date of **commencement of the action** within 10 **business days** after the date of **commencement of the action.**

Compliance records

12. The approval holder must maintain accurate and complete **compliance records**.

13. If the **Department** makes a request in writing, the approval holder must provide electronic copies of **compliance records** to the **Department** within the timeframe specified in the request.

Note: **Compliance records** may be subject to audit by the **Department** or an independent auditor in accordance with section 458 of the **EPBC Act**, and or used to verify compliance with the conditions. Summaries of the result of an audit may be published on the **Department**'s website or through the general media.

Preparation and publication of plans

14. The approval holder must:
    a. submit **plans** electronically to the **Department** for approval by the **Minister**;
    b. publish each **plan** on the **website** within 20 **business days** of the date the **plan** is approved by the **Minister** or of the date a revised action management plan is submitted to the **Minister** or the **Department**, unless otherwise agreed to in writing by the **Minister**;
    c. exclude or redact **sensitive ecological data** from **plans** published on the **website** or provided to a member of the public; and
    d. keep **plans** published on the **website** until the end date of this approval.

15. The approval holder must ensure that any **monitoring data** (including **sensitive ecological data**), surveys, maps, and other spatial and metadata required under condition 5 of this approval, is prepared in accordance with the **Department's** *Guidelines for biological survey and mapped data* (2018) and submitted electronically to the **Department**.

Annual compliance reporting

16. The approval holder must prepare a **compliance report** for each 12 month period following the date of **commencement of the action**, or otherwise in accordance with an annual date that has been agreed to in writing by the **Minister**. The approval holder must:

    a. publish each **compliance report** on the **website** within 60 **business days** following the relevant 12 month period;

    b. notify the **Department** by email that a **compliance report** has been published on the **website** and provide the weblink for the **compliance report** within five **business days** of the date of publication;

    c. keep all **compliance reports** publicly available on the **website** until this approval expires;

    d. exclude or redact **sensitive ecological data** from **compliance reports** published on the **website**; and

    e. where any **sensitive ecological data** has been excluded from the version published, submit the full **compliance report** to the **Department** within 5 **business days** of publication.

Note: **Compliance reports** may be published on the **Department**'s website.

Reporting non-compliance

17. The approval holder must notify the **Department** in writing of any: **incident;** non-compliance with the conditions; or non-compliance with the commitments made in **plans**. The notification must be given as soon as practicable, and no later than two **business days** after becoming aware of the **incident** or non-compliance. The notification must specify:

    a. any condition which is or may be in breach;

    b. a short description of the **incident** and/or non-compliance; and

    c. the location (including co-ordinates), date, and time of the **incident** and/or non-compliance. In the event the exact information cannot be provided, provide the best information available.

18. The approval holder must provide to the **Department** the details of any **incident** or non-compliance with the conditions or commitments made in **plans** as soon as practicable and no later than 10 **business days** after becoming aware of the **incident** or non-compliance, specifying:

    a. any corrective action or investigation which the approval holder has already taken or intends to take in the immediate future;

    b. the potential impacts of the **incident** or non-compliance; and

    c. the method and timing of any remedial action that will be undertaken by the approval holder.

Independent audit

19. The approval holder must ensure that **independent audits** of compliance with the conditions are conducted as requested in writing by the **Minister**.

20. For each **independent audit**, the approval holder must:

    a. provide the name and qualifications of the independent auditor and the draft audit criteria to the **Department**;

b. only commence the **independent audit** once the audit criteria have been approved in writing by the **Department**; and

c. submit an audit report to the **Department** within the timeframe specified in the approved audit criteria.

21. The approval holder must publish the audit report on the **website** within 10 **business days** of receiving the **Department's** approval of the audit report and keep the audit report published on the **website** until the end date of this approval.

Completion of the action

22. Within 30 days after the **completion of the action**, the approval holder must notify the **Department** in writing and provide **completion data**.

Part C - Definitions

In these conditions, except where contrary intention is expressed, the following definitions are used:

Approval holder means Western Australian Water Corporation.

Business day means a day that is not a Saturday, a Sunday or a public holiday in the state or territory of the action.

Carbunup King Spider Orchid means the **EPBC Act** listed critically endangered *Caladenia procera.*

Clear/Clearing means the cutting down, felling, thinning, logging, removing, killing, destroying, poisoning, ringbarking, uprooting or burning of vegetation (but not including weeds – see the *Australian weeds strategy 2017 to 2027* for further guidance, or for the purpose of translocation under condition 5c).

Cleared area/s means an area/s (in hectares) within the **project area** where loss or long-term modification of habitat has occurred.

Clearing area means the area (in hectares) where loss or long term modification of habitat will occur within the **project area**.

Clearing permit CPS 8191/1 means the clearing permit granted on 3 July 2020 under section 51E of the *Environmental Protection Act 1986* (WA), and any subsequent versions.

Commencement of the action means the first instance of any specified activity associated with the action including clearing of vegetation and **construction** of any infrastructure. **Commencement of the action** does not include minor physical disturbance necessary to:

i. undertake pre-clearance surveys or monitoring programs;

ii. install signage and /or temporary fencing to prevent unapproved use of the project area;

iii. protect environmental and property assets from fire, weeds and pests, including **construction** of fencing, and maintenance of existing surface access tracks;

iv. install temporary site facilities for persons undertaking pre-commencement activities so long as these are located where they have no impact on the **protected matters**.

Completion data means an environmental report and spatial data clearly detailing how the conditions of this approval have been met. The **Department**'s preferred spatial data format is **shapefile**. **Completion data** should include, but not be limited to, information detailing the date and location of **clearing**; the actual total **cleared area/s** within the **project area** (in hectares); the total area and type of **Western Ringtail Possum** habitat **cleared** within the **project area** (in hectares); and the total area and type of **Western Ringtail Possum** habitat within **retention area/s** (in hectares). **Completion data** must also include information on the location of rope bridges and nest hollows installed under the conditions of this approval.

Completion of the action means all specified activities associated with the action have permanently ceased.

Compliance records means all documentation or other material in whatever form required to demonstrate compliance with the conditions of approval in the approval holder's possession or that are within the approval holder's power to obtain lawfully.

Compliance reports means written reports:

i. providing accurate and complete details of compliance, **incidents**, and non-compliance with the conditions and the **plans**;

ii. consistent with the **Department's** *Annual Compliance Report Guidelines* (2014);

iii. include a **shapefile** of any clearance of any **protected matters**, or their habitat, undertaken within the relevant 12 month period; and

iv. annexing a schedule of all **plans** prepared and in existence in relation to the conditions during the relevant 12 month period.

Construction means the erection of a building or structure that is or is to be fixed to the ground and wholly or partially fabricated on-site; the alteration, maintenance, repair or demolition of any building or structure; preliminary site preparation work which involves breaking of the ground (including pile driving); the laying of pipes and other prefabricated materials in the ground, and any associated excavation work; but excluding the installation of temporary fences and signage.

Construction Environmental Management Framework means the document provided by Western Australian Water Corporation to the **Department** on 2 July 2020.

Department means the Australian Government agency responsible for administering the **EPBC Act**.

Drey means a nest for the **Western Ringtail Possum** typically formed from a mass of twigs.

Dieback and weed management methods mean various methodologies applied to control dieback of Western Australian native vegetation from *Phytophthora* species and multiple **weeds.**

EPBC Act means the *Environment Protection and Biodiversity Conservation Act 1999* (Cth).

EPBC Act listed species Threatened fauna and flora listed under Section 178 of the **EPBC Act**.

Fauna management plan means a management **plan** for fauna species including **Western Ringtail Possum** occurring within the **project area** prepared by Western Australian Water Corporation.

Flora management plan means a management **plan** for flora species including **Carbunup King Spider Orchid** occurring within the **project area** prepared by Western Australian Water Corporation.

Incident means any event which has the potential to, or does, impact on one or more **protected matter(s)**.

Independent audit: means an audit conducted by an independent and **suitably qualified person** as detailed in the *Environment Protection and Biodiversity Conservation Act 1999 Independent Audit and Audit Report Guidelines* (2019).

Life of the approval means the period for which this approval has effect.

Location means the exact position recorded using a Global Positioning System (GPS) unit set to Geocentric Datum Australia 1994 (GDA 1994), expressing the geographical co-ordinates in decimal degrees.

Monitoring data means the data required to be recorded under the conditions of this approval.

Minister means the Australian Government Minister administering the **EPBC Act** including any delegate thereof.

Plan(s) means any of the documents required to be prepared, approved by the **Minister**, and/or implemented by the approval holder and published on the **website** in accordance with these conditions (includes action management plans and/or strategies).

Project area means all of the areas approved to clear overlain with yellow in Attachment A and Attachment B and areas subject to conditions overlain with yellow and blue in Attachment C.

Protected matter means a matter protected under a controlling provision in Part 3 of the **EPBC Act** for which this approval has effect.

Residual significant impacts mean the residual impacts on the protected matters that are still likely to occur after the proposed activities to avoid and mitigate all impacts are taken into account.

Sensitive ecological data means data as defined in the Australian Government Department of the Environment (2016) *Sensitive Ecological Data – Access and Management Policy V1.0.*

Shapefile means location and attribute information of the action provided in an Esri shapefile format. Shapefiles must contain '.shp', '.shx' , '.dbf' files and a '.prj' file that specifies the projection/geographic co-ordinate system used. Shapefiles must also include an '.xml' metadata file that describes the shapefile for discovery and identification purposes**.**

State Government means the Government of Western Australia.

Suitably qualified biologist means a person who has professional qualifications and at least three years of work experience surveying for **Carbunup King Spider Orchid** and can give authoritative assessment, advice and analysis on performance relative to the subject matter using relevant protocols, standards, methods and/or literature. If the person does not have appropriate professional qualifications, the person must have at least five years of work experience related to the subject matter and can give authoritative assessment, advice and analysis on performance relative to the subject matter using relevant protocols, standards, methods and/or literature.

Suitably qualified ecologist means a person who has professional qualifications and at least three years of work experience surveying for **Western Ringtail Possum** and can give authoritative assessment, advice and analysis on performance relative to the subject matter using relevant protocols, standards, methods and/or literature. If the person does not have appropriate professional qualifications, the person must have at least five years of work experience related to the subject matter and can give authoritative assessment, advice and analysis on performance relative to the subject matter using relevant protocols, standards, methods and/or literature.

Suitably qualified person means a person who has professional qualifications, training, skills and/or experience related to the nominated subject matter and can give authoritative independent assessment, advice and analysis on performance relative to the subject matter using the relevant protocols, standards, methods and/or literature.

Targeted flora survey means a field-based investigation, including a review of established literature, of the biodiversity of flora and vegetation of the permit area, focusing on habitat suitable for **Carbunup King Spider Orchid** and carried out during the optimal time to identify the species, which is during the flowering period between September and October. Where target flora are identified in the or in close proximity to the permit area, the survey must also include a minimum of a 10 metre radius of the surrounding areas to place the permit area into a local context.

Translocation proposal means a written plan that details the deliberate, human-mediated movement of **Carbunup King Spider Orchid** from one area, with a release in another for the purpose of establishing, re-establishing or augmenting a population.

Website means a set of related web pages located under a single domain name attributed to the approval holder and available to the public.

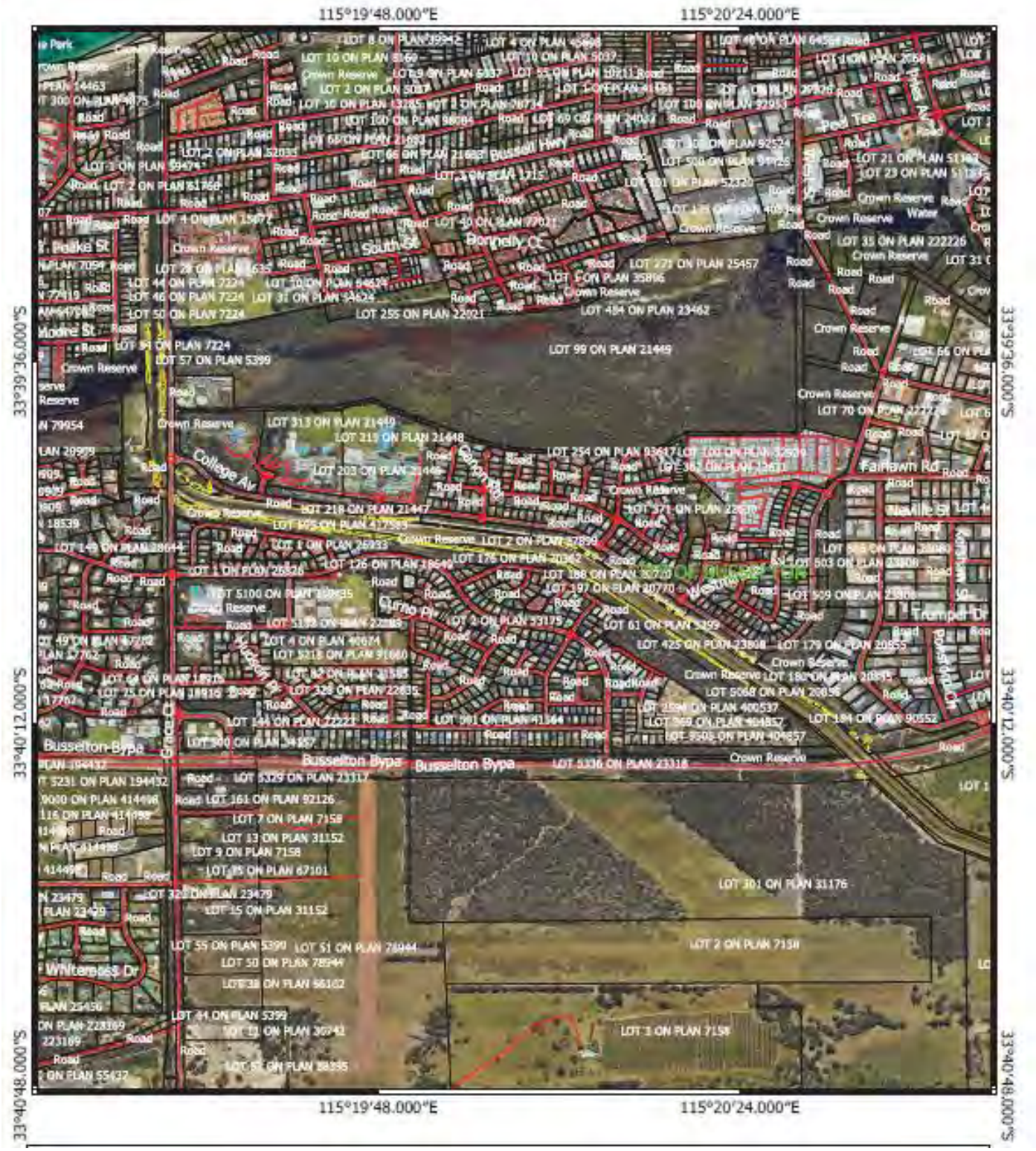
Weed/s means any plant species included in the Australian Government Weeds of National Significance or any other species defined as a weed in **clearing permit CPS 8191/1**.

Western Ringtail Possum means the **EPBC Act** listed critically endangered species *Pseudocheirus occidentalis.*

Western Ringtail Possum habitat means any areas where **Western Ringtail Possum** occurs naturally.

ATTACHMENTS

Attachment A



Attachment B



Attachment C



Appendix B
Approved Clearing Permit (CPS 8191/1)

GOVERNMENT OF WESTERN AUSTRALIA

CLEARING PERMIT

Granted under section 51E of the Environmental Protection Act 1986

Purpose Permit number:	CPS 8191/1
Permit Holder:	Water Corporation
Duration of Permit:	From 28 July 2020 to 28 July 2035

The Permit Holder is authorised to clear native vegetation subject to the following conditions of this Permit.

1. **Purpose for which clearing may be done**
   Clearing for the purpose of upgrading the Vasse Diversion Drain, including the reconstruction of the Vasse Diversion Dam and duplication of the culverts.

2. **Land on which clearing is to be done**
   Lot 866 on Diagram 4170 (Crown reserve 16061), West Busselton
   Lot 80 on Deposited Plan 70429, Bovell
   Lot 61 on Plan 5399, West Busselton
   Lot 59 on Plan 5399, West Busselton
   Lot 58 on Plan 5399, Bovell
   Lot 57 on Plan 5399 (Crown reserve 16061), West Busselton
   Lot 56 on Plan 9868, Bovell
   Lot 56 on Plan 9868, West Busselton
   Lot 56 on Plan 5399, Bovell
   Lot 55 on Plan 9868, West Busselton
   Lot 553 on Plan 23463 (Crown reserve 48018), West Busselton
   Lot 5337 on Plan 23318, Bovell
   Lot 5210 on Plan 22191 (Crown reserve 45170), West Busselton
   Lot 5209 on Plan 22630 (Crown reserve 45170), West Busselton
   Lot 5190 on Deposited Plan 220139 (Crown reserve 41460), West Busselton
   Lot 5136 on Diagram 42478 (Crown reserve 45588), Bovell
   Lot 5068 on Plan 20855 (Crown reserve 44380), Busselton
   Lot 5067 on Plan 20770 (Crown reserve 43250), West Busselton
   Lot 5067 on Plan 20362 (Crown reserve 43250), West Busselton
   Lot 505 on Deposited Plan 417589, West Busselton
   Lot 501 on Deposited Plan 417589, West Busselton
   Lot 4989 on Plan 18644 (Crown reserve 43250), West Busselton
   Lot 4607 on Diagram 40995, West Busselton
   Lot 4348 on Diagram 27395 (Crown reserve 26555), West Busselton
   Lot 2594 on Deposited Plan 400537 (Crown Reserve 52132), West Busselton
   Lot 2593 on Deposited Plan 400537 (Crown Reserve 52132), West Busselton
   Lot 1 on Diagram 39001, West Busselton

Lot 100 on Diagram 9165, Bovell
Unallocated Crown Land (PIN 11993547), Bovell
Water Feature (PIN 11725451), Bovell
Road Reserve - 1172836, West Busselton
Road Reserve - 11440716, West Busselton
Road Reserve - 1183896, West Busselton
Deposited Plan 37514 - Easement J140752 (5067)
Deposited Plan 37514 - Easement J140752 (5209)
Deposited Plan 37514 - Easement J140752 (5210)

3. Area of clearing
The Permit Holder must not clear more than 2.16 hectares of native vegetation within the area hatched yellow on attached Plan 8191/1a and 8191/1b.

4. Period in which clearing is authorised
The Permit Holder shall not clear any native vegetation after 28 July 2025.

5. Application
This Permit allows the Permit Holder to authorise persons, including employees, contractors and agents of the Permit Holder, to clear native vegetation for the purposes of this Permit subject to compliance with the conditions of this Permit and approval from the Permit Holder.

6. Type of clearing authorised
This Permit authorises the Permit Holder to clear native vegetation for the *project activities* described in condition 1 of this Permit to the extent that the Permit Holder has the power to carry out works involving clearing for those *project activities* under the *Water Corporation Act 1995* or any other written law.

7. Avoid, minimise and reduce the impacts and extent of clearing
In determining the amount of native vegetation to be cleared authorised under this Permit, the Permit Holder must have regard to the following principles, set out in order of preference:
(a) avoid the clearing of native vegetation;
(b) minimise the amount of native vegetation to be cleared; and
(c) reduce the impact of clearing on any environmental value.

8. Dieback and weed management
When undertaking any clearing authorised under this Permit, the Permit Holder must take the following steps to minimise the risk of the introduction and spread of *weeds* and *dieback*:
(a) clean earth-moving machinery of soil and vegetation prior to entering and leaving the area to be cleared;
(b) ensure that no known *dieback* or *weed*-affected soil, *mulch*, *fill* or other material is brought into the area to be cleared; and
(c) restrict the movement of machines and other vehicles to the limits of the areas to be cleared.

9. Flora management – *Caladenia procera*
(a) Prior to undertaking any clearing, the Permit Holder must engage a *botanist* to conduct a *targeted flora survey* within *suitable habitat(a)* within the areas cross-hatched yellow on attached Plan 8191/1a for the presence of *Caladenia procera*;
(b) The Permit Holder shall ensure no clearing of any *Caladenia procera* individuals identified through the surveys required by condition 9(a);
(c) The Permit Holder shall ensure that no clearing occurs within 10 metres of *Caladenia procera* individuals identified through the surveys required by condition 9(a), unless the clearing is done in accordance with condition 9(d) of this Permit;
(d) Where clearing within 10 metres of individuals of *Caladenia procera* is unavoidable, the Permit Holder must:

(i) install clearly demarked temporary fencing around the individuals of *Caladenia procera* prior to undertaking any clearing and maintain the fencing until the *project activities* have ceased; and
(ii) Adhere to the Flora Management Plan required under condition 10 which has been approved by the *CEO.*

(e) Within two months of undertaking any clearing authorised under this Permit within the areas cross-hatched yellow on Plan 8191/1a, the Permit Holder must provide the results of the *targeted flora survey*, as required by condition 9(a), in a report to the *CEO;* and
(f) If *Caladenia procera* are identified within 10 metres of the areas cross-hatched yellow on Plan 8191/1a, the *targeted flora survey* report must include the following:
(i) the location of each *Caladenia procera* identified under condition 9(a), either as the location of individual plants, or where this is not practical, the areal extent of the population and an estimate of the number of plants, recorded using a Global Positioning System (GPS) unit set to Geocentric Datum Australia 1994 (GDA94), expressing the geographical coordinates in Eastings and Northings or decimal degrees;
(ii) map/s showing the location of any identified population of *Caladenia procera* cleared and the remaining population; and
(iii) the methodology used to survey the Permit area.

10. Flora Management Plan

Where clearing within 10 metres of individuals of *Caladenia procera* is unavoidable, the Permit Holder must submit a Flora Management Plan to the *CEO* for approval, prior to clearing commencing. The management plan must contain the following:
(i) Details of the Permit Holder's attempts to avoid and minimise impacts to *Caladenia procera*; and
(ii) Proposed methods of minimising and mitigating any indirect impacts to *Caladenia procera*.

11. Fauna management – other approvals

Prior to clearing, the Permit Holder must provide to the *CEO:*
(a) a copy of the fauna licence(s) obtained under the *Biodiversity Conservation Act 2016* for the *relocation* and/or *translocation* of Carter's freshwater mussel (*Westralunio carteri*) and the dispersion of western ringtail possum (*Pseudocheirus occidentalis*) individuals; and
(b) a copy of the approved exemption from the Department of Primary Industries and Regional Development under the *Fish Resources Management Act 1994 and Fish Resources Management Regulations 1995* for the collection of Carter's freshwater mussel for translocation.

12. Fauna management – Carter's freshwater mussel

(a) Prior to commencement of any clearing activities authorised under this Permit, the Permit Holder must submit a Carter's freshwater mussel (*Westralunio carteri*) Management Plan to the *CEO* for approval. The management plan must contain the following:
(i) Removal, transportation and *relocation* method, and where required, temporary storage method;
(ii) Location of the *relocation* site, including a field assessment confirming the suitability of the *relocation* site;
(iii) Stocking densities; and
(iv) The success rate monitoring plan.

13. Fauna management – western ringtail possum

(a) In relation to the area cross-hatched yellow on attached Plans 8191/1a and 8191/1b, the Permit Holder must engage a *fauna specialist* to inspect that area, including all trees and tree hollows present, within 24 hours prior to, and for the duration of clearing, for the presence of western ringtail possum(s) (*Pseudocheirus occidentalis*).
(b) Clearing must cease in any area where fauna referred to in condition 13(a) above are identified until the western ringtail possum(s) has moved out of the development area to adjoining *suitable habitat(b)*.
(c) Where fauna is identified under condition 13(a) of this Permit, the Permit Holder must provide the following records to the *CEO* as soon as practicable:

(i) the number of individuals identified;
(ii) the date each individual was identified;
(iii) the location where each individual was identified recorded using a Global Positioning System (GPS) unit set to Geocentric Datum Australia 1994 (GDA94), expressing the geographical coordinates in Eastings and Northings or decimal degrees;
(iv) the number of individuals displaced;
(v) the relevant qualifications of the *fauna specialist* undertaking the displacement;
(vi) the date each individual was displaced;
(vii) the method of dispersal;
(viii) the date each individual was dispersed;
(ix) the location where each individual dispersed to, recorded using a GPS unit set to GDA94, expressing the geographical coordinates in Eastings and Northings or decimal degrees; and
(x) details pertaining to the circumstances of any death of, or injury sustained by, an individual.

14. Fauna management – western ringtail possum rope bridges

Prior to commencement of any clearing activities authorised under this Permit, the Permit Holder must at a minimum install six rope bridges within the area cross-hatched red on the attached Plan 8191/1c, in accordance with the following requirements:

(i) the end of each rope bridge must be connected to at least two mature trees, or two different locations in the canopy of a single mature tree, at a height of at least three metres above ground level;
(ii) the rope bridges must be placed in areas that provide canopy connectivity for western ringtail possum movement across the local area, i.e. across roadways and other gaps in the canopy;
(iii) be monitored annually and maintained for a period of at least ten years; and
(iv) Within two months of undertaking any clearing authorised under this Permit within the combined areas cross-hatched yellow on Plan 8191/1a and 8191/1b, the Permit Holder must provide to the *CEO*, the locations where each rope bridge was placed using a Global Positioning System (GPS) unit set to Geocentric Datum Australia 1994 (GDA94), expressing the geographical coordinates in Eastings and Northings or decimal degrees.

15. Fauna management – western ringtail possum nest boxes

Prior to commencement of any clearing activities authorised under this Permit, the Permit Holder must, at a minimum, install 12 nest boxes within the area cross-hatched red on the attached Plan 8191/1c, in accordance with the following requirements:

(i) be designed and placed in accordance with the specifications detailed in the Project Revegetation Plan required by condition 17(a);
(ii) be placed at least three metres above ground level in a mature tree facing the shadiest side of the tree;
(iii) be monitored annually and maintained for a period of at least ten years; and
(iv) within two months of undertaking any clearing authorised under this Permit within the combined areas cross-hatched yellow on Plan 8191/1a, the Permit Holder must provide to the *CEO*, the locations where each nest box was placed using a Global Positioning System (GPS) unit set to Geocentric Datum Australia 1994 (GDA94), expressing the geographical coordinates in Eastings and Northings or decimal degrees.

16. Revegetation and rehabilitation – mitigation

(a) Within 12 months of the commencement of clearing, the Permit Holder must undertake revegetation within 0.55 hectares of the area hatched red on attached Plan 8191/1d in accordance with condition 17 of this permit.

17. **Offset – revegetation and rehabilitation**

(a) Within 3 months of clearing commencing, the Permit Holder must submit a Project Revegetation Plan to the *CEO* for approval for the *revegetation* of 10.34 hectares of land within the areas cross-hatched red on Plan 8191/1e, which shall be developed in accordance with *A Guide to Preparing Revegetation Plans for Clearing Permits* (Department of Water and Environmental Regulation (DWER) 2018).

(b) The Project Revegetation Plan must be prepared by an *environmental specialist*.

(c) The Project Revegetation Plan must include the following:

(i) *site preparation*;

(ii) deliberate planting of native vegetation that will provide *suitable habitat(b)* for western ringtail possum;

(iii) deliberate planting of species associated with the *Eucalyptus rudis* (flooded gum), *Corymbia calophylla*, *Agonis flexuosa* Closed Low Forest (near Busselton)' priority ecological community (PEC) in areas as outlined in the Project Revegetation Plan;

(iv) deliberate planting of up to 300 seedlings of *Conospermum caeruleum var.* Busselton;

(v) planting of *local provenance* native understorey species at an *optimal time* so as to achieve the *completion criteria* specified in condition 17(a)(xii) below;

(vi) a biannual weed control program within the area hatched red on Plan 8191/1e to achieve the *completion criteria* outline under condition 17(a)(xii), criterion 2;

(vii) establishment of a total of 34, 5 x 5 metre monitoring *quadrats* within the area hatched red on Plan 8191/1e;

(viii) maintenance of sufficient fencing to protect revegetation areas adjacent to areas most impacted by public access as outlined in the Project Revegetation Plan;

(ix) implementation of hygiene protocols by cleaning earth-moving machinery of soil and vegetation prior to entering and leaving the site;

(x) installation of signage to educate reserve users of the revegetation activities being undertaken;

(xi) achieve the below *completion criteria* within the ten year monitoring period for the area hatched red on Plan 8191/1e;

Criterion	Aspect	Scale	Completion criteria description	Monitoring frequency
1	Per cent *weed* cover	Average of *quadrat* data and site traverse	<15 per cent weed cover across all sites	Bi-annually in the first 2 years, and annually for the next 8 years
2	Declared *weeds*	Site traverse	Absence of declared weeds	Bi-annually in the first 2 years, and annually for the next 8 years
3	Per cent bare ground	Average of *quadrat* data and site traverse	Per cent of bare ground to be no greater than that recorded in the *pre clearing surveys*.	Bi-annually in the first 2 years, and annually for the next 8 years
4	Vegetation condition	Site traverse	The condition of the vegetation to be in a good to very good condition on average across the revegetation area (Keighery 1994).	Bi-annually in the first 2 years, and annually for the next 8 years
5	Native vegetation cover/density	Average of *quadrat* data and site traverse	>70 per cent native cover	Bi-annually in the first 2 years, and annually for the next 8 years
6	Species richness	Average of *quadrat* data	>70 per cent of species planted represented across all sites respectively (PEC sites, Geographe coastal wetland	Bi-annually in the first 2 years, and annually for the next 8 years

			system sites and Quindalup dune sites) as outlined in the species list provided in the Project Revegetation Plan	
7	*Conospermum caeruleum var.* Busselton	Site traverse and direct survival observation	>50 per cent survival rate to be achieved	Bi-annually in the first 2 years, and annually for the next 8 years

(xii) remedial actions to be undertaken if *completion criteria* are not met; and
(xiii) management commitments that will be achieved.

(d) The Permit Holder shall implement the Project Revegetation Plan as approved by the *CEO*.

18. Record keeping

The Permit Holder must maintain the following records:

(a) In relation to the clearing of native vegetation authorised under this Permit:
  (i) the boundaries of clearing undertaken on each date, recorded using a Global Positioning System GPS unit set to GDA94, expressing the geographical coordinates in Eastings and Northings or decimal degrees;
  (ii) the size of the area cleared (in hectares);
  (iii) actions taken to avoid, minimise and reduce the impacts and extent of clearing in accordance with condition 7 of this Permit;
  (iv) actions taken to minimise the risk of the introduction and spread of *weeds* and *dieback* in accordance with condition 8 of this Permit;
  (v) details required in accordance with flora management conditions 9and 10 of this Permit; and
  (vi) details required in accordance with fauna management conditions 11, 12, 13, 14 and 15 of this Permit.

(b) In relation to revegetation activities undertaken pursuant to conditions 16 and 17 of this Permit:
  (i) the date(s) each area was revegetated;
  (ii) the location of each area revegetated recorded using a GPS unit set to GDA94, expressing the geographical coordinates in Eastings and Northings or decimal degrees;
  (iii) at least two photographs of each area revegetated taken on an annual basis at the same location each year;
  (iv) a description of the revegetation activities undertaken each year for each area revegetated; and
  (v) a description of the tree density and native understorey vegetation cover for each area revegetated recorded on an annual basis.

19. Reporting

(a) The Permit Holder must provide to the *CEO* on or before 30 June of each year, a written report:
  (i) of records required under condition 18 of this Permit; and
  (ii) concerning activities done by the Permit Holder under this Permit between 1 January to 31 December of the preceding calendar year.

(b) If no clearing authorised under this Permit has been undertaken, a written report confirming that no clearing under this Permit has been undertaken, must be provided to the *CEO* on or before 30 June of each year.

(c) Prior to 30 March 2030, the Permit Holder must provide to the *CEO* a written report of records required under condition 18 of this Permit where these records have not already been provided under condition 19(a) of this Permit.

Definitions

The following meanings are given to terms used in this Permit:

botanist means a person who holds a tertiary qualification specialising in environmental science or equivalent, and has a minimum of two (2) years work experience in Western Australian flora identification and undertaking flora surveys native to the bioregion being inspected or surveyed, or who is approved by the CEO as a suitable environmental specialist for the bioregion, and who holds a valid flora licence issued under the *Biodiversity Conservation Act 2016*;

CEO means the Chief Executive Officer of the Department responsible for the administration of the clearing provisions under the *Environmental Protection Act 1986*;

completion criteria (quantitative) means a measurable outcome based on a suitable reference site, used to determine revegetation/rehabilitation success;

dieback means the effect of *Phytophthora* species on native vegetation;

environmental specialist means a person who holds a tertiary qualification in environmental science or equivalent, and has a minimum of 2 years work experience relevant to the type of environmental advice that an environmental specialist is required to provide under this permit, or who is approved by the CEO as a suitable environmental specialist;

fill means material used to increase the ground level, or fill a hollow;

local provenance means native vegetation seeds and propagating material from natural sources within 100 kilometres where practical, based on a species specific assessment and availability of sufficient propagation material and the same Interim Biogeographic Regionalisation for Australia (IBRA) subregion of the area cleared.

mulch means the use of organic matter, wood chips or rocks to slow the movement of water across the soil surface and to reduce evaporation;

optimal time means the most suitable period for undertaking direct seeding and planting based on species availability, as set out in the Project Revegetation Plan;

pre clearing surveys means those surveys undertaken by the applicant prior to the permit being granted, which informed the assessment of the clearing permit application;

quadrat means a sample plot established for the purpose of data collection and monitoring vegetation characteristics, for example species composition, structure, density and condition;

rehabilitate/ed/ion/ing means actively managing an area containing native vegetation in order to improve the ecological function of that area;

relocation means moving an individual animal (or family group) from one location within its home range to another location within the same home range for the purpose of resolving a human-wildlife conflict;

revegetate/ed/ion/ing means the re-establishment of a cover of local provenance native vegetation in an area using methods such as natural regeneration, direct seeding and/or planting, so that the species composition, structure and density is similar to pre-clearing vegetation types in that area;

reference site means a site used to provide baseline data for planning a revegetation project. Measurements from fixed reference points or plots where biodiversity components are measured are used to set measurable completion criteria for revegetation projects. Reference sites are to be in at least very good condition (Keighery 1994);

revegetation plan means a plan prepared by the Permit Holder, or an appropriate *environmental specialist* delegated by the Permit Holder, for the *revegetation* of a site in accordance with a Permit condition;

site preparation means management of existing site topsoil and preparation of the finished soil surface, for example by ripping or tilling the soil surface and respreading site topsoil and chipped native vegetation.

suitable habitat(a) means habitat known to support Carbunup king spider orchid (*Caladenia procera*) within the known current distribution of the species, typically characterised by jarrah (*Eucalyptus marginata*), marri (*Corymbia calophylla*) and peppermint (*Agonis flexuosa*) woodland on alluvial sandy-clay loam flats, with Mangles kangaroo paw (*Anigozanthos manglesii*) amongst dense heath and sedges or low dense shrubs. Other associated species include *Acacia stenoptera* and *Pimelea sylvestris.*

suitable habitat(b) means habitat known to support western ringtail possums (*Pseudocheirus occidentalis*) within the known current distribution of the species, typically characterised by abundant foliage, presence of suitable nesting structures such as tree hollows, as well as high canopy cover and continuity. Known habitat includes peppermint (*Agonis flexuosa*) dominated woodlands, jarrah (*Eucalyptus marginata*) and marri (*Corymbia calophylla*) forests, riparian vegetation with a canopy of Bullich (*Eucalyptus megacarpa*) or flooded gum (*Eucalyptus rudis*), karri (*Eucalyptus diversicolor*) forests, sheoak (*Allocasuarina fraseriana*) dominated woodlands, and other stands of myrtaceous trees growing near swamps, watercourses or floodplains;

targeted flora survey means a field-based investigation, including a review of established literature, of the biodiversity of flora and vegetation of the permit area, focusing on habitat suitable for *Caladenia procera* and carried out during the optimal time to identify the species, which is during the flowering period between September and October. Where target flora are identified in the or in close proximity to the permit area, the survey must also include a minimum of a 10 metre radius of the surrounding areas to place the permit area into local context;

translocation means deliberate, human-mediated movement of living organisms from one area, with release in another for the purpose of establishing, re-establishing or augmenting a population. Movement includes between wild locations and populations, from a captive facility or ex situ population to a wild location, and/or from the wild to a captive facility for population growth, with an intention to return the individuals or their progeny to the wild;

vegetation condition means the rating given to native vegetation which refers to the impact of disturbance on each of the layers and the ability of the community to regenerate (Keighery 1994);

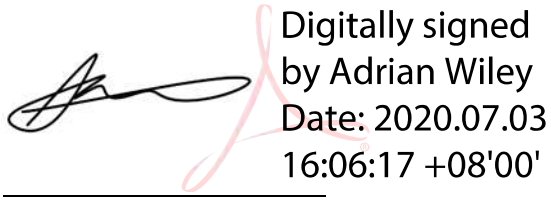
weed/s means any plant -

(a) that is a declared pest under section 22 of the *Biosecurity and Agriculture Management Act 2007*; or

(b) published in a Department of Biodiversity, Conservation and Attractions species-led ecological impact and invasiveness ranking summary, regardless of ranking; or

(c) not indigenous to the area concerned.

fauna specialist means a person who holds a tertiary qualification specialising in environmental science or equivalent, and has a minimum of 2 years work experience in fauna identification and surveys of fauna native to the region being inspected or surveyed, or who is approved by the CEO as a suitable fauna specialist for the bioregion, and who holds a valid fauna licence issued under the Biodiversity Conservation Act 2016.



Adrian Wiley
SENIOR MANAGER
NATIVE VEGETATION REGULATION

Officer delegated under Section 20
of the Environmental Protection Act 1986

3 July 2020

Appendix C
Compliance reporting time frame approval

Australian Government
Department of Agriculture, Water and the Environment

Ref: 2017/7932

Mr Sean Nicholson
Senior Environment Advisor
Assets Planning and Delivery
Water Corporation
Locked Mail Bag 2
Osborne Park Delivery Centre
OSBORNE PARK WA 6916

RE: EPBC 2017/7932 - Request to change compliance reporting

Dear Mr Nicholson

Thank you for your correspondence to the Department requesting changes to the compliance reporting for EPBC 2017/7932.

Officers of this Department have reviewed these requests and briefed me. As delegate of the Minister, I agree for the EPBC 2017/7932 compliance reporting dates to be aligned with the state clearing permit. Please note that in accordance with the relevant Annual compliance reporting condition, the Department must be notified by email that a compliance report has been published on the website and provide the weblink for the compliance report within five business days of the date of publication.

As you are aware, the Department has an active monitoring program which includes monitoring inspections, desk top document reviews and audits. Please ensure that you maintain accurate records of all activities associated with, or relevant to, the conditions of approval so that they can be made available to the Department on request.

Should you require any further information please contact Bayley Costin, Project Officer, Post Approvals Section, on 02 6274 1118 or by email: post.approval@awe.gov.au.

Yours sincerely

Kim Farrant
Assistant Secretary
Environment Assessments (Vic, Tas) and Post Approvals Branch
Environment Approvals Division

8 April 2022

Appendix D
Western ringtail possum

Monitoring of the Western Ringtail Possum following Clearing along the Vasse Diversion Drain, Busselton

Year Two

January 2022 – February 2023



Image 1: Western Ringtail Possum using rope bridge (J Bamford)

Prepared for: Water Corporation
PO Box 210,
Mandurah, WA, 6210

Prepared by: Amanda Bamford, Joshua Bamford & Jake Bamford
M.J. & A.R. Bamford Consulting Ecologists
23 Plover Way
Kingsley, WA 6026

30th May 2023

Executive Summary

The Water Corporation widened the Vasse Diversion Drain in Busselton in 2020 - 2021 for flood mitigation, and since the conservation significant Western Ringtail Possum occurs in remnant vegetation that was impacted by drain widening, Bamford Consulting Ecologists was commissioned to undertake the displacement of possums prior to clearing along the drain in two areas: a northern area between Queen Elizabeth Avenue and the Busselton Bypass Road, and a southern area near the Golf Course (VROS). BCE was also commissioned to conduct ongoing monitoring of the population and their use of installed shelters and rope bridges over a ten-year period, as a condition of the approval of the drain widening project. This report covers the second year of post-disturbance monitoring (January 2022 – February 2023).

Of the 43ha project area surveyed in 2019 prior to the project's approval, where 206 dreys and at least 66 possums were recorded, only 1.9ha was cleared in 2020. Forty-one dreys and hollows and 36 possums were identified in the impact area prior to clearing. Prior to and during clearing in November 2020, all possums were successfully relocated into adjacent vegetation without mortality or injury. Of the 41 dreys found, 23 were able to be relocated, and a further 63 artificial shelters (dreys and hollows) were installed, making a total of 88 new shelter locations (a commitment was made to provide 82 additional shelters). Rope bridges were also installed along the north side of the drain adjacent to College Avenue and Scott Street, to increase connectivity and reduce the need for possums to go to the ground to travel between trees, where they are at risk of predation by foxes, cats and dogs.

Since most possums could remain within their home ranges, handling was avoided where possible to minimise stress. In most cases, animals could be displaced into adjacent vegetation without handling them. Trees were checked and animals displaced immediately prior to clearing, to avoid them returning to the clearing area. Eleven possums had to be hand-captured and moved; four were moved without touching them, while contained within or holding onto the top of an artificial or natural drey; two were moved while within hollows; and two were moved by encouraging them to climb onto the net and carrying them to safety while perched on top of the net. The remaining 17 were displaced by gently disturbing them from their dreys and herding them to adjacent, safe trees. Clearing debris was then removed immediately to prevent animals trying to return.

As part of compliance for the project approval, a ten-year monitoring program is underway to determine:

- the effects of disturbance on the numbers and distribution of Western Ringtail Possums adjacent to the disturbance areas along the Vasse Diversion Drain,
- Whether artificial shelters are used by possums and can contribute to the maintenance of the population, post-disturbance,
- Which shelter designs are preferred by Western Ringtail Possums,
- Whether rope bridges will be used by possums and are therefore effective in improving connectivity in a disturbed landscape,

- Whether revegetation is being accessed by possums and results in increased habitat for the species during a ten-year period.

Six monitoring periods were undertaken during Year One; January, March, April / May, August, September 2021, and January 2022. In Year Two, there were two monitoring periods; December 2022 and February 2023. There were 38 possums recorded in the area adjacent to works in January 2021, following the disturbance. The numbers remained remarkably stable, with a minimum of 31 recorded in March 2021, which is consistent with the dispersal of juveniles, and had increased to 45 in January 2022. In Year Two, there were 40 in December 2022 and post-breeding numbers jumped up to 64 by February 2023. The high numbers of possums could be explained by a good breeding season, the abandonment of a fox den in the Council reserve, the provision of additional shelters and rope bridges, and the revegetation which may have begun to improve the quality of food plants available to the animals. Future monitoring will help to determine the factors affecting the population. It seems likely that many of the animals found during monitoring are those who were displaced from the impact area but have stayed and continued to breed within their remaining home ranges.

One hundred new natural dreys were recorded in the two sampling periods in Year Two, which is an impressive number. Many of the dreys were unoccupied, which is to be expected as possums often build and use more than one drey, however the large number of new dreys correlates with the high number of possums (64) recorded for Year Two.

Both Brushtail and Western Ringtail Possums were recorded using rope bridges again in Year Two, confirming that the design is successful. Rope bridges adjacent to Cook St appear to have provided safe access for possums into trees that were previously unavailable to them. Revegetation in the area will further support the movement of these animals. Future monitoring will help to determine the extent to which rope bridges are contributing to connectivity.

Artificial shelters were used consistently in both sampling periods in Year Two. Twenty-seven percent of the possums recorded during the December 2022 monitoring period and 20% of possums recorded in February 2023 were using artificial shelters. Plastic filter buckets were the most frequently occupied artificial dreys (50% were used in at least one monitoring period) in December 2022 and February 2023, followed by ‘short hollows’, 30% of which were used in at least one monitoring period. Coconut-lined cups and domes were also used at lower rates, including an empty cup which a possum chose to re-line with natural materials.

In Year One, there were six monitoring periods and results showed a seasonal difference in the preferred design of artificial shelters. In Year Two, only two monitoring periods were scheduled, so it was not possible to draw detailed conclusions on the seasonal use of different designs. More frequent sampling would provide a more robust assessment of seasonal variation in drey preference.

Unlike the results of monitoring along the Vasse Diversion Drain between Queen Elizabeth Avenue and the Busselton Bypass Road, possums have not been detected in any of the artificial dreys at the VROS since March 2021, although an empty natural drey was recorded in Year One. It is likely that fragmentation of the area has made it unsuitable for possums, and this is likely to continue unless revegetation occurs in collaboration with the farmers adjacent to the site.

Tranen Revegetation SouthWest is continuing revegetation work, which will provide increased food and connectivity. Once vegetation has established, it should also provide additional locations for natural dreys to be constructed, and possibly result in an increase in the population of possums. Additional dreys and an increase in possum numbers should be detectable within the ten-year monitoring timeframe for the project.

Relocated natural dreys performed an important function immediately following displacement of the possums but have deteriorated and none was used in Year Two. Fourteen were replaced with artificial shelters in February 2023, and further replacements will be required in Year Three to maintain the numbers of additional dreys provided, as committed to as part of approvals for the project. Since artificial dreys continue to be used at a consistent rate, it will be interesting to see if increasing the numbers of them increases their use, and if numbers of possums continue to increase.

Revegetation should proceed as quickly as practical to ensure the animals continue to have sufficient food resources to support them during lean times. The increased connectivity provided by plantings and rope bridges will also allow possums to move between the population along the drain and the rest of Busselton, improving the species' long-term viability in the area.

Results of the second year of monitoring support the findings of Year One monitoring that the displacement and disturbance due to drain works had not greatly impacted possum numbers, that artificial shelters are helping to house the population and that rope bridges are of a suitable design to keep possums off the ground and improve connectivity. The numbers of possums at the study site post-breeding have increased for the last two years since January 2021. Future monitoring will help to better assess these initial findings, and effects of revegetation work, which is likely to provide significant positive impact within the next ten years.

INTRODUCTION

The Water Corporation manages a network of drains in the vicinity of Busselton and in October 2020 – April 2021 works were undertaken to widen the Vasse Diversion Drain for flood mitigation. This widening affected some vegetation alongside the drain, but not the full width of this vegetation. An Environmental Impact Assessment conducted by GHD (2017) found that the Western Ringtail Possum *Pseudocheirus occidentalis*, which is a listed conservation significant species (Critically Endangered under both the Federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the *Western Australian Biodiversity Conservation Act 2016*) occurred in vegetation adjacent to the drain. Widening of the drain could affect >0.5ha of what might be primary corridor habitat for the species (*sensu* DEWHA 2009) and based on EPBC Act Policy Statement 3.10 (DEWHA 2009), this would be a significant impact. Therefore, the Department of Biodiversity, Conservation and Attractions requested the Water Corporation provide more information on the distribution and abundance of this species along the drain. Bamford Consulting Ecologists was commissioned to undertake this work in 2019.

The Vasse Drain Diversion Upgrade project was assessed Bilaterally by the DWER Native Vegetation branch under Part V of the EP Act [WA] and by AWE under the EPBC Act 1999 [Cwth] and the project was referred under the *EPBC Act* (Cwth). The project is a '*Controlled Action*,' so all activities must be undertaken in compliance with conditions set in the EPBC 2017/7932 Approval Conditions.

Following surveys of the 43ha project area in March 2019, where 206 dreys and at least 66 possums were recorded, areas were revised and only 2.16ha was identified as the impact area to be cleared in 2020.

A Fauna Management Plan for the Vasse Diversion Drain Upgrade was developed by Bamford Consulting Ecologists as part of the Approvals process and provides a detailed description of commitments and approach, as well as a summary of current research on Western Ringtail Possums and their requirements (Bamford et al., 2020). Implementation of the plan commenced in October 2020, prior to works commencing.

The Water Corporation committed to revegetation to re-establish and improve connectivity of vegetation, and the installation of rope bridges and fauna shelters, including ten years of maintenance and monitoring with the aim that any long-term effect of the works will be a positive one. Bamford Consulting Ecologists was commissioned to undertake relocation and subsequent monitoring of fauna in response to the disturbance and amelioration activities. The agreed approach was to gently displace the animals from the clearing zone but keep them within their home ranges where possible. By avoiding or minimising handling, personnel were able to keep stress to the animals to a minimum. Cowan et al. (2020), links the poor survival of relocated animals to the stress associated with their capture, handling and transport. Studies of Western Ringtail Possums report high mortality of relocated animals (Clarke, 2011, Thompson & Thompson, 2009). Transfer of parasites (Dunlop & Watson. 2022) can also occur when animals are moved out of their home ranges. Since the disturbance

was only to affect a narrow area, displacement, rather than translocation was the preferred option.

Western Ringtail Possums are nocturnal and shelter in tree hollows, or build shelters called 'dreys' in which they sleep during the day. Dreys are clumps of twigs and leaves that are generally quite conspicuous and placed in the mid canopy of trees (See Images 8 & 9 in Appendix 1). A possum may have five to eight dreys across a home range of 0.5 – 1.5ha, and home ranges overlap (Jones, 2000).

Clearing works were carried out from October to December 2020 and construction was completed in April 2021. Artificial shelters were installed, Western Ringtail Possums and other fauna were displaced from the clearing areas in October and November 2020, and a survey was carried out in January 2021 to make a preliminary assessment of the shelters and the possum population following displacement. Monitoring of possums and their use of shelters and rope bridges has continued during 2021 – 2022 (Year One) and 2022 – 2023 (Year Two). This report covers Year Two of the study; the period of January 2022 to February 2023.

Over its ten-year period, the monitoring program aims to determine:

- the effects of disturbance on the numbers and distribution of Western Ringtail Possums adjacent to the disturbance areas along the Vasse Diversion Drain,
- Whether artificial shelters are used by possums and can contribute to the maintenance of the population, post-disturbance,
- Which shelter designs are preferred by Western Ringtail Possums,
- Whether rope bridges will be used by possums and are therefore effective in improving connectivity in a disturbed landscape,
- Whether revegetation is being accessed by possums and results in increased habitat for the species during a ten-year period.

This Year Two report analyses data collected to date to inform these questions.

METHODS

Description of Project Area

The project area consists of land along two parts of the Vasse Diversion Drain (Figure 1). The northern area lies between the Busselton Bypass Road in the south and Bussell Highway in the north and includes some extra land in small reserves to the south of the drain. Much of the vegetation consists of Peppermint *Agonis flexuosa* forest and woodland, with varying proportions of Marri *Corymbia calophylla*, Flooded Gum *Eucalyptus rudis*, Jarrah *Eucalyptus marginata,* Coojong *Acacia saligna,* Swamp Banksia *Banksia littoralis*, Modong *Melaleuca priessiana* (Saltwater Paperbark *Melaleuca cuticularis* where the drain crosses The Broadwater), Spearwood *Kunzea* sp., and occasional other tree and tall shrub species. The understorey is generally in poor condition. Vegetation is in best condition on the south side of

the drain, between Queen Elizabeth Avenue and the Busselton Bypass Road. Open areas of weedy grasses are present, although these are being managed as part of rehabilitation.

The southern area lies adjacent to the Busselton Golf Course, east of Chapman Hill Rd and includes land on the eastern side of the drain, as well as encompassing a section of the Vasse River. This is the site of the Vasse River Overflow Structure (VROS). The vegetation is generally degraded and in places parkland cleared and grazed, with an open woodland of Peppermint and Flooded Gum, some planted, non-native eucalypts and some riparian woodland along the Vasse River The trees which provided some connectivity through the site were removed for construction of the VROS, so the remaining vegetation is fragmented (see Figure 1c).

The total area cleared was 1.9ha (see Figure 1 a, b and c), however the project area for this study also includes sites in adjacent bushland and rehabilitation areas into which artificial shelters, relocated dreys and rope bridges have been installed, and will increasingly include the rehabilitation areas as plantings mature and become attractive to possums.

(a)


LEGEND
Approved Clearing Area
1:5,000 at A4
Metres
N
WATER
CD00116
Vasse Diversion Drain
Equivalent to part of Plan 8191/1 a

(b)


LEGEND
Approved Clearing Area
1:5,500 at A4
Metres
N
WATER
CD00116
Vasse Diversion Drain
Equivalent to part of Plan 8191/1 a

(c)



Figure 1 (a,b,c). *The project areas. The northern site (a and b) stretches from Busselton Bypass Road in the south to Queen Elizabeth Avenue in the north. Figure 1(c)shows the Vasse River Overflow Structure (VROS) site. Areas that were cleared are hatched yellow.*

Approach

This report covers the second year of a ten-year study following the disturbance and relocation of possums due to clearing. All relocation work was carried out in accordance with the Fauna Management Plan for the Vasse Diversion Drain Upgrade (Bamford et al., 2020) and focussed on minimal disturbance to the animals. During clearing, animals had been displaced as little as possible, ideally within their existing home ranges, while moving them from the impact area. In most cases, this was able to be done without capturing the possums, to minimise disturbance and stress to the animals. Thirty-six possums were displaced from the clearing area during operations. All animals were relocated successfully without injury or mortality. In most cases, the animals were moved no more than 20 metres and in some cases as little as five metres. Details of the displacement techniques employed are given in Bamford et al. (2021).

Since most animals were not handled, they were not individually marked, so assessment of the population is undertaken by recording numbers and locations of animals and dreys. Given the sedentary nature of most of the animals, this is likely to be an accurate measure of the impact due to clearing and means that disturbance of the animals (and confounding of the results by the impacts of handling) has been kept to an absolute minimum.

Rope bridges are monitored using motion sensitive cameras, observation and scat records to search for evidence of use.

Survey methods

Monitoring is undertaken by Amanda (Mandy) Bamford (B.Sc. Hons. Zool.) and Mike Bamford (B.Sc. Hons. Ph.D. Biol.). Mandy and Mike have many years of experience in management of the Western Ringtail Possum (hereafter referred to as possum). The work was carried out under DPIRD Scientific licence (ethics) U261/2021-2022, DBCA Permit numbers TFA 2020-0149-2, TFA 2020-0149 and FR28000164, undertaken with reference to the Fauna Management Plan for the Vasse Diversion Drain Upgrade (Bamford et al, 2020) and informed by observations in Bamford et al (2021) and Bamford et al (2022). Field assistance was provided by Jake Bamford (B.C.I.), Joshua Bamford (B.Sc. B.Mus. Hons. M.A. D.Phil.[Oxon.]), Andrew McCreery (B.Sc.) and Nathan Ducker (B.Ed.). Data Management was undertaken by Joshua Bamford.

Possum monitoring was carried out in December 2022, and February 2023. Monitoring was carried on fine days once the sun was up to protect camera equipment and minimise disturbance to possums. Previous experience (Bamford pers. obs.) is that possums are often only dozing on overcast days or at first light and are easily disturbed. In bright sunlight they are usually firmly asleep and dreys may be checked without disturbing them. All artificial shelters and relocated natural dreys were checked with binoculars or a pole camera to assess their status and check for possums. Natural dreys, hollows and possums sighted out of dreys adjacent to the cleared area were also recorded opportunistically. Recognising that it was important to minimise disturbance during monitoring, the pole camera was used for the minimal time, and just close enough to check for activity and take a photo, to disturb the animals as briefly as possible. In some natural dreys, it was not possible to access the drey using the pole camera without disturbing the animal, in which case the drey was checked using binoculars.

Handling of Fauna

No fauna requires handling as part of the post-disturbance monitoring phase of the project. Checking of dreys is done with minimal disturbance and cameras are unbaited, so do not alter the behaviour of the animals. Bamford Consulting Ecologists operates under Scientific Use Licence U261 2021-2022 and if animals require handling for any reason, personnel use techniques outlined in the Fauna Sampling Manual by Bamford et al. (2013).

Relocated and Artificial Dreys

As outlined in the Fauna Management Plan (Bamford et al., 2020), a range of shelter types was installed in the project area in a variety of locations to augment the shelters available in

relocation areas and trial the attractiveness to possums of the different designs. The types included:

Relocated Natural Drey – a drey cut out from a tree before it was cleared and wired up into a tree outside the clearing zone.

Relocated Long Hollow – a long hollow cut from a tree in the clearing zone. There were only two of these so results are lumped with Short Hollows in this report.

Short Hollow – a short hollow log, capped at one end and chained with plastic coated chain to a tree, to minimise damage to the tree branch. Short hollows were chosen to trial as they may prove less attractive to European Honeybees *Apis mellifera* than long hollows and possums will shelter in short natural hollows.

Dome – a wire dome made from two hanging baskets wired together, with a quarter cut out for the entrance and lined with *Agonis flexuosa* leaves and twigs.*

Dome with Coconut Dome – a wire dome with matching coconut fibre liner and entrance hole. Two of these also contained paperbark*

Cup – a single hanging basket installed as a wire cup.*

Cup with Coconut – a single hanging basket lined with coconut.*

Plastic bucket – a plastic filter bucket.*

*In all cases, WA Peppermint *Agonis flexuosa* sprigs from the possum's nearest tree were added to each artificial drey to try to mimic as closely as possible the natural smell of the animal's home range. In some instances where an animal's natural drey could not be salvaged, material from the natural drey was added to an artificial drey to make the drey smell more familiar to the animal and perhaps make it more likely to be used.

Artificial shelters were installed throughout the project area, outside the impact area. Eighteen dreys and hollows were installed by Tree Surgeons WA, while they were installing the rope bridges. The remaining 68 relocated and artificial dreys were installed by Bamford Consulting Ecologists' personnel. Details of all dreys relocated and all installed shelters are given in Figures 2 and 3 and Appendices 2 and 3. Examples of shelter designs are provided in Appendix 1, Images 2 to 7.



Figure 2. *Locations of shelters for Western Ringtail Possums installed along the Vasse Drain in Busselton in October and November 2020.*



Figure 3. *The southern project area (VROS) off* [redacted] *the Vasse Diversion Drain and extending north along a natural drainage line, showing installed artificial shelters in red. The green marker was the location of a large* [redacted] *which a possum was displaced during clearing. It ran to a hollow (marked in white), behaving as if it knew the location. This hollow immediately adjacent to works was occupied in January 2021, despite active construction taking place nearby. Since March 2021, the hollow has been unoccupied, however a new natural drey was discovered in March 2021, further to the* [redacted] *(see Appendix 2, Figure 15)*

Monitoring of Artificial Shelters

A check of all artificial shelters was carried out on two occasions in 2022 (January and December) and in February 2023. December 2022 and February 2023 are the focus of this Year Two report. All locations were checked, shelters were photographed, and the state of the shelters recorded, noting any that needed repair or replacement. A pole camera was used to determine if the shelters were occupied by possums or had evidence of recent use (see Appendix 1, Image 16).

Replacement of Relocated Natural Dreys

Since many of the Relocated Natural Dreys that were installed during clearing had fallen down or become unusable, 14 additional artificial shelters were installed in February 2023 to replace those that had been lost. They were installed in similar locations to the dreys that they replaced. All the new shelters were photographed and images are provided in Appendix 3.

Monitoring of Natural Dreys

During the monitoring, a number of new, natural dreys were discovered in the study area. Locations and occupancy of these dreys were recorded, and they were added to future monitoring sessions. If a natural drey became disused and fell from the tree it was excluded from future monitoring. Natural dreys that remained in trees continued to be checked, as these will sometimes be repaired and reused by possums.

Monitoring of Rope Bridges

Two brands (Reconyx, Swift Enduro) of motion sensitive cameras were used to monitor use of the rope bridges on two sessions of three nights concurrently with the shelter monitoring periods. Cameras were set at a range of angles depending on the locations of ropes and adjacent branches.

When analysing camera data, groups of images of the same species taken less than five minutes apart were scored as a single instance to avoid overestimating the number of animals using the bridges.

In addition, opportunistic searches for scats underneath the rope bridges were undertaken during other monitoring activities.

RESULTS

Numbers of Possums

Figures 4 and 5 show the locations of Western Ringtail Possums prior to displacement, to provide context for interpreting the results of post-disturbance monitoring. Note that one retained tree on the edge of the drain where construction occurred has continued to record a possum in both Years One and Two.

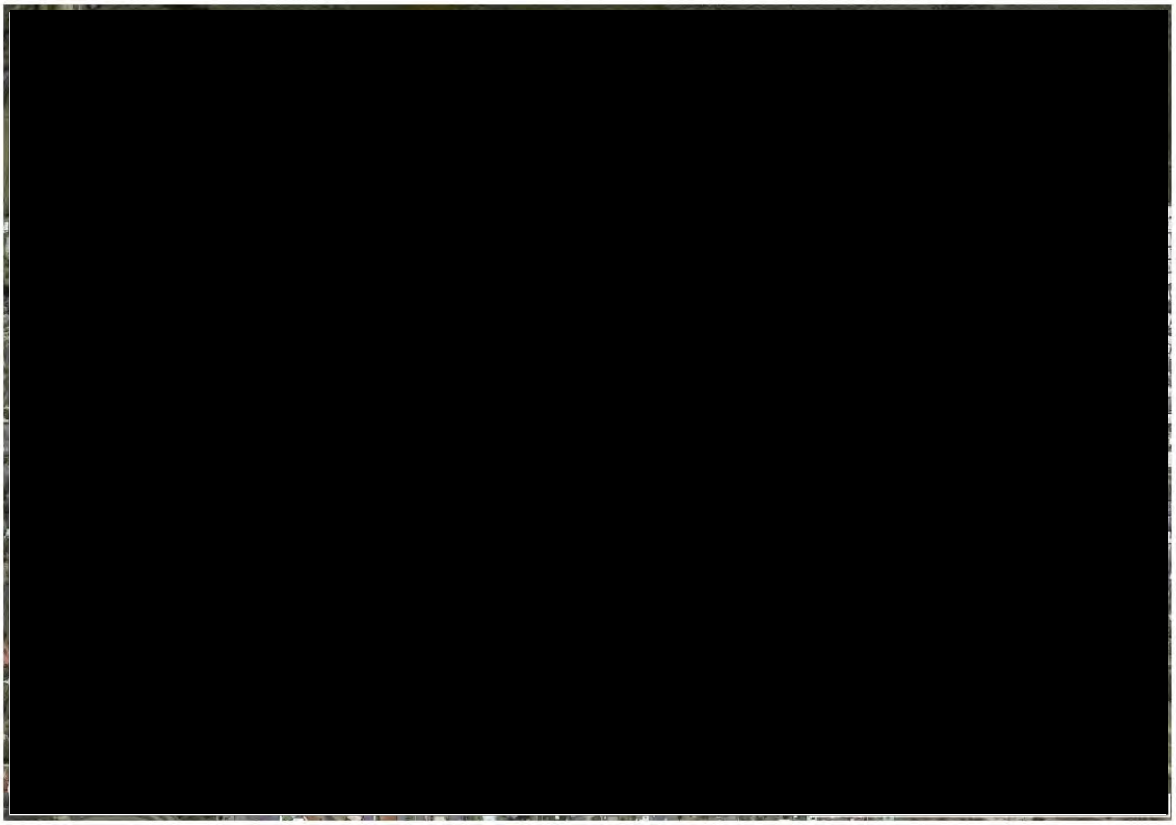


Figure 4. *Locations of Western Ringtail Possums along the Vasse Drain in Busselton in October and November 2020, prior to displacement. White dots denote possums +/- joeys which were displaced, blue points indicate possums which were on the border of clearing works and were not moved as their trees were retained. Two of these retained trees contained possums in January 2021, despite being immediately adjacent to construction work, and one of them was occupied in January 2022, and again in February 2023.*



***Figure 5**. Locations of Western Ringtail Possums in the southern (VROS) site prior to displacement in November 2020. See Appendix 2, Figure 12 for results from January 2021 onwards. No possums were observed in the VROS area in Year Two of monitoring.*

Summary tables of data for Year Two of monitoring are given in Table 1 and Appendix 3, with Year One data for comparison. Figures 6 and 7 illustrate the usage of natural and artificial dreys, and the numbers of possums in each monitoring period. Figure 10 shows the locations of possums along the drain in Year Two.

Numbers and locations of Possums

In January 2021, 14 of 38 possums (37%) were on branches not associated with dreys while six were using artificial shelters (16%). In January 2022, eight of 45 possums (18%) were using artificial shelters and although some were outside, or in the entrance of their drey, all possums were associated with dreys. In February 2023, four possums (6%) did not appear to be associated with a drey (see Figure 6). In February 2023, 13 possums (20%) were using artificial shelters. The numbers of natural dreys in January 2021 was 18 but in January 2022 it was 35. By February 2023 there were 100 natural dreys, ranging from recent to disused. The post-breeding count of possums was also higher in February 2023 than in either 2021 or 2022 (38 in January 2021, 45 in January 2022 and 64 by February 2023).

Appendix 2, Figures 12 and 13 show the locations of new natural dreys in December 2022 and February 2023. The majority of new dreys recorded were in the Reserve in December 2022, but in February 2023, records were distributed more evenly, including along the narrow strip of vegetation South of the Drain.

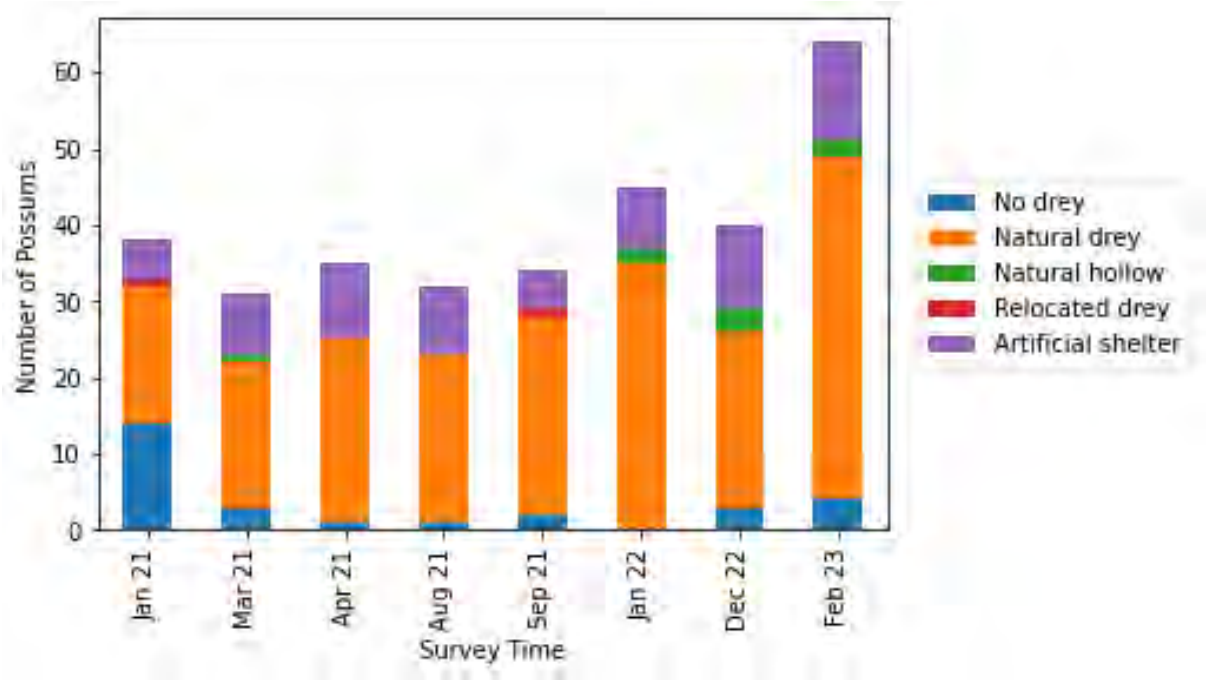


Figure 6. *Use of natural and artificial shelters by Western Ringtail Possums along the Vasse Diversion Drain in Busselton between January 2021 and February 2023. Note the continued use of artificial shelters and the large number of natural dreys that had been constructed, possibly by dispersing juvenile animals.*

Artificial shelters have continued to be used in all sampling periods. In Year Two, 27% (December 2022) and 20% (February 2023) of possums located were using artificial shelters. Plastic filter buckets were the most frequently used design in Year Two with 50% (3 out of 6) being used on at least one occasion (see Table 1 and Figure 7). Artificial 'short hollows' were the next most commonly occupied, with 30% (3 out of 10) being used in at least one monitoring period). Much of the coconut in the cups and domes had been harvested or rearranged by the possums by Year Two, however in one case, a possum later re-lined the drey (a cup) with new material (see Image 32, in Appendix 1).

Overall, 17% of artificial shelters were recorded as used by possums at least once in Year Two. Note that this is a minimum percentage as the dreys were only monitored on two occasions during Year Two, and dreys could have been in use at other times.

On one occasion in Year Two, a Brushtail Possum (*Trichosurus vulpecula*) was recorded using a short hollow (see Appendix 1, Image 34). This record was not included in the analysis of artificial drey use.

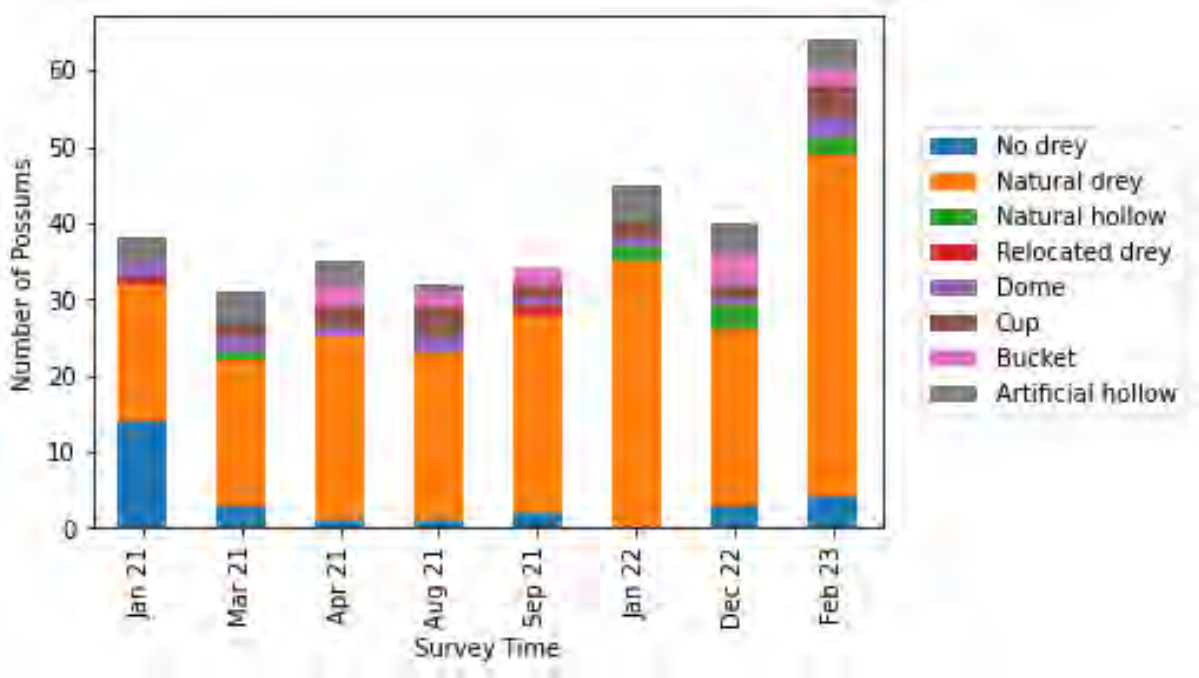


Figure 7. *Comparison of the use of a range of artificial shelter designs by Western Ringtail Possums along the Vasse Diversion Drain in Busselton between January 2021 and February 2023.*

Table 1. *Numbers and designs of artificial shelters installed along the Vasse Diversion Drain and their use by possums from January 2021 – February 2023. Year One and Year Two results are separated for comparison. Note that Year One records included six sampling periods, whereas Year Two results are based on only two sampling periods.*

Shelter type	Number installed	Number occupied in at least one monitoring period	Notes	Percentage of drey type occupied or used in at least one monitoring period
Relocated Natural Drey (NAT)	Year 1 24 Year 2 6 intact 14 replaced Feb'23	2 0	14 of these were replaced in Feb 2023 with artificial shelters at the same locations	2 (1%) 0
Dome with Coconut (DoCo)	17	Year 1 4 Year 2 1	One drey was occupied in both sampling periods.	5 (29%) 1%
Cup without Coconut (Cup)	12	Year 1 1 Year 2 1		1 (8%) 1(8%)
Cup with Coconut (CuCo)	14	Year 1 6 Year 2 2		6 (43%)
Installed or relocated Hollow (Hol)	10	Year 1 8 Year 2 3	Two hollows were occupied in both monitoring periods, One hollow was occupied in one monitoring period	8 (80%) 3 (30%)
Dome without Coconut (Dom)	5	Year 1 1 Year 2 1	This drey (Year 2) had been used but was not occupied in either sampling period.	1 (20%) 1 (20%)
Plastic Filter Bucket (Buc)	6	Year 1 4 Year 2 3	One was occupied in both sampling periods, two were occupied in one sampling period.	4 (60%) 3 (50%)
Totals	**88** **70**	Year 1 **26** Year 2 **11**	**1** (maintained)	**27 (30%)** **11 (16%)**
Totals excluding relocated dreys	**63** **63** 14 relocated dreys were replaced in Feb '23 A further 4 will be replaced during 2023	Year 1 **24** Year 2 **11** *	**1** (maintained)	**38%** **17%*** ***note that this is based on only two sampling periods rather than six in Year One so is not directly comparable.

Construction of Natural Dreys

Of the 100 natural dreys monitored during Year Two, 61 of them were new. In December 2022, 33 new natural dreys were recorded. A further 28 new natural dreys were recorded in February 2023.

Use of Rope Bridges

During the two camera sessions, many Ringtail and some Brushtail Possums were observed using the bridges. In February 2023 there were 71 individual photographs in 17 instances. See Images 20 to 26, in Appendix 1, and the cover of this report, for examples.

Western Ringtail Possum scats were observed during both sampling sessions under the rope bridges adjacent to Cook St industrial area. See Image 27 in Appendix 1.

Opportunistic Observations

A dead possum was found adjacent to a fox scat and was likely subject to fox predation. The fox den which was active in the Council Reserve during 2020 – 2022 was observed to have been abandoned in December 2022 and February 2023.

One artificial shelter (short hollow S66) contained a Brushtail Possum on 15/12/2022.

In December 2022, some possums were observed lying on their backs with their pouches open (see Appendix 1, Image 31).

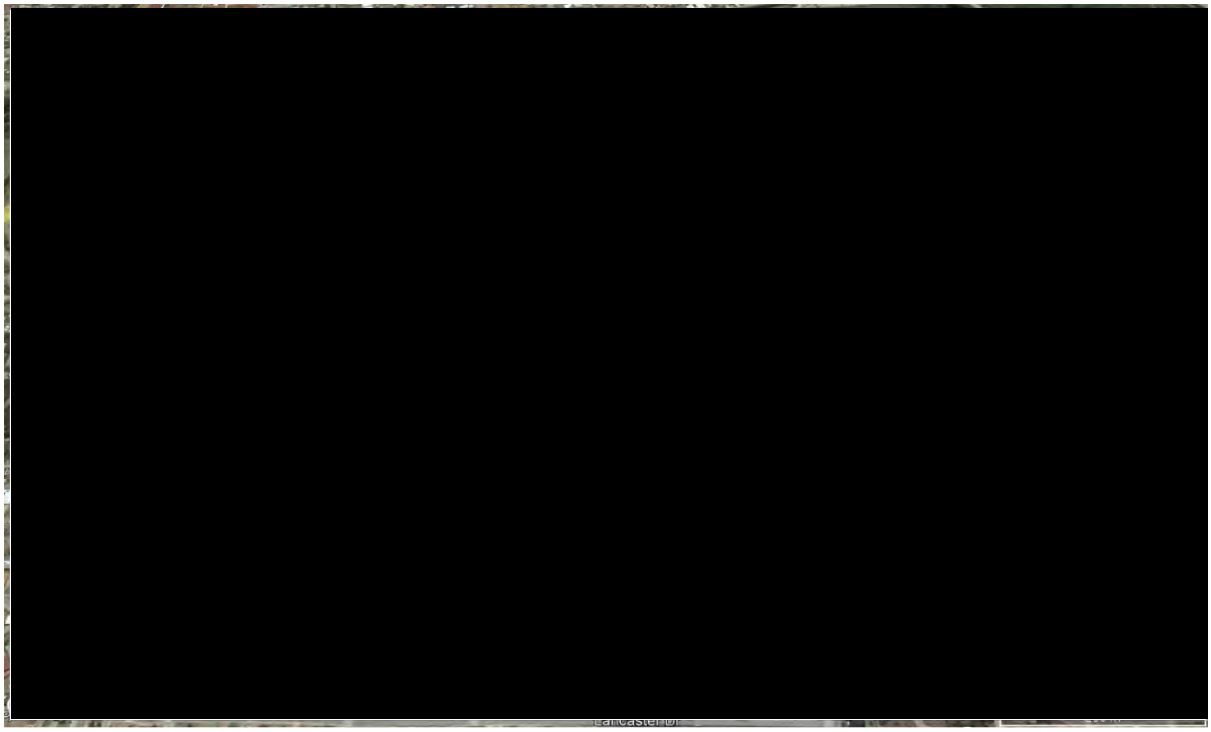


Figure 10. *Records of Western Ringtail Possums along the Vasse Drain in Busselton in Year Two.*

DISCUSSION

The second year of possum monitoring has consolidated the positive results from the first year. In the second year, 40 animals were recorded in the December sampling period and this increased to 64 animals by February, once the young were independent. Since six of the animals counted in December were joeys, an adjusted minimum number of adults would be 34, indicating a stable population size in comparison with previous years (32 in August 2021). This suggests that the possum management as part of drain widening works have not had a large impact on the population numbers to date. It also suggests that the possums have bred well in Year Two, and a large number of juveniles appeared to be beginning to disperse during February.

The use of the displacement technique outlined in the Fauna Management Plan for the Vasse Diversion Drain Upgrade (Bamford et al., 2020) to move possums from the clearing area appears to have been successful. All 36 possums were displaced from the clearing area without injury, many needing to be moved by less than 20 m. Most would only have been moved within their existing home ranges. By avoiding or minimising handling, personnel were able to keep stress to the animals to a minimum. Cowan et al. (2020), links the poor survival of relocated animals to the stress associated with their capture, handling and transport. Studies of Western Ringtail Possums report high mortality of relocated animals (Clarke, 2011, Thompson & Thompson, 2009) however observations from the first two years of the present study suggest that many animals have remained in the area following displacement. Ongoing surveys will better inform these observations.

Relocated dreys were probably important initially but most became disused once the possums had the opportunity to build new dreys or adopted artificial shelters. Interestingly, two relocated dreys were being used in September 2021 and one was still being maintained in January 2022 although was not occupied on the day of monitoring. By February 2023, none of the relocated dreys appeared to still be in use. Fourteen of the 18 relocated dreys that had blown down or were not found were replaced in February 2023, and monitoring of the use of these additional artificial dreys will commence from the next monitoring period and reported on in the Year Three Monitoring Report. Relocated natural dreys will continue to be replaced with additional artificial shelters as needed to fulfil commitments made as part of project approvals to install double the number of artificial shelters as were removed and maintaining them for ten years (DWER Clearing permit CPS 8191/1).

Artificial shelters were adopted quickly and have been used consistently (16% and 19%) in both sampling periods in Year Two. The availability of additional shelter is likely to have supported the population of possums following displacement and may have contributed to the sustained increase in numbers of possums at the ends of the breeding seasons (45 in January 2022, 64 in February 2023) by providing additional shelter for newly independent juveniles.

Many new, natural dreys were constructed across the site between December 2022 and February 2023, as was observed between January and March 2021. Some were close to maternity dreys, suggesting that juveniles had initially built dreys close to their mothers. The

results from Year Two suggest that there may also have been dispersal along the drain from the Council reserve in February 2023 as joeys became independent (see Appendix 2).

The number of possums using natural hollows is probably an underestimate, as the pole camera is not always able to detect them, if the hollow is curved. In January 2022, two animals were detected because their tails were hanging from their hollow. In some parts of their range with a greater number of trees with large hollows, Western Ringtail Possums rarely build dreys and are often difficult to detect without spotlighting transects, as they spend their days deep in hollow trees. Since the numbers of suitable natural hollows in the trees along the Vasse Diversion Drain is small, and spotlighting transects were carried out at the site before works began, the numbers of animals remaining undetected within the study site is likely to be low (less than five animals).

During hot weather in January 2022, and in December 2022, possums exhibited a range of behaviours probably associated with cooling. Hanging tails in the breeze, plucking hair and exposing bare skin on their tails, bellies and pouches, and seeking shelter in cool, damp vegetation are all behaviours that are likely to help the possums to manage their temperature in heat extremes. Saliva spreading has been observed to be used as a cooling mechanism in Red Kangaroos (Dawson et al., 1974). Van Helden et al. (2021) found Western Ringtail Possum abundance to be correlated to canopy cover in Albany. Revegetation and continued access to shady gardens are likely to be important to the long-term survival of the possum population in Busselton.

Artificial shelters are being used by the possums, with the preferred designs varying perhaps due to seasonal changes in weather conditions, or the breeding cycle of the animals. In Year One, artificial 'short hollows' were the most commonly occupied design (80% were used in at least one monitoring period), and although 30% of them were used in one of the two sampling periods in Year Two, the most popular design was the plastic buckets, 50% of which were occupied on at least one of the two sampling periods. In Year One, during which the dreys were sampled on six occasions, different drey designs appeared to be popular at different times of year. With only two sampling periods during Year Two however, it is not possible to assess seasonal variation in attractiveness of the different drey designs. In Year One, short hollows seemed to be preferred in the non-breeding season, however only one artificial hollow was observed to be used by a mother with a joey, presumably because hollows are not easily expanded to accommodate a growing joey. In Busselton, maternity dreys sometimes have a 'granny flat' arrangement when the juvenile is close to independence (pers. obs.), and this would be more difficult to accommodate in a short hollow. Short hollows were highly favoured at other times of year in Year One, however and have the advantage over large or long hollows that to-date, none has attracted feral bees.

In Year Two, artificial shelters were used at a similar rate in both sampling periods. Twenty to 27% of possums located during monitoring periods were using artificial shelters, which suggests that they may be providing an important additional resource. It will be interesting to see if the proportions stay the same, as the relocated natural dreys are replaced and the numbers of artificial dreys increase.

Black plastic buckets continued to be a popular choice in Year Two, with 50% of them occupied on at least one of the two sampling periods. Domes were popular when covered with coconut but were mostly unused once the coconut was removed by the possums or had collapsed. One peppermint lined dome without coconut was also used. Two coconut-lined domes also contained paperbark. Both these domes were used in Year One, one was occupied in five of the six monitoring periods. In Year Two however, it had deteriorated and was no longer used. It is possible that the waterproofing and insulating properties of paperbark, long recognised and utilised by Noongar people (Hansen and Horsfall, 2019) are also valued by the possums. Artificial shelters lined with paperbark and coconut appear more attractive and lasted longer than coconut alone, however additional trials will need to be made to confirm this due to the small sample size (only two dreys due to the availability of sustainably sourced paperbark).

Cups were used in both sampling periods in Year Two, including one cup without coconut, in which a possum constructed a drey (see Image 32 in Appendix 1). This cup was marked to be re-lined, but following this observation, it was decided not to re-line dreys, and to instead observe their use without maintenance or disturbance.

These are preliminary data only on the preference of different artificial drey designs and are confounded to some extent by the short-term disturbance caused by the drain widening project in Year One, and by the deterioration in coconut, which may have changed the attractiveness and functionality of the coconut-lined cups and domes. In some cases, the coconut was harvested by the possums to construct an alternate drey elsewhere! Additional artificial shelters are being added to replace the deteriorated relocated natural dreys. These dreys are a selection of lined cups and plastic filter buckets, to provide further data on the most effective shelters to support populations of possums in disturbed areas with insufficient natural shelter. Additional short hollows will also be installed if available.

To address the question of the seasonality in drey choice, it would be necessary to maintain a more regular monitoring regime than has been proposed for at least some years beyond Year Two. This would allow drey use to be monitored throughout the site at different times of year, as occurred in Year One, to detect seasonal variation in drey choice. This possibility will be discussed with the client.

VROS

Clearing in the VROS area has resulted in a highly fragmented landscape, and possums and the artificial dreys are on a ‘dead end’ without connectivity, and with less vegetation than in 2020, so are probably less attractive to possums. The artificial dreys in the VROS area were used initially, and although one possum stayed immediately adjacent to the VROS area in a natural hollow throughout most of the construction period, it was no longer in the hollow in March 2021 and a natural drey was found further north along the river, which was probably constructed by this individual. By September 2021, this drey had deteriorated and no evidence of possums was found in the area. No fresh evidence of possums was found during Year Two surveys. This is probably to be expected, given the number of trees removed and

the consequent loss of habitat and connectivity. If trees are replanted outside the VROS structure, this effect could be reversed in time, however the land surrounding the VROS area is privately owned farmland, so any plantings in the area would need to be negotiated with the landowner.

Rope Bridges

Rope bridges were again used by both Brushtail and Western Ringtail Possums in 2022-23. It is encouraging to find clear evidence of their continued use. Previous studies such as Yokochi and Bencini (2015) which monitored Western Ringtail Possums' use of rope bridges, found that the animals began using them within 36 days of installation. In their study the structures were heavily engineered, static bridges which move less in windy conditions than ropes, and tend to have less vegetation to interfere with the functioning of cameras. The trial of different camera angles has resulted in a much better result, with 17 instances and over 70 photos of possums using bridges, with both Reconyx and Swift Enduro demonstrating effective detection of possums.

The value of each tree

Bamford et al (2021) noted that animals were continuing to use trees retained immediately adjacent to the clearing area while work continued on site and emphasised the importance of retaining individual trees where possible. Several of the trees in the strip of vegetation immediately adjacent to the impact area continue to be used by possums in 2022/23. These include several trees with dreys which were marked to be cleared in November 2020. After consideration, a decision was made by the client and contractor to retain them. Three animals recorded in January 2021 were in dreys or hollows directly overlooking the construction site but the animals had persisted in them, tolerating the disturbance. These sites continued to be used during 2021 and one retained tree with a natural drey, immediately adjacent to the drain, was still in use in February 2023. Decisions made to reduce clearing, even by a single tree, can improve the outcome for fauna.

To maintain the displaced animals at the site in the long term despite the reduction in habitat, it is essential that additional food resources are provided in the form of revegetation, as soon as is practical. Although food resources do not appear to be limiting at present and all animals appear in good condition, there is a risk that drought conditions or insufficient nitrogen in leaves will begin to affect the population. The wide range of plant species being revegetated by Tranen (Tranen Revegetation SouthWest, 2020), including Coojong *Acacia saligna, Kunzea sp.* and Marri *Corymbia calophylla,* as well as WA Peppermint *Agonis flexuosa,* and a range of understorey plants will provide the varied diet which Mathieson et al. (2020) found Western Ringtail Possums prefer. This revegetation is progressing well and will soon be providing high quality food for possums. The regrowth of plants along the fence line adjacent to the impact area is also progressing well and will rapidly begin to provide additional food (see Image 33, Appendix 1).

Revegetation will also re-establish and enhance connectivity, supplemented by the rope bridges which were installed by Tree Surgeons WA. Increased connectivity will allow possums to

move between the population along the drain and the rest of Busselton to access food resources, expand home ranges and find mates, improving the species' long-term viability in the area. Rope bridges and revegetation will also enable possums to travel without going to the ground, avoiding the risks of foxes and cars, both identified as major threats to the viability of the Busselton population by (Yokochi *et al.,* (2015).

An alternative explanation to the continued increase in numbers of possums by February 2023 could be lack of connectivity; if juveniles were unwilling or unable to disperse to other areas due to reduced connectivity. This seems unlikely, as researchers such as Yokochi et al. (2015) have suggested that stranded animals tend to go to the ground and cross roads (with associated mortality) and possums have demonstrated their ability to use the installed rope bridges.

Engaging the community

Part of the long-term success of the project will be engaging the community in areas adjacent to the drain with possum conservation, helping them to value the critically endangered species which shares their suburb. Many of the animals monitored in this study have home ranges which overlap with residential and industrial properties, and so the actions of the human occupants of their home ranges could have a huge impact of the success or otherwise of the Water Corporation's rehabilitation in the area. Encouraging residents to retain and replant native trees, provide connectivity above ground to keep possums away from domestic pets, and being prepared to accept the occasional rose bloom or nectarine being harvested by possums (or netting the trees) will help to ensure the possums' long-term survival in the suburbs. There is increasing evidence that Western Ringtail Possums survive better in suburbs than they do in remnant bushland (Van Helden et al., 2020, Busschots et al., 2021), so residents can play a vital role in the species' conservation.

Although the Vasse Diversion Drain Widening Project caused disruption to the Busselton population of Western Ringtail Possums in the short term, it has the potential to contribute to the possums' long term survival by improving the availability of high nutrient foliage for food, increasing the availability of suitable structures for protection/breeding (artificial shelters, revegetation), and canopy continuity to escape predation and other threats (rope bridges and revegetation), all issues identified as important by Department of Parks and Wildlife, (2017) and Bamford et al., (2019). In addition, ongoing engagement with residents adjoining the drain to encourage them to make their backyards possum-friendly will contribute to sustaining the possum population in the long term. Future monitoring of the Western Ringtail Possum population along the drain as part of this project will help to show if this potential is realised and can be sustained.

CONCLUSIONS

While only two sampling sessions were undertaken in Year Two, the second year of possum monitoring at the VDD and VROS sites suggests that the minimal displacement method, choosing to retain trees that were on the border of the development, providing artificial shelters and rope bridges have minimised the impact on the possum population. The population has remained stable following the initial disturbance, has shown a slight increase in January 2022,

and a substantial increase again in February 2023, suggesting a good survival of juveniles following the 2021 and 2022 breeding seasons. The increase in numbers may reflect the provision of additional shelter, and possibly a decrease in the fox population. One dead possum was discovered during sampling in Year Two, probably the result of fox predation, however fox predation is likely to have decreased following the abandonment of the fox den in the Reserve.

The population of possums is stable and increasing in all areas except the VROS area, where no possums were observed during Year Two. It is likely that the lack of connectivity and reduction in cover following construction has made the remaining vegetation less attractive to possums. Revegetation of the surrounding area (mostly private farmland) would be required to make the area more attractive to possums.

Relocated natural dreys were probably important in the short term but most became disused after a few months, and most possums were found in newly constructed natural dreys, and in artificial shelters by March 2021. Relocated natural dreys were no longer being used in Year Two, but artificial dreys are being used consistently, and the provision of artificial dreys is likely to be helping to support a higher population. In Year One there appeared to be a seasonal pattern in their preferred designs. Artificial hollows appeared to be favoured in the non-breeding season, whereas plastic buckets and cups with coconut were chosen at other times of year, however it was not possible to determine seasonal preferences with only two sampling periods in Year Two. It will be interesting to see if the additional, newly installed replacement shelters (to replace the relocated dreys) are used by the possums. There is insufficient data to draw firm conclusions regarding drey design, because of the confounding effects of disturbance and seasonality, however plastic buckets followed by short hollows were the most frequently used in Year Two of the study.

Since 41 dreys were removed during clearing, replacement of relocated natural dreys is required to meet the condition 15 of DWER Purpose Permit CPS8191/1 (Bamford et al. 2020) to increase the number of additional shelters to 82. This requires an additional 18 shelters. Fourteen of these have so far been installed, with an additional four to be installed in coming months. As the remaining six relocated natural dreys deteriorate, these will also be replaced. Follow-up monitoring is recommended to determine if these new dreys are being used and if those with coconut are being harvested by the possums. In Year Two, twice yearly monitoring was conducted. While this demonstrated the use of the dreys, the rates of use were lower (probably an artifact of lower sampling effort – two rather than six data points for each drey) so a 'rate per sampling period' needed to be calculated. It was also not possible to detect seasonal differences in the use of dreys. Increasing the frequency of monitoring (ideally six, but at least three times per year) would assist in assessing the use of replenished and additional artificial dreys and would provide greater confidence in conclusions about preferred drey design.

In January 2021, a number of possums were observed without an associated drey, however in January 2022, despite numbers of possums being higher, all were associated with dreys, even if they were outside them, suggesting that they had adjusted to their altered home ranges and

new shelters after 12 months. In February 2023, a small number of possums did not appear to be associated with dreys, which may reflect a natural level of drey use, or a particularly high number of juveniles, following an exceptionally good breeding season. Future monitoring will demonstrate if a higher population can be maintained, with increased shelter, food plants and connectivity.

The rope bridge design has been demonstrated to be appropriate for use by possums, therefore increasing connectivity for urban possums in the area. The rope bridges adjacent to Cook St Industrial area were used by possums in both sampling periods.

Once revegetation is established sufficiently to provide additional food sources for the possums, monitoring will demonstrate if possum numbers rise, and if the population expands to use additional areas of the study site which are currently unsuitable.

RECOMMENDATIONS

- Artificial shelters where coconut fibre is collapsing should be observed but not repaired at this stage, in case possums choose to rebuild a drey inside them.
- Relocated Natural Dreys should continue to be replaced with artificial shelters to bring the total back up to or exceed the minimum of 82 shelters required as part of DWER Purpose Permit CPS8191/1, condition 15. This would require an additional 10 shelters. Additional short hollows, plastic filter buckets and wire domes / cups with paperbark and coconut seem the best choice, given preliminary results.
- To gain a detailed understanding of the seasonal usage of artificial dreys, monitoring would need to be conducted at a rate of three - six times per year in at least some of the remaining eight years of the study. The existing program is for twice yearly sampling from 2022 onwards, which will collect enough data to measure the overall population size and expansion into the revegetation areas but will not provide sufficient data to detect seasonal usage of the site, including changing preferences for artificial drey designs. This information would be valuable to collect to inform future rehabilitation projects if budget were available to maintain a more frequent monitoring regime.
- Revegetation should continue as quickly as possible to increase food resources and connectivity.
- Additional monitoring time may be required to detect and re-check all natural dreys once revegetation is advanced enough to support additional possums. This may require an additional day's monitoring for each session from the 2024 season.
- The fox den identified in Bamford et.al. (2021), south of the drain in the Council reserve has been abandoned. The den and all evidence of foxes should be monitored for any future activity.
- Residents should be encouraged to plant appropriate food and shelter plants for possums to improve connectivity and support their continued occurrence in the suburbs of Busselton.
- The Busselton community should be provided with opportunities to learn more about the possums and promote their occurrence as an asset. This could include workshops to make artificial shelters, plant local plants and encourage a sense of custodianship of the possums.
- When clearing works are required in areas containing Western Ringtail Possums, displacement rather than relocation should be the preferred option to minimise disturbance to the animals, provided that sufficient habitat remains.
- Every tree is important for species such as Western Ringtail Possums. In situations where trees are on the border of a development, they should be retained if possible.

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Appendix 1. Photographs













Images 2-7. *A selection of designs of Artificial Shelters: Dome – no coconut (Dom); Short Hollow (Hol); Cup with coconut (CuCo); Cup – no Coconut (Cup); Plastic Bucket (Buc); Dome with coconut (DoCo). More detailed analysis will be possible once more data has been collected.*





Image 8 (left). *A platform natural drey containing a Western Ringtail Possum mother and large joey taken in October 2020.*

Image 9 (right*). A dome-shaped natural drey containing one or two possums. Numbers of possums can be difficult to determine in dome-shaped dreys without disturbing the occupants.*



Image 10. *An example of a Relocated Natural Drey. Relocated Natural Dreys were probably an important interim measure in November 2020 for newly displaced possums. One Relocated Drey were still being maintained in January 2022 but by February 2023, all relocated natural dreys were disused or had fallen apart.*



Image 11. *Motion sensitive cameras were installed on various angles and directed towards the rope bridges. The angle depended on the position of vegetation obstructing the view of the ropes, so possums were photographed without taking large numbers of photos of moving rope and branches. See Images 20 – 26 for examples of motion sensitive camera photos.*



Image 12. *Multiple dreys in one flowering Melaleuca nesophila. Although this species is not native to the South-West, it produces abundant nectar and is a good example of the non-native food resources available in the suburbs of Busselton.*





Images 13 & 14. *Possums frequently harvested coconut fibre from the coconut-lined dreys resulting in the denuding of most lined cups and dreys by January 2022. It was planned to replace coconut in the dreys, however in Year Two, one possum re-lined an empty drey with natural material, so the decision was made to leave them undisturbed to see if more possums would choose to rebuild in them.*





Image 15 (left). *By January 2021, a number of the artificial shelters containing coconut had been rearranged. In this case, the possum obviously preferred to choose an alternate location to create its own shelter using coconut from the artificial drey!*

Image 16 (right). *Artificial Shelters were checked using a pole camera if necessary. Examples of pole camera images may be seen in Images 28 to 30.*



Image 18. *Rope Bridge along* [redacted] *installed by Tree Surgeons WA. Project Approvals require six rope bridges to be maintained for 10 years to help improve connectivity for possums, so they do not need to come to the ground.*



Image 19. *Revegetation adjacent to the industrial area in* [redacted] *by Tranen Revegetation SouthWest. These plantings are establishing well and will rapidly increase connectivity, shelter and food supplies for possums. Possums prefer a range of food plants, particularly those with high nitrogen such as Acacia saligna, so these plantings will provide high quality food for them. The seedlings used include a wide range of plant species which will benefit not only possums but increase local biodiversity.*



Image 20. *Brushtail Possum on rope bridge adjacent to [redacted] on 17 February 2023, demonstrating that the design is suitable for both species of possums.*



Image 21. *Western Ringtail Possum crossing the same rope bridge as shown in the previous image, adjacent to [redacted]n Busselton on 17 February 2023.*



Image 22. *Western Ringtail Possum crossing the rope bridge adjacent to* [redacted] *Busselton on 19th January 2022. First in a series of three photos (Images 19 – 21)*



Image 23. *Western Ringtail Possum crossing the rope bridge adjacent to* [redacted] *in Busselton on 19th January 2022. Second in a series of three photos (Images 19 – 21)*



Image 24. *Western Ringtail Possum crossing the rope bridge adjacent to* [redacted] *Busselton on 19th January 2022. Third in a series of three photos (Images 19 – 21)*



Image 25. *Western Ringtail Possums crossing the rope bridge in February 2023. This camera was set underneath the rope facing upwards to avoid moving vegetation. This technique worked well in areas with open ground between trees.*



Image 26. *Brushtail crossing the same rope bridge as shown in the previous photo. This camera was set facing upwards, underneath the rope, to minimise the camera being triggered by moving vegetation.*





Images 27 & 28. *Possum scat with finger for scale (left). One of several found on the path beneath the rope [redacted] (right) during the February 2023 monitoring period in the area being revegetated. Scats had not been recorded along the pathway prior to the rope bridges being installed. The revegetation (right) is already having a positive visual impact, and once it is large enough, it should provide additional nesting and high quality feeding sites for possums.*



Image 29. *A Western Ringtail Possum in an artificial hollow in February 2023. Identification is often easily made as Ringtails often hang their tail out of the hollow, especially on warm days.*

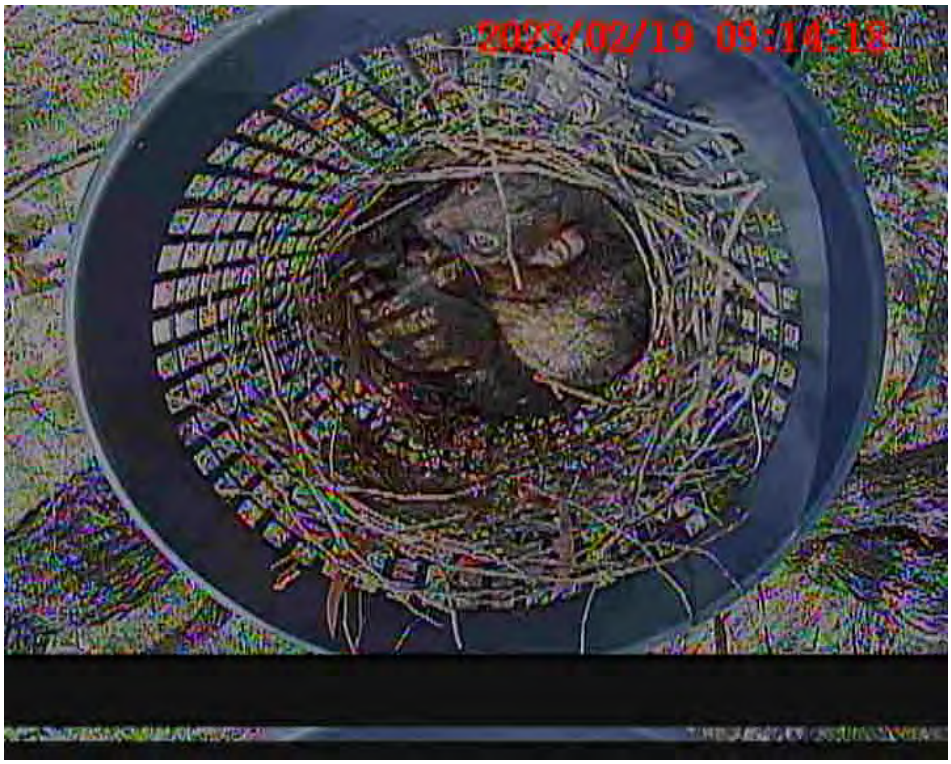


Image 30. *Western Ringtail Possum in February 2023, in a plastic filter bucket. These were the most popular drey design in Year Two, with 50% of them being occupied during at least one sampling period..*



Image 31. *Western Ringtail Possum in December 2022, keeping cool. This individual appeared to be exposing the bare skin under its tail and spreading saliva on and in the pouch to help it thermoregulate.*



Image 32 *An occupied artificial drey, rebuilt with natural materials by the possum, subsequent to most of the coconut being removed some months previously. The possum is just visible as a dark shape under the fresh twigs. After observing this behaviour, the decision was made not to replace coconut that had been removed, to see if other possums would choose to rebuild dreys that had been pulled apart.*



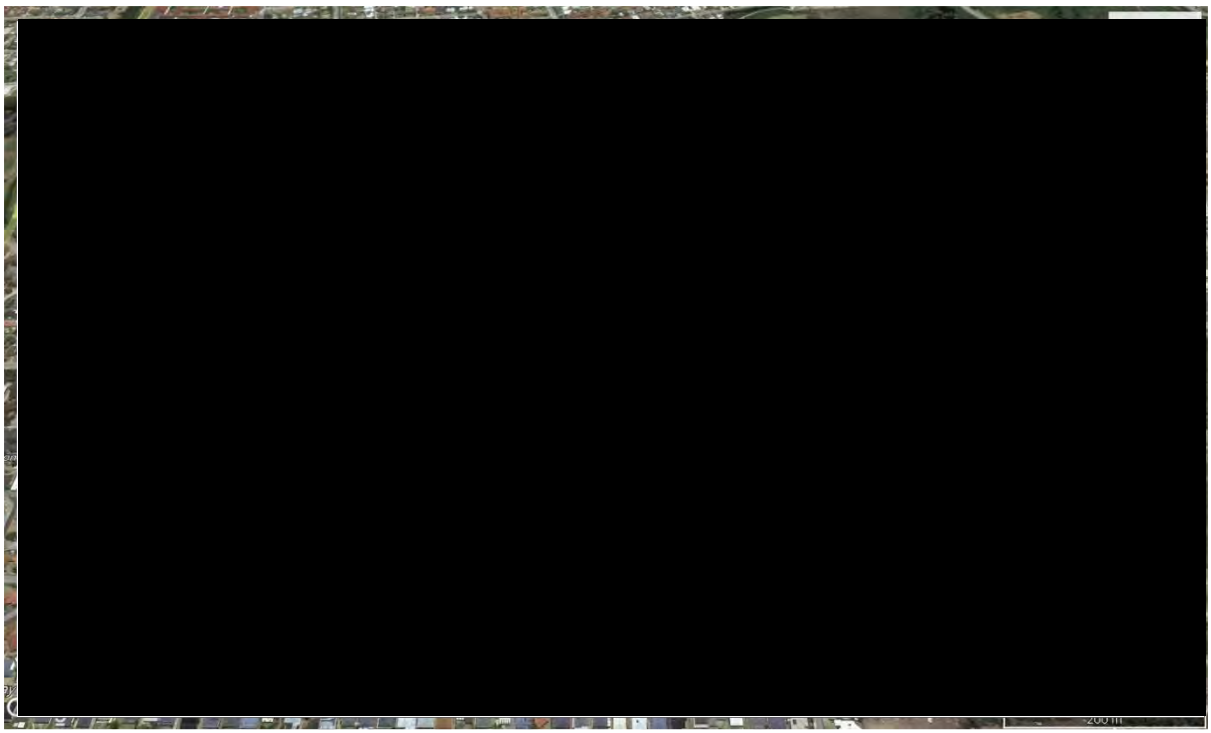
Image 33. *Retained WA Peppermint tree (Agonis flexuosa) containing a natural drey on the edge of the impact area on the south side of the drain which contained a possum in all but two monitoring periods, even during works. A decision was made to retain this tree although it was on the edge of the clearing zone. Its continued use by a possum throughout 2021 – February 2023 illustrates the importance of decisions to retain individual trees. Also visible are regenerating Coojong (Acacia saligna) seedlings, which will provide important, high-nitrogen forage for possums within two years.*



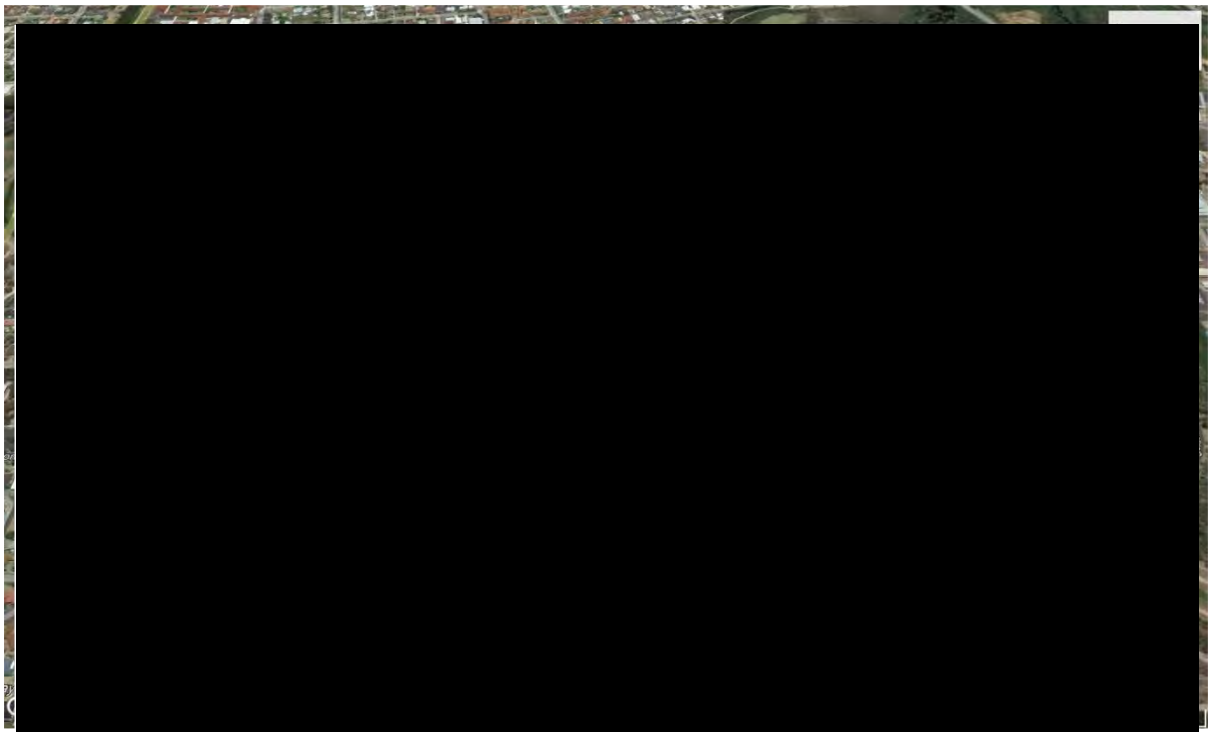
Image 34. *Artificial 'Short Hollow' S66 contained a Brushtail Possum in December 2022. Brushtail Possums are not commonly recorded using the short hollows, probably as they are larger than Western Ringtail Possums and probably prefer larger hollows. This record was not included in the analysis of artificial drey use, however it demonstrates the additional value of increased shelter for non-target species, as well as for Ringtails. Animals such as bats, birds, geckoes and invertebrates will also benefit from the increased structure provided by the shelters, particularly in disturbed areas, or those under rehabilitation.*

Appendix 2. Time series maps showing new Natural Dreys discovered in December 2022 (12a.) and February 2023 (12b.).

Figure 12. New Natural Dreys in Year Two of Sampling



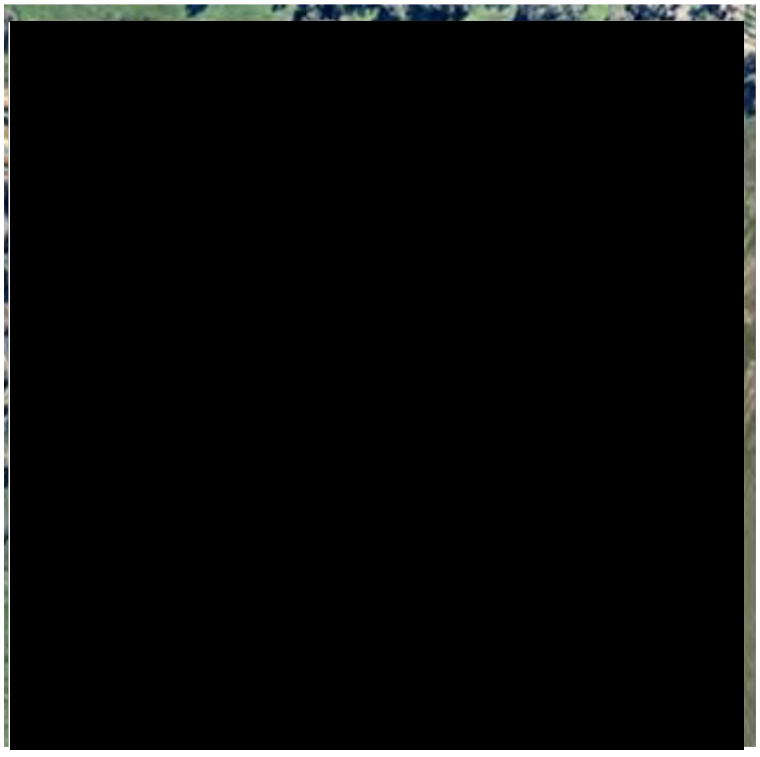
a). December 2022. Dreys appear to be congregated near to the Reserve.



b) February 2023. By February 2023, new dreys have been constructed along the south of the drain, perhaps reflecting post-breeding dispersal.

Figure 13. Vasse River Overflow Structure (VROS) area. Time series maps showing Natural and Artificial Dreys (January 2021) and a new Natural Drey discovered in March 2021. No additional dreys were discovered at the VROS in Year Two.


a).

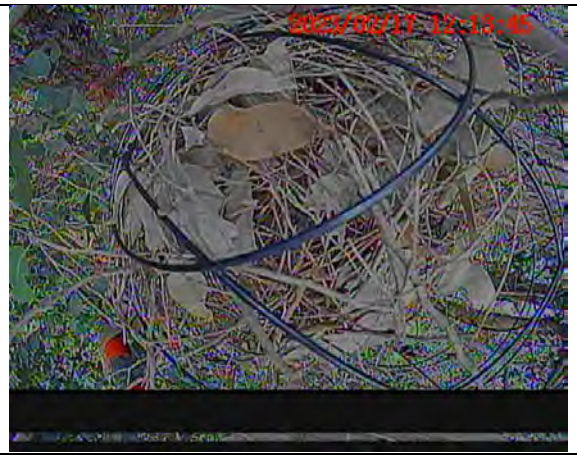

b).

Appendix 3. Table showing relocated and artificial dreys and logs installed outside the clearing zone of the project area. Types of shelters are: DoCo= Dome with coconut fibre (and Agonis leaves), Dom = Dome (with Agonis leaves only), CuCo = Cup with coconut fibre, Cup = Cup (with Agonis leaves only), Buc = Plastic Bucket, Hol = Hollow, Nat = Relocated Natural Drey. Poss. = number of Possums observed using the shelter. The locations of each shelter are plotted in Figures 4 and 5.

ID	Easting	Northing	Type	Tree	Possum numbers during 8 monitoring periods: Year One (line one): Jan, Mar, May, Aug, Sept 2021, Jan 2022 Year Two (line two): Dec 2022, Feb 2023.	Used	Photos	Notes

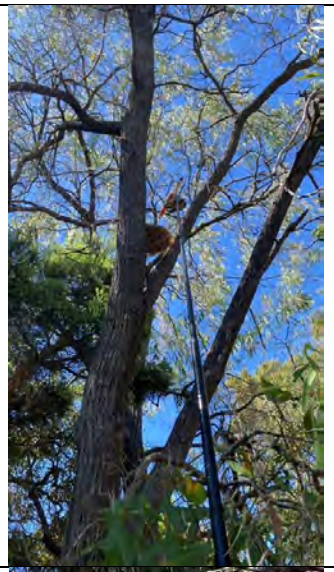
S1	[redacted]	[redacted]	DoCo	E. rudis	0 0 0 0 0 0 0 0	Unused		Collapsed coconut, very close to edge of works
S2	[redacted]	[redacted]	Dom	A. flexuosa	0 0 0 0 0 0 0 0	Unused		Very close to edge of works

S3	[redacted]	[redacted]	Dom	A. flexuosa	0 0 0 0 0 0 0 0	Unused		old leaves only
S4	[redacted]	[redacted]	DoCo	E. rudis	0 1 0 0 0 0 0 0	used		Coconut collapsed – needs repair

S5	[redacted]	[redacted]	Dom	E. rudis	0 0 0 0 0 1 0 0	Used			Old Agonis, Dense
S6	[redacted]	[redacted]	DoCo	C. calophylla	0 0 0 0 0 0 0 0	Unused			

S7	[redacted]	Dom	A. flexuosa	0 0 0 0 0 0 0 0	Unused		Only old leaves in drey
S8		CuCo	A. flexuosa	0 0 0 0 0 0 0 0	Unused		Bare twig only – needs replacing.
S9		Nat	A. flexuosa	0 0 - - - - - -	Unused	Not found – Replaced Feb 2023	Replaced. Installed Large Black Bucket now S9R
S10		Nat	A. flexuosa	0 – 0 - - - - -	Unused	Not found – Replaced Feb 2023	Replaced. Installed Black Cup with Coconut now S10R

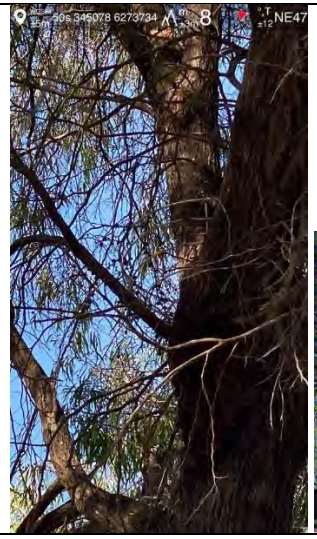
S11	[redacted]		Cup	A. flexuosa	0 0 0 0 0 0 0 0	Unused		Empty
S12	[redacted]		Buc	E. marginata	0 0 0 0 0 0 0 0	Used		Lined with sticks

S13	[redacted]	CuCo	A. flexuosa	0 1 0 0 0 0 0 0	Unused			dry Agonis leaves
S14		Cup	A. flexuosa	0 0 0 0 0 0 0 0	Unused			Lots of dead leaves

S15	[redacted]		Buc	A. flexuosa	0 0 1 1 1 0 0 0	Used	 	Few leaves, probably used on occasions
S16			Nat	A. flexuosa	0 0 ---- --	Unused	Not found - replaced	Degraded, then not found – replaced with DoCo S16R
S17			CuCo	A. flexuosa	0 0 0 0 0 0 0 0	Unused	 	Lots of brown, old leaves

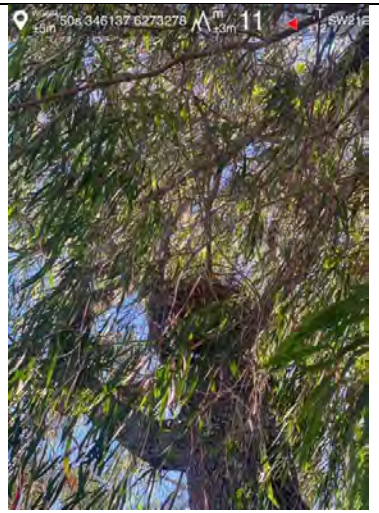
S18	[redacted]		Nat	A. flexuosa	0 0 0 0 0 0 0 0	Unused		Brown old Agonis
S19			Cup	A. flexuosa	0 0 0 0 0 0 0 0	Unused		Exposed location

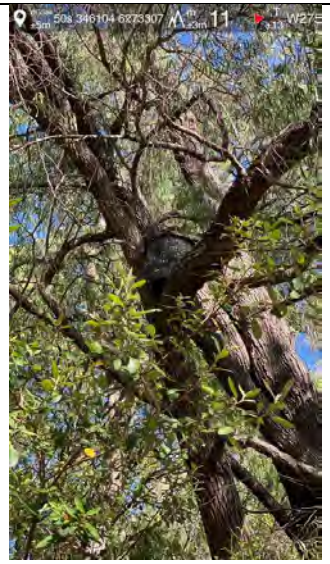
S20	[redacted]	Buc	A. flexuosa	0 0 0 0 0 0 1 0	Unused Used	 	Dead leaves, Used in Dec 2022 Nose of possum visible in pole camera photo.
S21		CuCo	A. flexuosa	0 0 0 1 0 0 0 0	Used		lots of dead Agonis leaves. Occupied on one occasion.

S22 a	[redacted]		DoC o	A. flexuosa	0 0 - - - - 0 0	Unused	 	Nat Drey was replaced at the beginning of Year Two. Coconut removed but does not look recently used.
S23	[redacted]		Cup	A. flexuosa	0 0 0 0 0 0 0 0	Unused	 	No fresh material

S24	[redacted]	DoCo	C. calophylla	0 0 0 0 0 0 0 0	Unused		Coconut gone
S25		Nat	A. flexuosa	0 0 0 0 0 0 0 0	Unused		No fresh material
S26		Nat	Kunzea sp.	0 0 0 0 0 0 0 0	Unused		Needs replacing
S27		Nat	Kunzea sp.	0 0 0 0 0 0 0 0	Unused	Replaced Feb 2023	Black Cup w. coconut S27R
S28		Nat	Kunzea sp.	0 0 0 0 0 – - -	Used	Replaced Feb 2023	Black Cup w. coconut S28R
S29		Nat	A. flexuosa	0 0 0 0 - - - -	Unused	Replaced Feb 2023	Large Plastic Bucket S29R

S30	[redacted]	CuCo	C. calophylla	0 0 1 1 0 1 0 0	Used	 	Been used but empty on monitoring days. Coconut almost gone and sticks added. Often used during Year One.
S31		Cup	C. calophylla	0 0 0 0 0 0 0 0	Unused		few leaves

S32	[redacted]		CuCo	A. flexuosa	0 0 0 0 0 0 0 1	Used Used		Appears to have been used recently
S33			Dom	A. flexuosa	0 0 0 0 0 0 0 0	Unused Used	 	Old leaves, but looks to have been used.

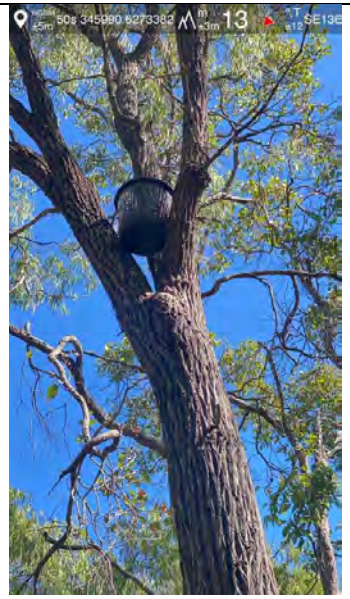
S34	[redacted]	Buc	A. flexuosa	0 0 1 0 1 0 1 1	Used Used	 		Occupied on both sampling occasions in Year Two.
S35	[redacted]	DoCo	A. saligna	0 0 0 0 0 0 0 0	Used			Material added – no possum

S36	[redacted]	Cup	A. flexuosa	0 0 0 0 0 0 0 0	Unused		Few leaves
S37	[redacted]	Nat	A. flexuosa	0 0 0 0 0 0 0 0	Unused		Falling down, needs replacing.

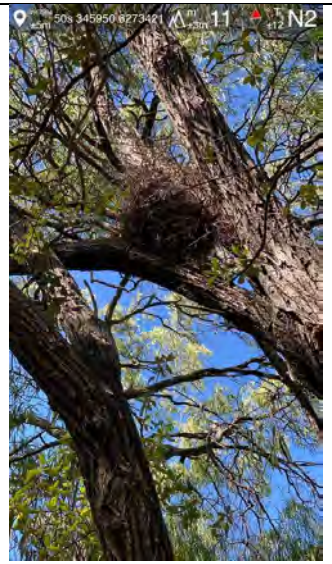
S38	[redacted]	Nat	A. flexuosa	1 0 0 0 0 0 0 0	Used		Only old leaves seen from outside but drey in good condition, possum inside in January 2021 then not occupied during sampling but probably used occasionally .
S39		Nat	A. flexuosa	0 0 0 0 0 0 0 0 -	Unused	To be replaced	Not found in Feb 2023, needs replacing.

S40	[redacted]		Cuco	A. flexuosa	0 0 0 1 0 0 0 1	Used		Filled with natural material by possum
S41			Nat	A. flexuosa	0 0 0 0 1 0 0 0	Unused		Degraded, will need replacing.

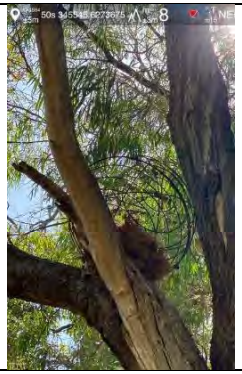
S42	[redacted]		Nat	A. flexuosa	0 0 0 0 0 0 0 0	Unused		Degraded but still in tree. Not in use.
S43			Nat	A. flexuosa	0 0 0 0 0 0 0 0	Unused		Large drey, still in tree, but not in use. Will need replacing soon.

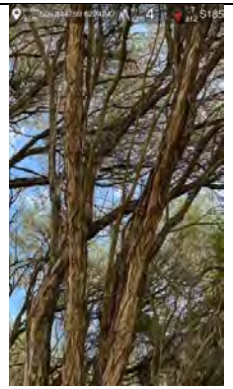
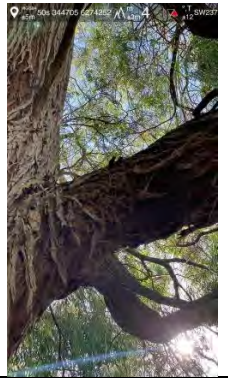
S44	[redacted]	Buc	A. flexuosa	0 0 1 0 0 0 2 0	Used Used	 	December 2022 the bucket contained a mother and joey – the first time that a bucket has recorded more than a single animal.
S45		Nat	A. flexuosa	0 0 0 0 0 0 0 0	Unused		Replaced with Cup with Coconut, now S45R

S46	[redacted]		Nat	A. flexuosa	0 0 0 0 0 0 0 0	Unused		Replaced with Large Filter Bucket, now S46R
S47	[redacted]		Nat	A. flexuosa	0 0 0 0 0 0 0 0	Unused		Replaced with Large Filter Bucket, now S47R

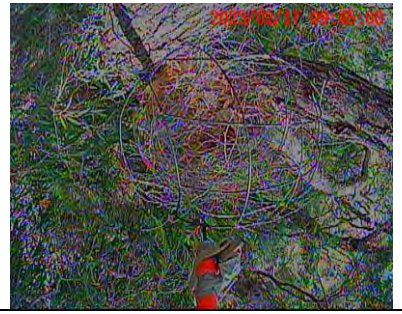
S48	[redacted]		Cup	A. flexuosa	0 0 1 0 1 0 1 1	Used Used		Occupied in both monitoring periods in Year 2.
S49			CuCo	A. flexuosa	0 1 0 0 0 0 1 0	Used Used		Coconut removed and sticks added, occupied in Dec 2022.

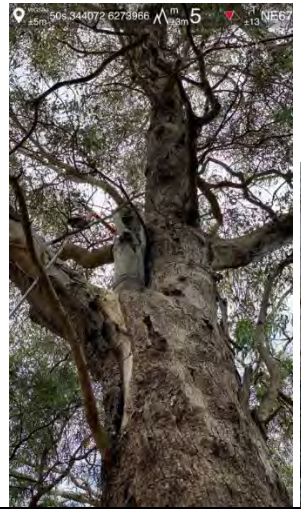
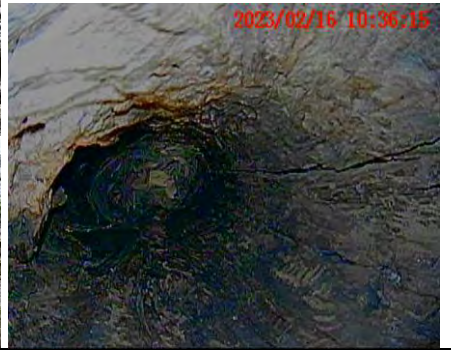
S50	[redacted]		Buc	A. flexuosa	0 0 0 1 0 0 0 0	Used	 	Twig lined, has been used.
S51	[redacted]		Cup	A. flexuosa	0 0 0 0 0 0 0 0	Unused		Few old leaves only

S52	[redacted]	CuCo	A. flexuosa	0 0 0 0 0 0 0 0	Unused			Empty
S53		Cup	A. flexuosa	0 0 0 0 0 0 0 0	Unused			few leaves
S54		DoCo	A. flexuosa	0 0 0 0 0 0 0 0	Unused			Coconut removed in Year One. No evidence of recent use.

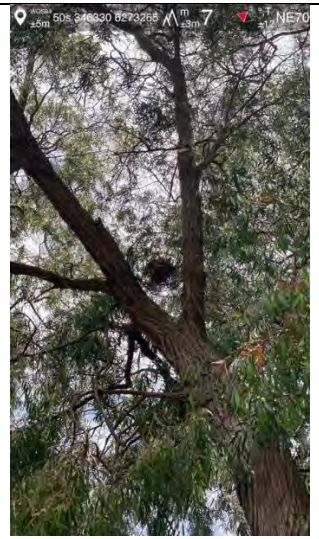
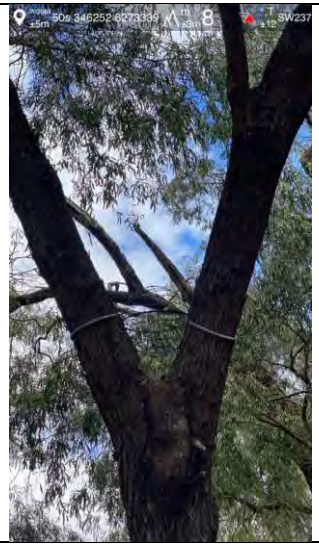
S55	[redacted]		DoCo	M. cuticularis	0 0 0 0 0 0 0 0	Unused		Collapsed Difficult for possum to enter – needs repair - Now empty dome
S56			Nat	A. flexuosa	0 0 0 0 1 0 0 0	Used		Large Agonis. Used in September 2021, still has platform but prob. not recently used.
S57			CuCo	A. flexuosa	0 0 0 0 0 0 0 0	Unused		Large Agonis, very full, old drey inserted into shelter

S58	[redacted]		Cup	A. flexuosa	0 0 0 0 0 0 0 0	Used		Some fresh leaves in Year One. Very few leaves in Year Two.
S59			Nat	A. flexuosa	0 0 0 0 0 0 0 0	Unused		Replaced with large plastic filter bucket 17/02/2023

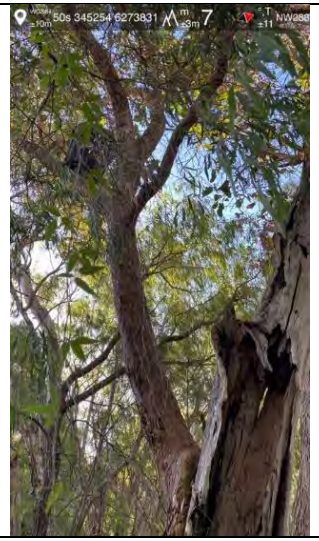
S60	[redacted]	Cup	A. flexuosa	0 0 0 0 0 0 0 0	Unused		Still some Agonis leaves
S61		DoCo	A. flexuosa	0 0 0 0 0 0 - -	Unused	 	Coconut collapsed
S62		DoCo	A. flexuosa	0 0 0 0 0 0 - -	Unused	Damaged due to drain maintenance – replaced in February 2023	Damaged, replaced with Cup with Coconut
S63		Hol	E. patens	0 0 0 1 0 0 - -	Used		Approx. 8m high, relocated from E.

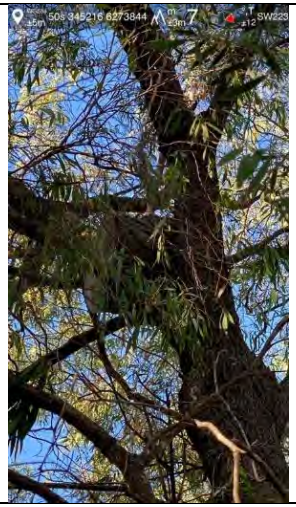
							 	rudis in Links Ct. Occupied in August 2021, not in Year Two monitoring
S64	[redacted]	[redacted]	Hol	E. patens	0 0 0 0 0 0 0 0	Unused	 	relocated from E. rudis in Links Ct

S65	[redacted]		DoCo	A. flexuosa	0 0 0 0 0 0 0 0	Unused		Coconut dome collapsed
S66	[redacted]		Hol	C. calophylla	0 0 0 0 0 0 1(B) 0	Unused Used		Brushtail in Dec 2022

S67	[redacted]		Cup	E. marginata	0 0 0 0 0 0 0 0	Unused		few old leaves
S68			DoCo	A. flexuosa	0 0 0 0 0 0 0 0	Used		coconut taken and placed further up tree, some blown down

S69	[redacted]		DoCo	A. flexuosa	0 0 0 1 0 0 0 0	Used		natural drey inserted into artificial drey, Coconut collapsed in Jan 21, but occupied in August 21. Not occupied in Year Two.
S70			Hol	A. flexuosa	1 1 0 0 0 0 0 0	Used		Possum in base of log in Jan and Mar 21.

S71	[redacted]		CuCo	A. flexuosa	0 0 1 1 0 1 0 0	Used		coconut rearranged, removed from base, occupied in April / May, August and Jan 2022
S72			Nat		0 – 0 -0 0 - - -			Replaced with Large Filter Bucket, now 72R

S73	[redacted]		Hol	A. flexuosa	0 0 0 0 0 1 0 0	Used Unused		A few old leaves only. Occupied in Jan 2022
S74			DoCo	E. rudis	0 0 0 0 0 0 1 1	Used Used		coconut still in fairly good condition, used in both sampling periods in Year 2 – tail clearly visible in image.

S75	[redacted]		Hol	A. flexuosa	0 0 0 0 0 1 0 0	Used		Slightly green leaves in bottom, probably used in Jan 2021, occupied in Jan 2022
S76			DoCo	A. flexuosa	1 0 0 0 0 0 0 0	Used		coconut rearranged – visible from the outside, possum inside. Not recorded as occupied since Jan 21

S77	[redacted]	Hol	C. calophylla	1 2 1 0 0 1 1 1	Used Used			Possum regularly recorded. The only short hollow which has recorded a mother and joey inside (Mar 21)
S78	[redacted]	CuCo	C. calophylla	0 0 0 0 0 0 0 0	Unused			coconut collapsed. Needs repair

S79	[redacted]		Hol	E. rudis	1 0 1 0 0 0 1 1	Used Used	 	Possum recorded on both monitoring sessions in Year 2.
S80			DoCo	A. flexuosa	1 1 1 1 1 0 0 0	Used		Most of lining has gone.

S81	[redacted]		Hol	A. flexuosa	0 0 0 0 0 1 0 1	Used	 	Tail visible in photo
S82	[redacted]		Nat	A. flexuosa	0 0 0 0 0 0 0 0	Unused		Dry, collapsed, needs replacing

S83	[redacted]	Hol	C. calophylla	0 1 1 0 0 1 1 0	Used Used		Occupied in 3 of 6 monitoring periods
S84		Nat	Ground	0 0 - - - - - -	Unused	Replaced February 2023	Replaced with Large Black Bucket S84R

S85	[redacted]		DoCo	E. marginata	0 0 0 0 0 0 0 0	Unused		Coconut mostly gone
S86	[redacted]		DoCo	C. calophylla	0 0 0 0 0 0 0 0	Unused		Coconut removed

S87	[redacted]		Cup	A. flexuosa	0 0 0 0 0 0 0 0	Unused		Empty and not used.
S88			Cup	A. flexuosa	- - 0 0 0 0 0 0	Used		Coconut removed

Monitoring of the Western Ringtail Possum following Clearing along the Vasse Diversion Drain, Busselton

Year Three

February 2023 – March 2024





Images 1 & 2: Western Ringtail Possums using artificial shelters: Short Hollow(left) and Cup (right) Photos: J. Bamford

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30th May 2024

Executive Summary

The Water Corporation widened the Vasse Diversion Drain in Busselton in 2020 - 2021 for flood mitigation, and since the conservation significant Western Ringtail Possum occurs in remnant vegetation that was impacted by drain widening, Bamford Consulting Ecologists (BCE) was commissioned to undertake the displacement of possums prior to clearing along the drain in two areas: a northern area between Queen Elizabeth Avenue and the Busselton Bypass Road, and a southern area near the Golf Course (VROS). BCE was also commissioned to conduct ongoing monitoring of the population and their use of installed shelters and rope bridges over a ten-year period, as a condition of the approval of the drain widening project. This report covers the third year of post-disturbance monitoring (February 2023 – March 2024).

Of the 43ha project area surveyed in 2019 prior to the project's approval, where 206 dreys and at least 66 possums were recorded, only 1.9ha was cleared in 2020. Forty-one dreys and hollows and 36 possums were identified in the impact area prior to clearing. Prior to and during clearing in November 2020, all possums were successfully relocated into adjacent vegetation without mortality or injury. Of the 41 dreys found, 23 were able to be relocated, and a further 63 artificial shelters (dreys and hollows) were installed, making a total of 88 new shelter locations (a commitment was made to provide 82 additional shelters). Rope bridges were also installed along the north side of the drain adjacent to [redacted] and [redacted] to increase connectivity and reduce the need for possums to go to the ground to travel between trees, where they are at risk of predation by foxes, cats and dogs.

Since most possums could remain within their home ranges, handling was avoided where possible to minimise stress. In most cases, animals could be displaced into adjacent vegetation without handling them. Trees were checked and animals displaced immediately prior to clearing, to avoid them returning to the clearing area. Eleven possums had to be hand-captured and moved; four were moved without touching them, while contained within or holding onto the top of an artificial or natural drey; two were moved while within hollows; and two were moved by encouraging them to climb onto the net and carrying them to safety while perched on top of the net. The remaining 17 were displaced by gently disturbing them from their dreys and herding them to adjacent, safe trees. Clearing debris was then removed immediately to prevent animals trying to return.

As part of compliance for the project approval, a ten-year monitoring program is underway to determine:

- the effects of disturbance on the numbers and distribution of Western Ringtail Possums adjacent to the disturbance areas along the Vasse Diversion Drain,
- Whether artificial shelters are used by possums and can contribute to the maintenance of the population, post-disturbance,
- Which shelter designs are preferred by Western Ringtail Possums,
- Whether rope bridges will be used by possums and are therefore effective in improving connectivity in a disturbed landscape,

- Whether revegetation is being accessed by possums and results in increased habitat for the species during a ten-year period.

Six monitoring periods were undertaken during Year One; January, March, April / May, August, September 2021, and January 2022. In Year Two, there were two monitoring periods; December 2022 and February 2023. In Year Three, monitoring was undertaken in November 2023 and March 2024. There were 38 possums recorded in the area adjacent to works in January 2021, following the disturbance. The numbers remained remarkably stable, with a minimum of 31 recorded in March 2021, which is consistent with the dispersal of juveniles, and had increased to 45 in January 2022. In Year Two, there were 40 in December 2022 and post-breeding numbers jumped up to 64 by February 2023. In Year Three, 47 possums were recorded in November 2023 and 59 in March 2024. The numbers of possums have remained higher than were recorded in 2021 which could be explained by several good breeding seasons, the abandonment of a fox den in the Council reserve, the provision of additional shelters and rope bridges, and the revegetation which may have begun to improve the quality of food plants available to the animals. Future monitoring will help to determine the factors affecting the population. It seems likely that many of the animals found during monitoring are those who were displaced from the impact area but have stayed and continued to breed within their remaining home ranges using the additional resources that are being provided.

Ninety-one natural dreys were monitored in the two sampling periods in Year Three. Of these, Sixty-three of these were existing dreys, and 26 of them were built during Year Three. Many of the new dreys were found adjacent to revegetation areas. This is the first year where the revegetation is beginning to have a positive impact, so the results are preliminary, however it is possible that the animals have chosen to build in these locations because of adjacent food resources. Future monitoring will inform this hypothesis.

Both Brushtail and Western Ringtail Possums were recorded using rope bridges again at both [redacted] and [redacted] in Year Three, confirming that the design is successful. Rope bridges [redacted] appear to have provided safe access for possums into trees that were previously difficult for them to access, resulting in a new natural drey and use of an artificial drey that was previously unused. Revegetation in the [redacted] will further support the movement of these animals and ultimately should replace the need for rope bridges there.

As expected with natural fibre ropes, the rope bridges have shown considerable wear in Year Three, resulting in several failures and the need for repair under the supervision of Tranen Revegetation SouthWest. Failures of ropes at [redacted] have not affected connectivity, however the loss of the rope bridge across [redacted] and deterioration of bridges [redacted] are of concern as they will affect connectivity and may force possums to go to the ground to cross where they risk vehicle strike or predation. Consideration should be given to replacement of these bridges in the long term with permanent structures to provide connectivity beyond the ten-year period of this project.

Thirty-six percent of possums located in Year Three were using artificial shelters. Short hollows were the most frequently occupied artificial dreys (90% were used in at least one monitoring period) followed by plastic filter buckets, 64% of which were used in at least one monitoring period. Coconut-lined cups and domes were also used at lower rates, including an empty cup which a possum chose to re-line with natural materials and another empty cup which an animal chose to sleep in, without lining it. Two artificial hollows have needed to be replaced through damage and others will need repair or replacement in the coming year due to wear and tear.

In Year One, there were six monitoring periods and results showed a seasonal difference in the preferred design of artificial shelters. In Years Two and Three, only two monitoring periods were scheduled, so it was not possible to draw detailed conclusions on the seasonal use of different designs. More frequent sampling would provide a more robust assessment of seasonal variation in drey preference.

Unlike the results of monitoring along the Vasse Diversion Drain between Queen Elizabeth Avenue and the Busselton Bypass Road, possums have not been recorded in any of the artificial dreys at the VROS since March 2021, although a natural hollow adjacent to works at VROS which was occupied throughout the construction period but was empty in Year Two, showed evidence of use in Year Three although a possum was not present when checked. Fragmentation of vegetation in the area has made it less suitable for possums, however revegetation occurring on the eastern side of the site may help to provide connectivity in future.

Tranen Revegetation SouthWest is continuing revegetation work, which will provide increased food and connectivity throughout the site. Once vegetation has established, it should also provide additional locations for natural dreys to be constructed as may already be happening in some areas, and possibly result in an increase in the population of possums. Additional dreys and an increase in possum numbers should be detectable within the ten-year monitoring timeframe for the project.

Relocated natural dreys performed an important function immediately following displacement of the possums but have deteriorated, although there was evidence of use of two in Year Three. Fourteen were replaced with artificial shelters in February 2023, and a further three were replaced in Year Three to maintain the numbers of additional dreys provided, as committed to as part of approvals for the project. Thirty-eight percent of artificial dreys were recorded as used in Year Three, which is a much higher rate than in Year Two, which was only 17%. This may reflect the replacement of deteriorated Relocated Natural Dreys with additional plastic buckets and cups with coconut, which are both popular designs for dreys, or it may indicate that the animals are adapting to the use of novel resources.

Revegetation should proceed as quickly as practical to ensure the animals continue to have sufficient food resources to support them during lean times. The increased connectivity provided by plantings and rope bridges will also allow possums to move between the

population along the drain and the rest of Busselton, improving the species' long-term viability in the area.

Results of the third year of monitoring support the findings of Years One and Two monitoring that the displacement and disturbance due to drain works had not greatly impacted possum numbers, that artificial shelters are helping to house the population and that rope bridges are of a suitable design to keep possums off the ground and improve connectivity, although an alternative design should be sought to provide long-term connectivity for possums at College Avenue beyond the life of VDD widening project. The numbers of possums at the study site post-breeding have increased and remained high for the three years since January 2021. Future monitoring will help to better assess these initial findings, and effects of revegetation work, which is likely to provide significant positive impact within the next ten years.

INTRODUCTION

The Water Corporation manages a network of drains in the vicinity of Busselton and in October 2020 – April 2021 works were undertaken to widen the Vasse Diversion Drain for flood mitigation. This widening affected some vegetation alongside the drain, but not the full width of this vegetation. An Environmental Impact Assessment conducted by GHD (2017) found that the Western Ringtail Possum *Pseudocheirus occidentalis*, which is a listed conservation significant species (Critically Endangered under both the Federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the *Western Australian Biodiversity Conservation Act 2016*) occurred in vegetation adjacent to the drain. Widening of the drain could affect >0.5ha of what might be primary corridor habitat for the species (*sensu* DEWHA 2009) and based on EPBC Act Policy Statement 3.10 (DEWHA 2009), this would be a significant impact. Therefore, the Department of Biodiversity, Conservation and Attractions requested the Water Corporation provide more information on the distribution and abundance of this species along the drain. Bamford Consulting Ecologists was commissioned to undertake this work in 2019.

The Vasse Drain Diversion Upgrade project was assessed Bilaterally by the DWER Native Vegetation branch under Part V of the EP Act [WA] and by AWE under the EPBC Act 1999 [Cwth] and the project was referred under the *EPBC Act* (Cwth). The project is a '*Controlled Action*,' so all activities must be undertaken in compliance with conditions set in the EPBC 2017/7932 Approval Conditions.

Following surveys of the 43ha project area in March 2019, where 206 dreys and at least 66 possums were recorded, areas were revised and only 2.16ha was identified as the impact area to be cleared in 2020.

A Fauna Management Plan for the Vasse Diversion Drain Upgrade was developed by Bamford Consulting Ecologists as part of the Approvals process and provides a detailed description of commitments and approach, as well as a summary of current research on Western Ringtail Possums and their requirements (Bamford et al., 2020). Implementation of the plan commenced in October 2020, prior to works commencing.

The Water Corporation committed to revegetation to re-establish and improve connectivity of vegetation, and the installation of rope bridges and fauna shelters, including ten years of maintenance and monitoring with the aim that any long-term effect of the works will be a positive one. Bamford Consulting Ecologists was commissioned to undertake relocation and subsequent monitoring of fauna in response to the disturbance and amelioration activities. The agreed approach was to gently displace the animals from the clearing zone but keep them within their home ranges where possible. By avoiding or minimising handling, personnel were able to keep stress to the animals to a minimum. Cowan et al. (2020), links the poor survival of relocated animals to the stress associated with their capture, handling and transport. Studies of Western Ringtail Possums report high mortality of relocated animals (Clarke, 2011, Thompson & Thompson, 2009). Transfer of parasites (Dunlop & Watson. 2022) can also occur when animals are moved out of their home ranges. Since the disturbance

was only to affect a narrow area, displacement, rather than translocation was the preferred option.

Western Ringtail Possums are nocturnal and shelter in tree hollows, or build shelters called 'dreys' in which they sleep during the day. Dreys are clumps of twigs and leaves that are generally quite conspicuous and placed in the mid canopy of trees (See Images 8 & 9 in Appendix 1). A possum may have five to eight dreys across a home range of 0.5 – 1.5ha, and home ranges overlap (Jones, 2000).

Clearing works were carried out from October to December 2020 and construction was completed in April 2021. Artificial shelters were installed, Western Ringtail Possums and other fauna were displaced from the clearing areas in October and November 2020, and a survey was carried out in January 2021 to make a preliminary assessment of the shelters and the possum population following displacement. Monitoring of possums and their use of shelters and rope bridges has continued during 2021 – 2022 (Year One), 2022 – 2023 (Year Two) and 2023- 2024 (Year Three). This report covers Year Three of the study; the period of February 2023 to March 2024.

Over its ten-year period, the monitoring program aims to determine:

- the effects of disturbance on the numbers and distribution of Western Ringtail Possums adjacent to the disturbance areas along the Vasse Diversion Drain,
- Whether artificial shelters are used by possums and can contribute to the maintenance of the population, post-disturbance,
- Which shelter designs are preferred by Western Ringtail Possums,
- Whether rope bridges will be used by possums and are therefore effective in improving connectivity in a disturbed landscape,
- Whether revegetation is being accessed by possums and results in increased habitat for the species during a ten-year period.

This Year Three report analyses data collected to date to inform these questions.

METHODS

Description of Project Area

The project area consists of land along two parts of the Vasse Diversion Drain (Figure 1). The northern area lies between the Busselton Bypass Road in the south and Bussell Highway in the north and includes some extra land in small reserves to the south of the drain. Much of the vegetation consists of Peppermint *Agonis flexuosa* forest and woodland, with varying proportions of Marri *Corymbia calophylla*, Flooded Gum *Eucalyptus rudis*, Jarrah *Eucalyptus marginata,* Coojong *Acacia saligna,* Swamp Banksia *Banksia littoralis*, Modong *Melaleuca priessiana* (Saltwater Paperbark *Melaleuca cuticularis* where the drain crosses The Broadwater), Spearwood *Kunzea* sp., and occasional other tree and tall shrub species. The understorey is generally in poor condition. Vegetation is in best condition on the south side of

the drain, between Queen Elizabeth Avenue and the Busselton Bypass Road. Open areas of weedy grasses are present, although these are being managed as part of rehabilitation.

The southern area lies adjacent to the Busselton Golf Course, east of Chapman Hill Rd and includes land on the eastern side of the drain, as well as encompassing a section of the Vasse River. This is the site of the Vasse River Overflow Structure (VROS). The vegetation is generally degraded and in places parkland cleared and grazed, with an open woodland of Peppermint and Flooded Gum, some planted, non-native eucalypts and some riparian woodland along the Vasse River The trees which provided some connectivity through the site were removed for construction of the VROS, so the remaining vegetation is fragmented (see Figure 1c).

The total area cleared was 1.9ha (see Figure 1 a, b and c), however the project area for this study also includes sites in adjacent bushland and rehabilitation areas into which artificial shelters, relocated dreys and rope bridges have been installed, and will increasingly include the rehabilitation areas as plantings mature and become attractive to possums.

(a)


LEGEND
Approved Clearing Area
1:5,000 at A4
Metres
N
WATER
CD00116
Vasse Diversion Drain
Equivalent to part of Plan 8191/1 a

(b)


LEGEND
Approved Clearing Area
1:5,500 at A4
Metres
N
WATER
CD00116
Vasse Diversion Drain
Equivalent to part of Plan 8191/1 a

(c)



Figure 1 (a,b,c). *The project areas. The northern site (a and b) stretches from Busselton Bypass Road in the south to Queen Elizabeth Avenue in the north. Figure 1(c)shows the Vasse River Overflow Structure (VROS) site. Areas that were cleared are hatched yellow.*

Approach

This report covers the third year of a ten-year study following the disturbance and relocation of possums due to clearing. All relocation work was carried out in accordance with the Fauna Management Plan for the Vasse Diversion Drain Upgrade (Bamford et al., 2020) and focussed on minimal disturbance to the animals. During clearing, animals had been displaced as little as possible, ideally within their existing home ranges, while moving them from the impact area. In most cases, this was able to be done without capturing the possums, to minimise disturbance and stress to the animals. Thirty-six possums were displaced from the clearing area during operations. All animals were relocated successfully without injury or mortality. In most cases, the animals were moved no more than 20 metres and in some cases as little as five metres. Details of the displacement techniques employed are given in Bamford et al. (2021).

Since most animals were not handled, they were not individually marked, so assessment of the population is undertaken by recording numbers and locations of animals and dreys. Given the sedentary nature of most of the animals, this is likely to be an accurate measure of the impact due to clearing and means that disturbance of the animals (and confounding of the results by the impacts of handling) has been kept to an absolute minimum.

Rope bridges are monitored using motion sensitive cameras, observation and scat records to search for evidence of use. The locations of rope bridges are shown in Appendix 3.

Survey methods

Monitoring is undertaken by Amanda (Mandy) Bamford (B.Sc. Hons. Zool.) and Mike Bamford (B.Sc. Hons. Ph.D. Biol.). Mandy and Mike have many years of experience in management of the Western Ringtail Possum (hereafter referred to as possum). The work was carried out under DPIRD Scientific licence (ethics) U261/2021-2022, U261/2022-2023 and U261/2023-2024, DBCA Permit numbers TFA 2020-0149-2, TFA 2020-0149 and FR28000164, undertaken with reference to the Fauna Management Plan for the Vasse Diversion Drain Upgrade (Bamford et al, 2020) and informed by observations in Bamford et al. (2021), Bamford et al. (2022) and Bamford et al. (2023). Field assistance was provided by Jake Bamford (B.C.I.). Data Management was undertaken by Joshua Bamford.

Possum monitoring was carried out in November 2023, and March 2024. Monitoring was undertaken on fine days once the sun was up to protect camera equipment and minimise disturbance to possums. Previous experience (A. Bamford pers. obs.) is that possums are often only dozing on overcast days or at first light and are easily disturbed. In bright sunlight they are usually firmly asleep and dreys may be checked without disturbing them. All artificial shelters and relocated natural dreys were checked with binoculars or a pole camera to assess their status and check for possums. Natural dreys, hollows and possums sighted out of dreys adjacent to the cleared area were also recorded opportunistically. Recognising that it was important to minimise disturbance during monitoring, the pole camera was used for the minimal time, and just close enough to check for activity and take a photo, to disturb the animals as briefly as possible. In some natural dreys, it was not possible to access the drey using the pole camera without disturbing the animal, in which case the drey was checked using binoculars and a photo taken from the ground.

Handling of Fauna

No fauna requires handling as part of the post-disturbance monitoring phase of the project. Checking of dreys is done with minimal disturbance and cameras are unbaited, so as not to alter the behaviour of the animals. Bamford Consulting Ecologists operates under Scientific Use Licence U261 2021-2022 and U261 2022-2023, DBCA Permit numbers TFA 2020-0149-2, TFA 2020-0149 and FR28000164, undertaken with reference to the Fauna Management Plan for the Vasse Diversion Drain Upgrade (Bamford et al, 2020) and if animals require handling for any reason, personnel use techniques outlined in the Fauna Sampling Manual by Bamford et al. (2013) and DBCA Standard Operating Procedures for Fauna.

Relocated and Artificial Dreys

As outlined in the Fauna Management Plan (Bamford et al., 2020), a range of shelter types was installed in the project area in a variety of locations to augment the shelters available in relocation areas and trial the attractiveness to possums of the different designs. The types included:

Relocated Natural Drey – a drey cut out from a tree before it was cleared and wired up into a tree outside the clearing zone.

Relocated Long Hollow – a long hollow cut from a tree in the clearing zone. There were only two of these so results are lumped with Short Hollows in this report.

Short Hollow – a short hollow log, capped at one end and chained with plastic coated chain to a tree, to minimise damage to the tree branch. Short hollows were chosen to trial as they may prove less attractive to European Honeybees *Apis mellifera* than long hollows and possums will shelter in short natural hollows.

Dome – a wire dome made from two hanging baskets wired together, with a quarter cut out for the entrance and lined with *Agonis flexuosa* leaves and twigs.*

Dome with Coconut Dome – a wire dome with matching coconut fibre liner and entrance hole. Two of these also contained paperbark*

Cup – a single hanging basket installed as a wire cup.*

Cup with Coconut – a single hanging basket lined with coconut.*

Plastic bucket – a plastic filter bucket.*

*In all cases, WA Peppermint *Agonis flexuosa* sprigs from the possum's nearest tree were added to each artificial drey to try to mimic as closely as possible the natural smell of the animal's home range. In some instances where an animal's natural drey could not be salvaged, material from the natural drey was added to an artificial drey to make the drey smell more familiar to the animal and perhaps make it more likely to be used.

Artificial shelters were installed throughout the project area, outside the impact area. Eighteen dreys and hollows were installed by Tree Surgeons WA, while they were installing the rope bridges. The remaining 68 relocated and artificial dreys were installed by Bamford Consulting Ecologists' personnel. Details of all dreys relocated and all installed shelters are given in Figures 2 and 3 and Appendices 2 and 3. Examples of shelter designs are provided in Appendix 1, Images 2 to 7.

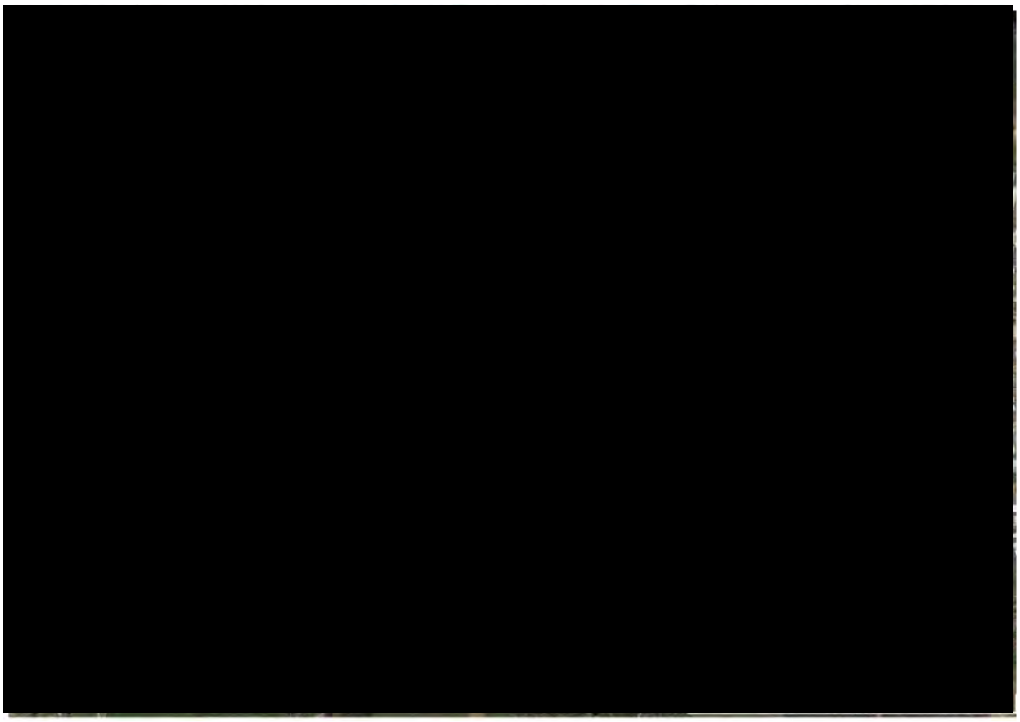


Figure 2. *Locations of shelters for Western Ringtail Possums installed along the Vasse Drain in Busselton in October and November 2020.*



Figure 3. *The southern project area (VROS) off* [redacted] *along the Vasse Diversion Drain and extending north along a natural drainage line, showing installed artificial shelters in red. The green marker was the location of a large Eucalyptus rudis from which a possum was displaced during clearing. It ran to a hollow (marked in white), behaving as if it knew the location. This hollow* [redacted] *was occupied in January 2021, despite active construction taking place nearby. Since March 2021, the hollow had been unoccupied, however in March 2024 there was evidence of use.*

Monitoring of Artificial Shelters

A check of all artificial shelters was carried out on two occasions in 2023 (February and November 2023 and again in March 2024. Results from the February 2023 monitoring period were discussed in Bamford et al. (2023) so November 2023 and March 2024 are the focus of this Year Three report. All locations were checked, shelters were photographed, and the state of the shelters recorded, noting any that needed repair or replacement. A pole camera and binoculars were used to determine if the shelters were occupied by possums or had evidence of recent use (see Appendix 1, Image 19).

Replacement of Relocated Natural Dreys

Since many of the Relocated Natural Dreys that were installed during clearing had fallen down or become unusable, 14 additional artificial shelters were installed in February 2023 and a further three in March 2024 to replace those that had been lost. They were installed in similar locations to the dreys that they replaced. A range of designs was used for replacement dreys. All the new shelters were photographed and details are provided in Appendix 4.

Monitoring of Natural Dreys

During the monitoring of artificial dreys, new, natural dreys were also discovered in the study area. Locations and occupancy of these dreys were recorded, and they were added to future monitoring sessions. If a natural drey became disused and fell from the tree it was excluded from future monitoring. Natural dreys that remained in trees continued to be checked, as these will sometimes be repaired and reused by possums.

Monitoring of Rope Bridges

Three brands (Reconyx, Bushnell and Swift Enduro) of motion sensitive cameras were used to monitor use of the rope bridges on two sessions concurrently with the shelter monitoring periods. Cameras were set at a range of angles depending on the locations of ropes and adjacent branches.

When analysing camera data, groups of images of the same species taken less than five minutes apart were scored as a single instance to avoid overestimating the number of animals using the bridges.

In addition, opportunistic searches for scats underneath the rope bridges were undertaken during other monitoring activities and a review of the condition and connectivity provided by each bridge was undertaken.

RESULTS

Locations of Possums

Figures 4 and 5 show the locations of Western Ringtail Possums prior to displacement, to provide context for interpreting the results of post-disturbance monitoring. Note that one retained tree on the edge of the drain where construction occurred had continued to record a possum in both Years One and Two, however no possum was recorded in this tree in Year Three.



Figure 4. *Locations of Western Ringtail Possums along the Vasse Drain in Busselton in October and November 2020, prior to displacement. White dots denote possums +/- joeys which were displaced, blue points indicate possums which were on the border of clearing works and were not moved as their trees were retained. Two of these retained trees contained possums in January 2021, despite being immediately adjacent to construction work, and one of them was occupied in January 2022, and again in February 2023, although no possum was recorded there in either November 2023 or March 2024.*



***Figure 5**. Locations of Western Ringtail Possums in the southern (VROS) site prior to displacement in November 2020. See Appendix 2, Figure 12 for results from January 2021 onwards. No possums were observed in the VROS area in Year Two of monitoring, however in Year Three, there was evidence of use of one of the natural hollows.*

Summary tables of data for Year Three of monitoring are given in Table 1 and Appendix 4, with Years One and Two data for comparison. Figure 6 illustrates the usage of natural and artificial dreys, and the numbers of possums in each monitoring period. Figures 7 and 8 show the locations of possums along the drain in the two monitoring periods in Year Three.

Numbers of Possums

In November 2023 47 WRP were recorded while 59 animals were found in March 2024. 91 natural dreys were monitored in Year Three of which 28 were new. In January 2021, 14 of 38 possums (37%) were on branches not associated with dreys while six were using artificial shelters (16%). Since that time, the numbers of WRP not associated with a drey has remained low. The post-breeding count of possums was higher in February 2023 than in either 2021 or 2022 (38 in January 2021, 45 in January 2022 and 64 by February 2023). In Year Three post breeding numbers appear to have stabilised, with 59 WRP being counted in March 2024.

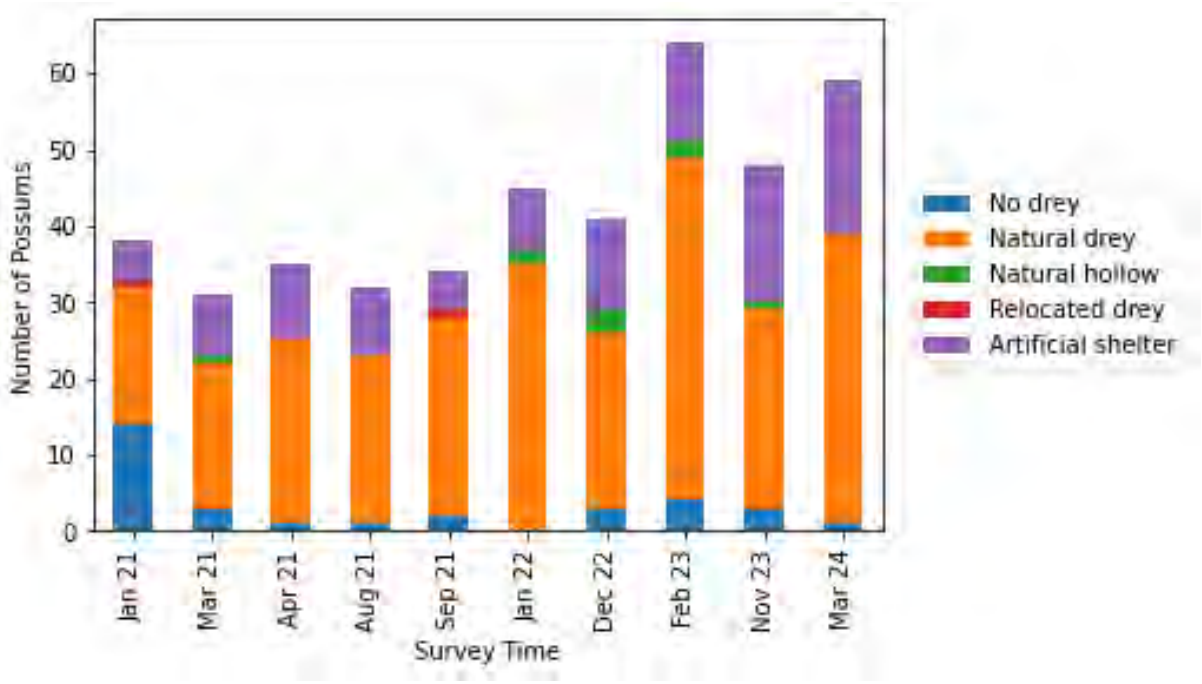


Figure 6. *Use of natural and artificial shelters by Western Ringtail Possums along the Vasse Diversion Drain in Busselton between January 2021 and March 2024. Note the continued use of artificial shelters and the large number of natural dreys that have been constructed since January 2021. The overall numbers of possums have also increased, although Year Three's counts suggest that numbers may have plateaued.*

Artificial shelters have continued to be used in all sampling periods. In Year Three, 36% of possums located were in artificial dreys (38% in November 2023 and 34% in March 2024). This compares to 27% (December 2022) and 20% (February 2023) in Year Two. Short hollows were the most frequently used design in Year Three (90% - 9 out of 10 were used on at least one occasion) with plastic filter buckets being the next most popular, with 64% (9 out of 14) of them being used on at least one occasion. (see Table 1 and Figure 6). Much of the coconut in the cups and domes is harvested or rearranged by the possums, however sometimes a possum later re-lines the drey with new material (see Image 32, in Appendix 1), or uses an unlined drey as a place to sleep.

Overall, 38% of artificial shelters were recorded as used by possums at least once in Year Three. Note that this is a minimum percentage as the dreys were only monitored on two occasions during Year Three, and dreys could have been in use at other times. There are also five artificial shelters that were occupied in all three years, including some that were occupied in all monitoring periods in Years Two and Three. These include a short hollow, two plastic buckets and two cups with coconut.

No Brushtail Possums *Trichosurus vulpecula* were recorded using a short hollow in Year Three, although a couple of short hollows showed evidence of use by Common Bronzewing Pigeons *Phaps calcoptera.*

Table 1. *Numbers and designs of artificial shelters installed along the Vasse Diversion Drain and their use by possums from January 2021 – February 2024. Years One, Two and Three results are separated for comparison. *Note that Year One records included six sampling periods, whereas Year Two and Three results are based on only two sampling periods.*

Shelter type	Number installed	Number occupied in at least one monitoring period	Notes	Percentage of drey type occupied or used in at least one monitoring period
Relocated Natural Drey (NAT)	Year 1 24 Year 2 11 remain Year 3 8 remain 14 replaced Feb'23 3 replaced Mar '24	2 0 0	14 of these were replaced in Feb 2023 with artificial shelters at the same locations	2 (1%) 0 2 (1%) had new material
Dome with Coconut (DoCo)	17 18	Year 1 4 Year 2 1 Year 3 1	Year 3: One occupied in both periods, 2 used but not occupied when checked.	5 (29%) 1% 3 (16%)
Cup without Coconut (Cup)	12 14	Year 1 1 Year 2 1 Year 3 2	Year 3: One occupied in one period, one occupied in both periods	1 (8%) 1(8%) 2 (14%)
Cup with Coconut (CuCo)	14 17	Year 1 6 Year 2 2 Year 3 6	Year 3: 3 occupied in one period, 3 occupied in both periods	6 (43%) 2 (14% 6 (35%)
Installed or relocated Hollow (Hol)	10 10	Year 1 8 Year 2 3 Year 3 9	Year 3: 3 hollows occupied in both monitoring periods, 6 occupied in one monitoring period	8 (80%) 3 (30%) 9 (90%)
Dome without Coconut (Dom)	5 5	Year 1 1 Year 2 1 Year 3 0	One drey (Year 3) had been used but was not occupied in either period.	1 (20%) 1 (20%) 1 (20%)
Plastic Filter Bucket (Buc)	6 14	Year 1 4 Year 2 3 Year 3 8	Year 3: Five were occupied in both periods, three were occupied in one sampling period.	4 (60%) 3 (50%) 9 (64%)
Totals Year 1 **Year 2** **Year 3**	**88** **70** **86**	Year 1 **26** Year 2 **11** Year 3 26		**27 (30%)** **11 (16%)** **32 (32%)**
Totals excluding relocated dreys	**63** **63** **78** 17 relocated dreys replaced with artificial dreys Feb '23 and March '24	Year 1 **24** Year 2 **11** Year 3 **26**		**38%** **17%*** **38%***

Construction of Natural Dreys

Of the 91 natural dreys monitored during Year Three, 26 of them were new. In November 2023, 10 new dreys were recorded and in March 2024, a further 16 were recorded. The locations of new dreys are shown in Figure 9.

Use of Rope Bridges

During the two camera sessions, both Ringtail and Brushtail Possums were observed using the bridges, with multiple crossings per night in the case of WRP. In November 2023, a camera on the rope bridge across [redacted] recorded three instances of WRP crossing and one instance of a Brushtail Possum (see Images 28 – 32 in Appendix 1).

Western Ringtail Possum scats were observed during both sampling sessions under the rope bridges [redacted]. See Image 35 in Appendix 1.

Review of Condition of Rope Bridges

Rope bridges adjacent to [redacted] are mostly intact, except for a small section at the western end of RB20, which is not required as it is not providing connectivity. Wear is evident on several sections of rope which cross the [redacted] and these continue to be repaired by contractors under the supervision of Tranen Revegetation SouthWest. The rope bridge across [redacted] RB31 has failed which will affect connectivity for WRP. Maps of the bridge locations are provided in Appendix 3.

Opportunistic Observations

Two dead possums were found during monitoring in Year Three. An adult was found dead on the ground (possibly predated) in November 2023 and a juvenile was found dead below a small drey in March 2024, with no apparent injuries. The death of this animal may reflect the natural mortality of juvenile animals when they are first independent.

Several possums were observed lying on their backs with their pouches open, or with tails protruding from hollows again this year, probably as a response to hot weather (see Appendix 1, Image 41).



Figure 7. *Records of Western Ringtail Possums (yellow dots) along the Vasse Drain in Busselton in November 2023.*



Figure 8. *Records of Western Ringtail Possums (yellow dots) along the Vasse Drain in Busselton in March 2024.*



Figure 9. *New natural dreys constructed during Year Three, recorded in November 2023 (yellow dots) and March 2024 (blue dots). Note the concentration of new dreys recorded in the* [redacted] *This is an area being revegetated by Tranen Revegetation SouthWest as part of the VDD project and vegetation cover has increased markedly in the last year. The number of new dreys may be a reflection of the increase in vegetation quality and therefore available habitat for WRP in this area.*

DISCUSSION

The third year of possum monitoring has consolidated the positive results from the first and second years. In Year Three, 47 animals were recorded in the November 2023 sampling period and this increased to 59 animals by March 2024, once many of the young were independent. This suggests that the possum management as part of drain widening works has not had a large impact on the population numbers to date and there are indications that the provision of artificial shelters, connectivity through rope bridges and revegetation work may be having a positive impact on the population. The possums appear to have bred well again in Year Three, with juveniles dispersing in February / March.

The use of the displacement technique outlined in the Fauna Management Plan for the Vasse Diversion Drain Upgrade (Bamford et al., 2020) to move possums from the clearing area appears to have been successful. All 36 possums were displaced from the clearing area without injury, many needing to be moved by less than 20 m. Most would only have been moved within their existing home ranges. By avoiding or minimising handling, personnel were able to keep stress to the animals to a minimum. Cowan et al. (2020), links the poor survival of relocated animals to the stress associated with their capture, handling and transport. Studies of Western Ringtail Possums report high mortality of relocated animals (Clarke, 2011, Thompson & Thompson, 2009) however observations from the first three years of the present study suggest that many animals have remained in the area following displacement. Ongoing surveys will continue to inform these observations.

Relocated natural dreys were probably important initially but most became disused once the possums had the opportunity to build new dreys or adopted artificial shelters. Interestingly, two relocated dreys were being used in September 2021 and one was still being maintained in January 2022 although was not occupied on the day of monitoring. By February 2023, none of the relocated dreys appeared to still be in use, however two of the relocated natural dreys had new leaves added to them during Year Three, although neither of them had a possum residing in them during a sampling period. Relocated natural dreys will continue to be replaced with additional artificial shelters as needed and artificial dreys will continue to be monitored and maintained to fulfil commitments made as part of project approvals to install double the number of artificial shelters as were removed and maintaining them for ten years (DWER Clearing permit CPS 8191/1).

Artificial shelters were adopted quickly and have been used consistently. 38% of dreys were recorded as used on at least one of the two monitoring periods in Year Three, and 17% were occupied in both sampling periods. These rates are considerably higher than the percentage use in Year Two, where only 17% were used on at least one occasion. Perhaps the animals are adapting their behaviour to use a novel resource. It is likely that the availability of additional shelter has supported the population of possums following displacement and may have contributed to the sustained increase in numbers of possums at the ends of the breeding seasons (45 in January 2022, 64 in February 2023 and 59 in March 2024) by providing additional shelter for newly independent juveniles, such as the newly independent juvenile which was discovered in Short Hollow S79 in March 2024 (see Image 20 in Appendix 1).

Twenty-six new dreys were recorded in Year Three and there was a noticeable concentration [redacted]. Revegetation is starting to establish across all areas of the site, including the VROS. It will be interesting to see if the WRP population continues to increase in revegetation areas, as might be predicted.

The number of possums using natural hollows is probably an underestimate, as the pole camera is not always able to detect them if the hollow is curved. In monitoring periods when the weather was hot, some animals were detected because their tails were hanging from their hollow. In some parts of their range with a greater number of trees with large hollows, Western Ringtail Possums rarely build dreys and are often difficult to detect without spotlighting transects, as they spend their days deep in hollow trees. Since the numbers of suitable natural hollows in the trees along the Vasse Diversion Drain is small, and spotlighting transects were carried out at the site before works began, the numbers of animals remaining undetected within the study site is likely to be low (less than five animals).

During hot weather in Years Two and Three, possums exhibited a range of behaviours probably associated with cooling. Hanging tails in the breeze, plucking hair and exposing bare skin on their tails, bellies and pouches, and seeking shelter in cool, damp vegetation are all behaviours that are likely to help the possums to manage their temperature in heat extremes. Saliva spreading has been observed to be used as a cooling mechanism in Red Kangaroos (Dawson et al., 1974). Van Helden et al. (2021) found Western Ringtail Possum abundance to be correlated to canopy cover in Albany. Revegetation and continued access to shady gardens and water supplies above ground level are likely to be important to the long-term survival of the possum population in Busselton, particularly with a drying and warming climate.

Artificial shelters are being used by the possums, with the preferred designs varying perhaps due to seasonal changes in weather conditions, or the breeding cycle of the animals. In Years One and Three, artificial 'short hollows' were the most commonly occupied design (80% and 90% respectively were used in at least one monitoring period), although only 30% of them were used in at least one of the two sampling periods in Year Two. The most popular design in Year Two was the plastic buckets, 50% of which were occupied on at least one of the two sampling periods. In Year Three, plastic buckets were also popular, with 64% of them being used in at least one monitoring period. In Year One, during which the dreys were sampled on six occasions, different drey designs appeared to be popular at different times of year. With only two sampling periods during Years Two and Three however, it is not possible to assess seasonal variation in attractiveness of the different drey designs. In Year One, short hollows seemed to be preferred in the non-breeding season, however only one artificial hollow was observed to be used by a mother with a joey, presumably because hollows are not easily expanded to accommodate a growing joey. In Busselton, maternity dreys sometimes have a 'granny flat' arrangement when the juvenile is close to independence (pers. obs.), and this would be more difficult to accommodate in a short hollow. Short hollows were highly favoured at other times of year in Year One, however and have the advantage over large or long hollows that to-date, none has attracted feral bees.

In Year One, Domes were popular when they were covered with coconut but were mostly unused once the coconut was removed by the possums or had collapsed and so most were not used in Years Two and Three. Two coconut-lined domes initially contained paperbark. Both these domes were used in Year One, one was occupied in five of the six monitoring periods. In Year Two however, it had deteriorated and was no longer used. By Year Three it was empty and unused. It is possible that the waterproofing and insulating properties of paperbark, long recognised and utilised by Noongar people (Hansen and Horsfall, 2019) are also valued by the possums. Artificial shelters lined with paperbark and coconut appear more attractive and lasted longer than coconut alone, however additional trials will need to be made to confirm this due to the small sample size (only two dreys due to the availability of sustainably sourced paperbark). No paperbark lined shelters have been provided in Year Three but will be provided in future years if sustainably sourced paperbark is available.

Initially, it was planned to re-line dreys that had become denuded, however since several empty dreys have since been re-lined with natural materials by WRP, and some even just used without lining, a decision was made to only add coconut if a drey is being replaced, to minimise disturbance.

It should be noted that a small number of artificial shelters of various designs in various locations were used in almost all monitoring periods, so it may be the position rather than the design which was the most important factor in these cases, or it may be due to chance. It will be interesting to see if these shelters continue to be regularly occupied in future years.

In Year Two, 27% of possums located during monitoring periods were using artificial shelters. In Year Three, their usage was higher with 36% of WRPs recorded being in artificial shelters, so they are clearly an important resource. This increase may reflect the number of relocated natural dreys that were replaced with artificial shelters during 2023, or it may be that the animals are learning to exploit a novel resource. WRP built dreys inside a range of artificial shelters in Year Three demonstrating a willingness to adapt and use available items. This is in line with the experiences of residents who report animals curling up in items such as old carpet and furniture in their backyards. It will be interesting to see if the use of artificial dreys is sustained once revegetation is well established.

In Year Three, cups were used in both sampling periods, as was the case in Year Two, including one cup without coconut, which contained a possum without any lining (see Image 1 on the cover of this report and Image 39 in Appendix 1). In other cases, possums relined cups with natural material (see Appendix 1, Image 42) so unless an artificial shelter is damaged and needs replacement, the use of dreys is observed without maintenance or disturbance.

These data on the preference of different artificial shelter designs are preliminary only and are confounded to some extent by the short-term disturbance caused by the drain widening project in Year One, and by the deterioration in coconut, which may have changed the attractiveness and functionality of the coconut-lined cups and domes. In some cases, the coconut was harvested by the possums to construct an alternate drey elsewhere! To date, 17 additional artificial shelters have been added to replace the deteriorated relocated natural dreys. These

shelters are a selection of lined cups and plastic filter buckets, to provide further data on the most effective shelters to support populations of possums in disturbed areas with insufficient natural shelter. Additional short hollows will also be installed if available.

To address the question of the seasonality in shelter choice, it would be necessary to maintain a more regular monitoring regime than has been proposed for at least some years beyond Year Three. This would allow shelter use to be monitored throughout the site at different times of year, as occurred in Year One, to detect seasonal variation in shelter choice. This possibility will be discussed with the client.

VROS

Clearing in the VROS area has resulted in a highly fragmented landscape, and possums and the artificial shelters are on a 'dead end' without connectivity, and with less vegetation than in 2020, so are probably less attractive to possums. The artificial shelters in the VROS area were used initially, and although one possum stayed immediately adjacent to the VROS area in natural hollow 466 (see Appendix 1, Image 45 and Appendix 2) throughout most of the construction period, it was no longer in the hollow in March 2021 and a natural drey was found further north along the river, which was probably constructed by this individual. By September 2021, this drey had deteriorated and no evidence of possums was found in the area. This was probably to be expected, given the number of trees removed and the consequent loss of habitat and connectivity. No fresh evidence of possums was found during Year Two surveys, however in Year Three natural hollow 466 appeared to have been used, so it is possible that WRP still occurs at a low level in the area. A narrow line of revegetation has been installed by Tranen Revegetation SouthWest on the eastern boundary of the VROS site (see Images 25 & 26 in Appendix 1). Once this establishes, this will improve connectivity for WRP so it will be interesting to monitor WRP activity at the site in coming years. Land surrounding the VROS area is privately owned farmland, so any plantings in the area adjacent to the site would also support possums but would need to be negotiated with the landowner.

Rope Bridges

Rope bridges were again used by both Western Ringtail Possums and Brushtail Possums in 2023-24. Previous studies such as Yokochi and Bencini (2015) which monitored Western Ringtail Possums' use of rope bridges, found that the animals began using them within 36 days of installation and used them consistently throughout their study. In their study the structures were heavily engineered, static bridges however the results from Year Three of the present study demonstrate that a simpler rope design is also readily used by possums.

The ropes installed along the [redacted] will no longer be needed for connectivity once revegetation in the area is advanced, within the next few years. Several of the rope bridges along and across [redacted] however span areas which will not be revegetated further and so as the rope bridges fail, connectivity will be lost and animals will be forced to go to the ground to cross, putting them at risk of vehicle strike or predation by foxes, cats and dogs.

Natural sisal rope was used for the rope bridges at the VDD to ensure minimal environmental impact which might result from longer lasting ropes that would release microplastics into the environment as they degraded. Natural fibre rope bridges require ongoing maintenance as they deteriorate over time in natural environments. Ongoing maintenance of the ropes is organised by Tranen Revegetation SouthWest as required during the 10 year post-disturbance period. If long-term rope bridges are to be provided along or across [redacted], which would be of considerable benefit to the WRP, a more permanent design will need to be installed.

The value of each tree

Bamford et al (2021) noted that animals were continuing to use trees retained immediately adjacent to the clearing area while work continued on site and emphasised the importance of retaining individual trees where possible. Several of the trees in the strip of vegetation immediately adjacent to the impact area continued to be used by possums in 2022/23 although the animals were not present in 2023/24. The trees included several with dreys which were marked to be cleared in November 2020. After consideration, a decision was made by the client and contractor to retain them. Three animals recorded in January 2021 were in dreys or hollows directly overlooking the construction site but the animals had persisted in them, tolerating the disturbance. These sites continued to be used during 2021 and one retained tree with a natural drey, immediately adjacent to the drain, was still in use in February 2023, although there was no evidence of the tree being used in 2024. Decisions made to reduce clearing, even by a single tree, can improve the outcome for fauna.

To maintain the displaced animals at the site in the long term despite the reduction in habitat, it is essential that additional food resources are provided in the form of revegetation, as soon as is practical. Although food resources do not appear to be limiting at present and all animals appear in good condition, there is a risk that drought conditions or insufficient nitrogen in leaves will begin to affect the population. The wide range of plant species being revegetated by Tranen (Tranen Revegetation SouthWest, 2020), including Coojong *Acacia saligna, Kunzea sp.* and Marri *Corymbia calophylla,* as well as WA Peppermint *Agonis flexuosa,* and a range of understorey plants will provide the varied diet which Mathieson et al. (2020) and Nature Conservation Margaret River Region (n.d.) report that Western Ringtail Possums prefer. The revegetation is progressing well and will soon be providing high quality food for possums. The regrowth of plants at the [redacted] and at the [redacted] is also progressing well and many additional dreys were recorded in that area in Year Three (see Images 22, 24, 33 & 34, Appendix 1).

Revegetation will also re-establish and enhance connectivity, supplemented by the rope bridges which were installed by Tree Surgeons WA. Increased connectivity will allow possums to move between the population along the drain and the rest of Busselton to access food resources, expand home ranges and find mates, improving the species' long-term viability in the area. Rope bridges and revegetation will also enable possums to travel without going to the ground, avoiding the risks of foxes and cars, both identified as major threats to the viability of the Busselton population by (Yokochi *et al.,* (2015).

In the long term, rope bridges should be uneccessary at the [redacted] site, however it would be preferable if the bridge across [redacted], and across the main [redacted] could be replaced with long term alternatives to maintain canopy connectivity for possums and protect them from the dangers of vehicle strike and predation beyond the ten-year life of this project.

Engaging the community

Part of the long-term success of the project will be engaging the community in areas adjacent to the drain with possum conservation, helping them to value the critically endangered species which shares their suburb. Many of the animals monitored in this study have home ranges which overlap with residential and industrial properties, and so the actions of the human occupants of their home ranges could have a huge impact of the success or otherwise of the Water Corporation's rehabilitation in the area. Encouraging residents to retain and replant native trees, provide connectivity above ground to keep possums away from domestic pets, and being prepared to accept the occasional rose bloom or nectarine being harvested by possums (or netting the trees) will help to ensure the possums' long-term survival in the suburbs. There is increasing evidence that Western Ringtail Possums survive better in suburbs than they do in remnant bushland (Van Helden et al., 2020, Busschots et al., 2021), so residents can play a vital role in the species' conservation.

Although the Vasse Diversion Drain Widening Project caused disruption to the Busselton population of Western Ringtail Possums in the short term, it has the potential to contribute to the possums' long term survival by improving the availability of high nutrient foliage for food, increasing the availability of suitable structures for protection/breeding (artificial shelters, revegetation), and canopy continuity to escape predation and other threats (rope bridges and revegetation), all issues identified as important by Department of Parks and Wildlife, (2017) and Bamford et al., (2019). In addition, ongoing engagement with residents adjoining the drain to encourage them to make their backyards possum-friendly will contribute to sustaining the possum population in the long term. Future monitoring of the Western Ringtail Possum population along the drain as part of this project will help to show if this potential is realised and can be sustained.

CONCLUSIONS

While only two sampling sessions were undertaken in Year Three, the third year of possum monitoring at the VDD and VROS sites suggests that the minimal displacement method, choosing to retain trees that were on the border of the development, providing artificial shelters and rope bridges have minimised the impact on the possum population and may actually have a positive impact once revegetation is advanced. The population has remained stable following the initial disturbance, has shown a slight increase in January 2022, and a substantial increase again in February 2023 and has remained relatively stable in March 2024, suggesting a good survival of juveniles following the 2021, 2022 and 2023 breeding seasons. The increase in numbers may reflect the provision of additional shelter, connectivity and possibly a decrease in the fox population following the abandonment of the fox den in the Reserve.

The population of possums is stable or increasing in all areas except the VROS area, where no possums were observed during Year Two but there was some evidence in Year Three. It is likely that the lack of connectivity and reduction in cover following construction has made the remaining vegetation less attractive to possums. Although widespread replanting is not compatible with operations at the site, revegetation taking place along the eastern boundary of the site may improve connectivity in this area over time and make the area more attractive to possums.

Relocated natural dreys were probably important in the short term but most became disused after a few months, and most possums were found in newly constructed natural dreys, and in artificial shelters by March 2021. Relocated natural dreys were no longer being used in Year Two, but artificial shelters are being used consistently, and the provision of artificial shelters is likely to be helping to support a higher population. In Year One there appeared to be a seasonal pattern in their preferred designs. Artificial hollows appeared to be favoured in the non-breeding season, whereas plastic buckets and cups with coconut were chosen at other times of year, however it was not possible to determine seasonal preferences with only two sampling periods in Years Two and Three. There is insufficient data to draw firm conclusions regarding drey design yet, because of the confounding effects of disturbance and seasonality, however short hollows and plastic buckets were the most frequently used in both Years Two and Three of the study.

Since 41 dreys were removed during clearing, replacement of relocated natural dreys is required to meet the condition 15 of DWER Purpose Permit CPS8191/1 (Bamford et al. 2020) to increase the number of additional shelters to 82. This requires ongoing replacement of relocated natural dreys as they fail, and repair and replacement of any damaged or aging artificial shelters. Seventeen relocated natural dreys have so far been replaced, as well as a cup and a dome which were damaged by drain works. Follow-up monitoring will be undertaken to determine if these new shelters are being used and if those with coconut are being harvested by the possums. In Years Two and Three, twice yearly monitoring was conducted. While this demonstrated the use of the shelters, it was also not possible to detect seasonal differences in their use. Increasing the frequency of monitoring (ideally six, but at least three times per year) would assist in assessing the use of replenished and additional artificial shelters and would provide greater confidence in conclusions about preferred shelter design.

In January 2021, a number of possums were observed without an associated shelter, however in January 2022, despite numbers of possums being higher, all were associated with shelters, even if they were outside them, suggesting that they had adjusted to their altered home ranges and new shelters after 12 months. In Years Two and Three, a small number of possums did not appear to be associated with shelters, which may reflect a natural level of shelter use, or indicate an undetected hollow. Future monitoring will demonstrate if a higher population can be maintained, with increased shelter, food plants and connectivity as revegetation matures.

The rope bridge design has been demonstrated to be appropriate for use by possums, therefore increasing connectivity for urban possums in the area. Possums were recorded using rope bridges [redacted].

Once revegetation is established sufficiently to provide additional food sources for the possums, monitoring will demonstrate if possum numbers rise, and if the population expands to use additional areas of the study site which are currently unsuitable.

RECOMMENDATIONS

- Artificial shelters where coconut fibre is collapsing should be observed but not repaired to minimise disturbance in case possums choose to rebuild a drey inside them.
- Relocated Natural Dreys should continue to be replaced with artificial shelters to bring the total back up to or exceed the minimum of 82 shelters required as part of DWER Purpose Permit CPS8191/1, condition 15. Additional short hollows, plastic filter buckets and wire cups with paperbark (if available) and coconut seem the best choice.
- Artificial shelters are subject to wear and tear and damage and need to be repaired and replaced as required. In Year Four, two short hollows will need repairs and several cups are showing signs of rust and may need replacement.
- Rope bridges at [redacted] should be maintained until revegetation is high enough to provide canopy connectivity. Bridges along and across [redacted] should be maintained and consideration given to a permanent structure or structures over the two [redacted] and across [redacted] once the ten-year maintenance period concludes.
- To gain a detailed understanding of the seasonal usage of artificial dreys, monitoring would need to be conducted at a rate of three - six times per year in at least some of the remaining seven years of the study. The existing program is for twice yearly sampling and yearly reporting from 2022 onwards, which will collect enough data to measure the overall population size and expansion into the revegetation areas but will not provide sufficient data to detect seasonal usage of the site, including changing preferences for artificial drey designs. This information would be valuable to collect to inform future rehabilitation projects if budget were available to maintain a more frequent monitoring regime.
- Revegetation should continue as quickly as possible to increase food resources and connectivity.
- Additional monitoring time may be required to detect and re-check all natural dreys once revegetation is advanced enough to support additional possums. This may require an additional day's monitoring for each session from the 2024 season.
- The fox den identified in Bamford et.al. (2021), south of the drain in the Council reserve has been abandoned. The den and all evidence of foxes should continue to be monitored for any future activity.
- Residents should be encouraged to plant appropriate food and shelter plants for possums to improve connectivity and support their continued occurrence in the suburbs of Busselton.
- The Busselton community should be provided with opportunities to learn more about the possums and promote their occurrence as an asset. This could include workshops to make artificial shelters, plant local plants and encourage a sense of custodianship of the possums.
- When clearing works are required in areas containing Western Ringtail Possums, displacement rather than relocation should be the preferred option to minimise disturbance to the animals, provided that sufficient habitat remains.
- Every tree is important for species such as Western Ringtail Possums. In situations where trees are on the border of a development, they should be retained if possible.

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Appendix 1. Photographs













Images 3-8. *A selection of designs of Artificial Shelters: Dome – no coconut (Dom); Short Hollow (Hol); Cup with coconut (CuCo); Cup – no Coconut (Cup); Plastic Bucket (Buc); Dome with coconut (DoCo). In Year Three, Short Hollows, followed by Plastic Buckets were the most frequently used artificial shelters.*





Image 9 (left). *A platform natural drey containing a Western Ringtail Possum mother and large joey taken in October 2020.*

Image 10 (right*). A dome-shaped natural drey containing one or two possums. Numbers of possums can be difficult to determine in dome-shaped dreys without disturbing the occupants.*



Image 11. *An example of a Relocated Natural Drey. Relocated Natural Dreys were probably an important interim measure in November 2020 for newly displaced possums. One Relocated Drey were still being maintained in January 2022 but in February 2023, all relocated natural dreys were disused or had fallen apart. In March 2024 however, two of the remaining relocated natural dreys had some new material added to them, although they were not occupied when checked.*



Image 12. *Motion sensitive cameras were installed on various angles and directed towards the rope bridges. The angle depended on the position of vegetation obstructing the view of the ropes, so possums were photographed without taking large numbers of photos of moving rope and branches. See Images 28 – 32 for examples of motion sensitive camera photos.*




Images 13 & 14. *WRP will shelter and feed in a variety of plants. This possum chose to shelter 1.5m up in a Snottygobble (Persoonia longifolia). Image 12 shows a close-up of the animal on its platform drey. Image 14 shows the whole plant, with the tell-tale snipped branchlets which alerted the BCE team to the WRP concealed inside.*



Image 15. *Multiple dreys in one flowering Melaleuca nesophila. Although this species is not native to the South-West of Western Australia, it produces abundant nectar and is a good example of the non-native food resources available in the suburbs of Busselton.*





Images 16 & 17. *Possums frequently harvested coconut fibre from the coconut-lined dreys resulting in the denuding of most lined cups and dreys within a year of being installed. Initially, it was planned to replace coconut in the dreys, however several denuded dreys have now been re-lined with natural material by possums (Image 17), so the decision was made to leave these dreys undisturbed and only replace the coconut if a whole drey needs to be replaced, such as when Relocated Natural Dreys deteriorate and need replacement with artificial ones.*





Image 18 (left). *By January 2021, a number of the artificial shelters containing coconut had been rearranged. In this case, the possum obviously preferred to choose an alternate location to create its own shelter using coconut from the artificial drey!*

Image 19 (right). *Artificial Shelters were checked using a pole camera if necessary. An example of a pole camera image may be seen in Image 20.*



Image 20. *Shelter S79 contained a juvenile WRP in March 2024, likely a newly independent animal. S79 is one of five artificial shelters of various designs that have been occupied in all years of the study. S79 was also occupied in all four monitoring periods in Years Two and Three.*



Image 21. *Rope Bridge along* [redacted] *installed by Tree Surgeons WA. Project Approvals require six rope bridges to be maintained for 10 years to help improve connectivity for possums, so they do not need to come to the ground to move between trees.*



Image 22. *Rope Bridge between [redacted]. Several records of WRP were made in this area in Year Three, which previously had no records of WRP since monitoring began. Rope bridges are providing essential connectivity while plants establish. WRP using the ropes are shown in images 28 - 32. Revegetation is progressing well, and within several years, the revegetation will provide the necessary connectivity, and the rope bridges in this area will become redundant.*



Image 23. *Another example of the connectivity provided by rope bridges in* [redacted]. *This isolated tree contains an artificial hollow (S66) whose only connection to other tree canopy is by rope bridges. Year Three was the first year that a WRP was recorded using this hollow and a new drey was built in another isolated tree nearby, connected by rope bridges. Underneath the rope bridges, restoration work is being undertaken by Tranen Revegetation SouthWest. Eventually the establishing vegetation will provide the required connectivity. In the photograph, the tail of the WRP can just be seen protruding from the entrance of the shelter.*



Image 24. *Revegetation being undertaken by Tranen Revegetation SouthWest as part of the VDD project. The seedlings used include a wide range of plant species which will benefit not only possums but increase local biodiversity. These plantings are establishing well and are rapidly increasing connectivity, shelter and food supplies for possums. Possums prefer a range of food plants, particularly those with high nitrogen such as Acacia saligna, so these plantings will provide high quality food for them. The establishment of this vegetation may explain the concentration of new dreys found in the area in Year Three (see Figure 9).*





Images 25 & 26. *Although comprehensive revegetation is not possible at the VROS area due to maintenance requirements, a line of revegetation has been installed by Tranen Revegetation SouthWest along the* [redacted] *where natural dreys previously occurred and artificial dreys were installed as part of mitigation. The seedlings are growing well and in time will re-establish linkage through the site. It will be interesting to see if WRP reinvade the area in coming years once plants are established.*



Image 27. *Rope bridge [redacted] in November 2023. This bridge was used by both species of possums during Year Three (see Images 28 and 29). This gap is likely to remain so once the ten-year maintenance period expires, consideration should be given to alternative ways to maintain the connectivity provided by this bridge and others [redacted].*



Image 28. *Western Ringtail Possum crossing the same rope bridge as shown in the previous image, [redacted] in November 2023. On this evening there were three instances of WRP crossing the bridge and one of a Brushtail (see Image 29 below).*



Image 29. *Brushtail Possum using the rope bridge* [redacted] *in November 2023 (see also the previous two images), demonstrating that the design is suitable for both species of possums. On the evening of the 21/ 11/2023 the cameras recorded three crossings by WRP and one crossing by this Brushtail Possum.*



Image 30. *Western Ringtail Possum using a rope bridge connecting isolated trees* [redacted] *Natural Drey 1013 was constructed in this tree, only connected to other canopy by ropes, indicating the value of bridges.*





Images 31 & 32. *Western Ringtail Possum crossing a rope bridge* [redacted] *in March 2024. This camera was set underneath the rope facing upwards to avoid moving vegetation. This technique worked well in areas with open ground between trees. Tranen's revegetation fence is visible in the foreground at the right of the photos.*





Images 33 & 34. *Revegetation* [redacted] *in February 2023 (above) and March 2024 (below). Once the vegetation is large enough, it should provide additional nesting and high-quality feeding sites for possums as well as connectivity, so rope bridges will be unnecessary.*



Image 35. *Possum scat with pencil for scale, found on the path beneath the rope bridge* [redacted] *shown in the previous images. Scats are regularly found beneath the rope bridges and had not been recorded along the pathway prior to the rope bridges being installed.*





Images 36 & 37. *Fraying rope bridge (Image 36) and broken rope (Image 37). Natural fibre rope bridges require ongoing maintenance as they deteriorate over time in natural environments. Natural sisal rope was used for the rope bridges to ensure minimal environmental impact that might result from longer lasting ropes that would release microplastics into the environment as they degraded. Ongoing maintenance of the ropes is organised by Tranen Revegetation SouthWest as required. If long-term rope bridges are to be provided* [redacted] *, which would be of considerable benefit to the WRP, a more permanent design will need to be installed.*



Image 38. *A Western Ringtail Possum in an artificial hollow in February 2023. Identification is easily made as Ringtails often hang their tail out of the hollow, especially on warm days.*



Image 39. *WRP in unlined cup in March 2024. Occasionally animals choose to sleep in unlined artificial shelters although usually they would place some snipped branchlets inside.*



Image 40. *Plastic filter buckets were the second most popular drey design in Year Three, with 64% of them being occupied during at least one sampling period. Unusually, this Western Ringtail Possum chose to shelter underneath rather than inside the bucket.*



Image 41. *Western Ringtail Possum in March 2024. This individual appeared to be exposing the bare skin under its tail and spreading saliva on and in the pouch to help it thermoregulate.*



Image 42. *An occupied artificial drey, rebuilt with natural materials by the possum, subsequent to most of the coconut being removed some months previously. The possum is just visible as a dark shape under the fresh twigs. After observing this behaviour, the decision was made not to replace coconut that had been removed, to see if other possums would choose to rebuild dreys that had been pulled apart. Several empty dreys have now been relined by WRP.*



Image 43. *Retained WA Peppermint tree (Agonis flexuosa) containing a natural drey [redacted] which contained a possum in all but two monitoring periods during works. A decision was made to retain this tree although it was [redacted]. Its continued use by a possum throughout 2021 – February 2023 illustrates the importance of decisions to retain individual trees. This tree did not contain a drey in Year Three so the animal using it may be deceased or have moved, but the site will continue to be monitored, to see if it is reused in subsequent years.*

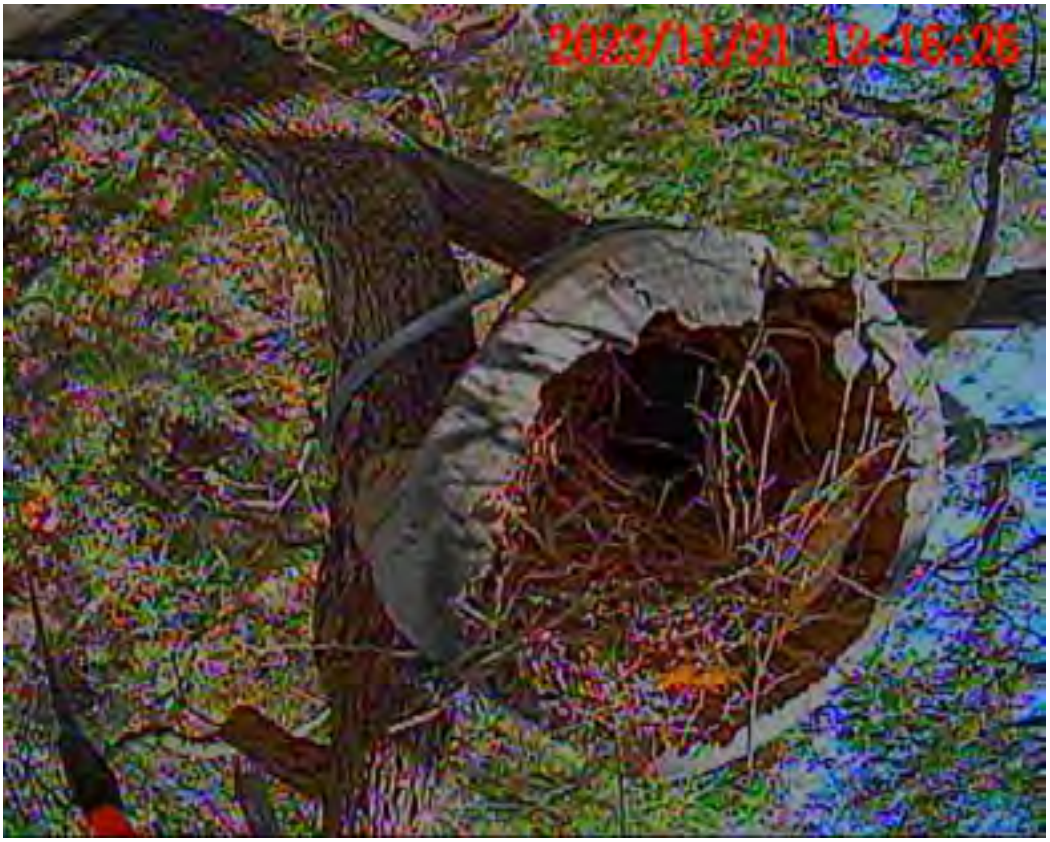


Image 44. *This WRP has built an elaborate drey inside this Artificial Short Hollow. Short hollows were the most popular choice of artificial shelter in Year Three, and unlike longer hollows appear not to be attractive to the introduced European Honeybee Apis mellifera.*



Image 45. *Log from the VROS area which was occupied during works and has shown recent evidence of use.*

Appendix 2. Changes to Vegetation at the Vasse River Overflow Structure (VROS) area.

Figure 10. Time series maps showing a). Natural and Artificial Dreys (January 2021) and b). a new Natural Drey discovered in March 2021. No additional dreys were discovered at the VROS in Year Two or Three, although 466 (old hollow tree) did show evidence of use, but was not occupied, in March 2024. A narrow line of revegetation installed by Tranen Revegetation SouthWest (see Images 25 & 26) may help WRP to reinvade the area once it is established.


a).


b).

Appendix 3. Maps showing locations of rope bridges.

Figure 11. Figure 11 a) and b) show bridges along [redacted], while c) and d) show bridges [redacted]. The bridges [redacted] will become redundant once revegetation matures, however the replacement of bridges across [redacted] and [redacted] with more permanent structures would safeguard the WRP population beyond the ten year commitment required under the approvals for this project, as although revegetation is being undertaken on [redacted], the risks of vehicle strike and predation for animals moving between these locations will remain.



a)



b)

Appendix 3 (cont.)



c)



d)

Appendix 4. Table showing relocated and artificial dreys and logs installed outside the clearing zone of the project area. Types of shelters are: DoCo= Dome with coconut fibre (and Agonis leaves), Dom = Dome (with Agonis leaves only), CuCo = Cup with coconut fibre, Cup = Cup (with Agonis leaves only), Buc = Plastic Bucket, Hol = Hollow, Nat = Relocated Natural Drey. Poss. = number of Possums observed using the shelter. The locations of each shelter are plotted in Figures 2 and 3.

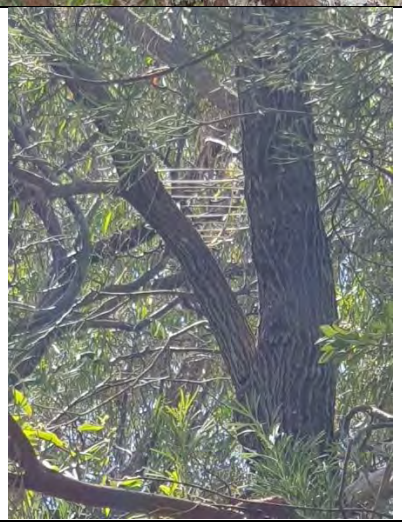
ID	Easting	Northing	Type	Tree	Possum numbers during 8 monitoring periods: Year One (line one): Jan, Mar, May, Aug, Sept 2021, Jan 2022 Year Two (line two): Dec 2022, Feb 2023. Year Three (line three) Nov 2023 Mar 2024	Used	Photos	Notes

S1	[redacted]		DoCo	E. rudis	0 0 0 0 0 0 0 0 0 0	unused unused		Replanting of corridor of vegetation next to the farmer's paddock to the east may provide a corridor for WRP to move back into this area.

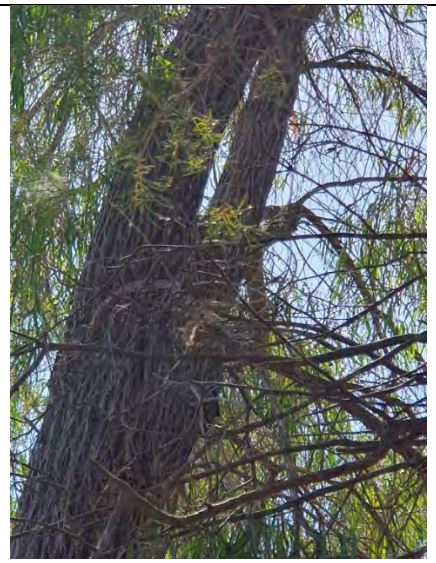
S2	[redacted]	Dom	A. flexuosa	0 0 0 0 0 0 0 0 0 0	unused unused			Replanting of corridor of vegetation next to the farmer's paddock to the east may provide a corridor for WRP to move back into this area.
S3	[redacted]	Dom	A. flexuosa	0 0 0 0 0 0 0 0 0 0	unused unused			Replanting of corridor of vegetation next to the farmer's paddock to the east may provide a corridor for WRP to move back into this area.

S4	[redacted]		DoCo	E. rudis	0 1 0 0 0 0 0 0 0 0	Used unused		Replanting of corridor of vegetation next to the farmer's paddock to the east may provide a corridor for WRP to move back into this area.

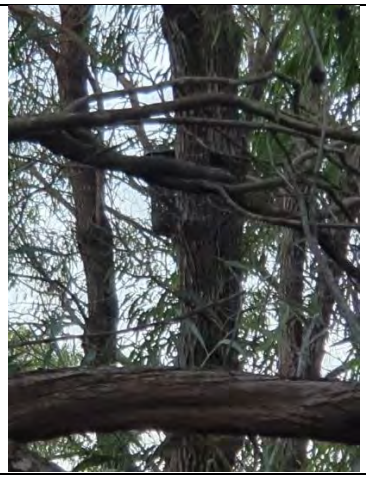
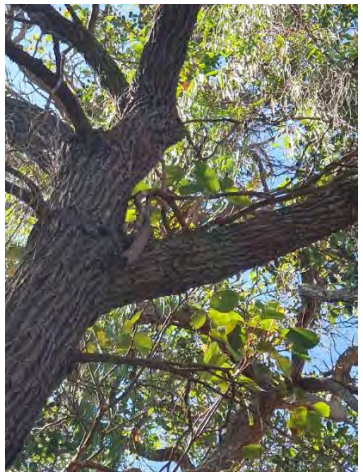
S5	[redacted]		Dom	E. rudis	0 0 0 0 0 1 0 0 0 0	Used used		Empty but looks used!
S6	[redacted]		DoCo	C. calophylla	0 0 0 0 0 0 0 0 0 0	unused unused		Small amount of coco

S7	[redacted]	Dom	A. flexuosa	0 0 0 0 0 0 0 0 0 0	unused unused		Few twigs
S8	[redacted]	CuCo	A. flexuosa	0 0 0 0 0 0 0 0 0 0	unused unused		Few twigs

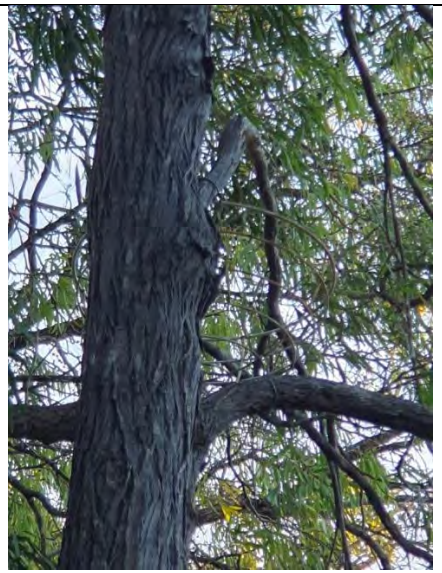
S9a	[redacted]	Nat now Buc	A. flexuosa	0 0 - - - - - - 1 1	unused used			Replaced. Installed Large Black Bucket S9R in Feb 23, occupied in both Nov23 and Mar 24
S10a	[redacted]	Nat Now CuCo	A. flexuosa	0 – 0 - - - - - 0 0	unused unused			Replaced Feb 23. Installed Black Cup with Coconut now S10R

S11	[redacted]	Cup	A. flexuosa	0 0 0 0 0 0 0 0 0 0	unused unused		Empty and beginning to rust
S12	[redacted]	Buc	E. marginata	0 0 0 0 0 0 0 0 0 0	Used Used	 	Neat drey, unoccupied in either Nov 23 or Mar 24, but obviously in use.

S13	[redacted]	CuCo	A. flexuosa	0 1 0 0 0 0 0 0 0 0	used unused		Beginning to rust, some coconut still present
S14	[redacted]	Cup	A. flexuosa	0 0 0 0 0 0 0 0 0 0	unused used		Beginning to rust, evidence of use.

S15	[redacted]		Buc	A. flexuosa	0 0 1 1 1 0 0 0 1 1	Used Used		Full of material, animal active so no pole camera photo taken.
S16a	[redacted]		Nat now DoCo	A. flexuosa	0 0 ---- -- 0 0	Unused unused unused	 this is Nat S16 check Nov 23	Degraded, then not found – replaced with DoCo S16R – some coco removed in Nov 2023.

S17	[redacted]	CuCo	A. flexuosa	0 0 0 0 0 0 0 0 0 0	unused unused		Few leaves only
S18	[redacted]	Nat	A. flexuosa	0 0 0 0 0 0 0 0 0 0	unused unused		Small amount of material

S19	[redacted]		Cup	A. flexuosa	0 0 0 0 0 0 0 0 0 0	unused unused		Exposed location

S20	[redacted]		Buc	A. flexuosa	0 0 0 0 0 0 1 0 0 1	Unused Used		Lined but no possum present in Nov 23, occupied in Mar 24. Lid constructed over bucket – see photo

S21	[redacted]	CuCo	A. flexuosa	0 0 0 1 0 0 0 0 0 1	Used used	 	Empty in Nov 23. Large WRP in Mar 24
S22a	[redacted]	DoCo	A. flexuosa	0 0 - - - - 0 0 0 0	unused unused	 Check	Nat Drey was replaced at the beginning of Year Two. Unused

S23	[redacted]	Cup	A. flexuosa	0 0 0 0 0 0 0 0 0 1	unused used			Empty in Nov 23. WRP sitting awake in open basket Mar 24
S24	[redacted]	DoCo	C. calophylla	0 0 0 0 0 0 0 0 0 0	unused unused			Coconut gone

S25	[redacted]		Nat	A. flexuosa	0 0 0 0 0 0 0 0 0 0	unused unused		Still up but no material

S26	[redacted]	Nat	Kunzea sp.	0 0 0 0 0 0 0 0 0 0	unused unused		Still up but disused
S27a	[redacted]	Nat now CuCo	Kunzea sp.	0 0 0 0 0 0 0 0 0 0	unused unused		Black Cup w. coconut S27R Feb 23
S28a	[redacted]	Nat now CuCo	Kunzea sp.	0 0 0 0 0 – - - 0 0	Used used		Black Cup w. coconut S28R

								replaced Feb 23, coco rearranged in Year Three but not occupied when checked
S29a	[redacted]		Nat now Buc	A. flexuosa	0 0 0 0 - - - - 0 1	unused used	 	Large Plastic Bucket S29R replaced Feb 23, occupied (WRP underneath) in fork in Mar 24

S30	[redacted]	CuCo	C. calophylla	0 0 1 1 0 1 0 0 1 1	Used Used Used		Coconut almost gone and sticks added. Often used during Year One. WRP occupied in both Nov 23 and Mar 24.
S31	[redacted]	Cup	C. calophylla	0 0 0 0 0 0 0 0 0 0	unused unused		No fill

S32	[redacted]		CuCo	A. flexuosa	0 0 0 0 0 0 0 1 1 0	Used Used Used		Filled with drey, in use Nov 23, empty but looks used Mar 24
S33	[redacted]		Dom	A. flexuosa	0 0 0 0 0 0 0 0 0 0	unused Used used		Has been used – drey built inside
S34	[redacted]		Buc	A. flexuosa	0 0 1 0 1 0 1 1 0 1	Used Used Used		Lined but empty. Hot afternoon so WRP may have been out of the drey to keep cool in Nov 23, WRP in drey in Mar 24.

S35	[redacted]	DoCo	A. saligna	0 0 0 0 0 0 0 0 0 0	Used used		Been used, twigs added in Mar 24
S36	[redacted]	Cup	A. flexuosa	0 0 0 0 0 0 0 0 0 0	unused unused		empty

S37a	[redacted]		Nat Now CuCo	A. flexuosa	0 0 0 0 0 0 0 0 0 0 Repl.	Unused unused		Falling down, needs replacing. Replaced Mar 24, now CuCo
S38	[redacted]		Nat	A. flexuosa	1 0 0 0 0 0 0 0 0 0	Used unused		Still up but disused. Has few twigs
S39a	[redacted]		Nat now CuCo	A. flexuosa	0 0 0 0 0 0 0 – 0 Replaced	Unused		Not found in Nov 2023, Replaced in Mar 24

								
S40	[redacted]		Cuco	A. flexuosa	0 0 0 1 0 0 0 1 1 1	Used Used Used		Some coconut and lined with Agonis, used every year, occupied in both Nov 23 and Mar 24

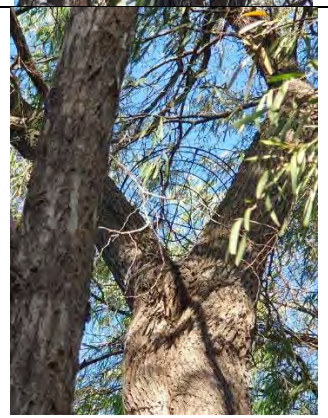
S41a	[redacted]		Nat Now Buc	A. flexuosa	0 0 0 0 1 0 0 0 replaced	Used unused NF		Not found Nov 2023, Replaced Mar 24, now Black Plastic Bucket
S42	[redacted]		Nat	A. flexuosa	0 0 0 0 0 0 0 0 0 0	unused used		Disused but still in tree Nov 23, few fresh leaves in Mar 24

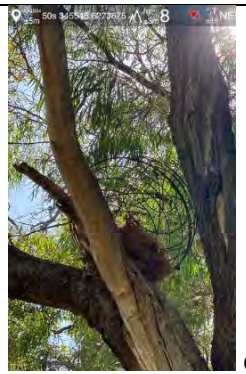
S43	[redacted]		Nat	A. flexuosa	0 0 0 0 0 0 0 0 0 0	unused unused		Large drey, still in tree, fallen over but still attached. Will need replacing soon.
S44	[redacted]		Buc	A. flexuosa	0 0 1 0 0 0 2 0 1 1	Used Used Used		Roof built over basket, twigs inside, occupied Mar 24

S45a	[redacted]		Nat now CuCo	A. flexuosa	0 0 0 0 0 0 0 0 0 0	unused used		Replaced with Cup with Coconut, now S45R, Coconut rearranged
S46a	[redacted]		Nat now Buc	A. flexuosa	0 0 0 0 0 0 0 0 Repl. 1 1	unused unused Used	 	Replaced with Large Filter Bucket, Feb 23, S46R in use Nov 23, filled with Melaleuca foliage Mar 24

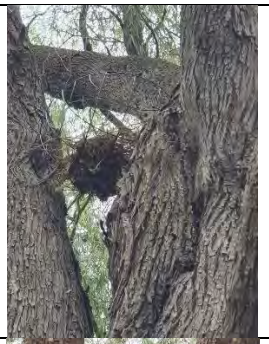
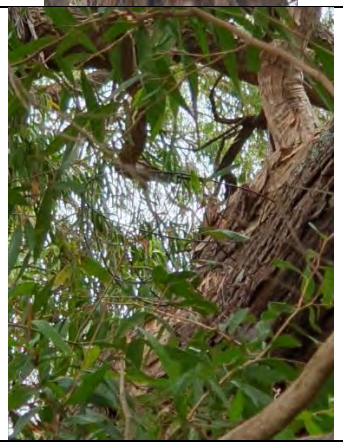
S47a	[redacted]	Nat now Buc	A. flexuosa	0 0 0 0 0 0 0 0 0 0	unused unused			Replaced with Large Filter Bucket Feb 23, now S47R. no twigs
S48	[redacted]	Cup	A. flexuosa	0 0 1 0 1 0 1 1 1 1	Used Used Used			Occupied in all four monitoring periods in Years 2 and 3.

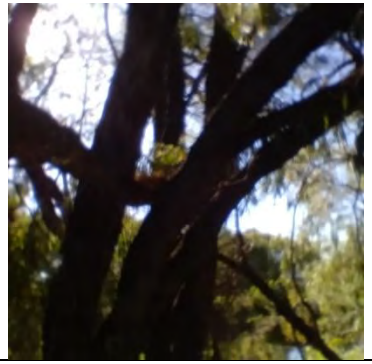
S49	[redacted]	CuCo	A. flexuosa	0 1 0 0 0 0 1 0 1 0	Used Used Used		Coconut removed and sticks added, occupied in Dec 2022 and Nov 23, very dense, lots of twigs used but empty in Mar 24
S50	[redacted]	Buc	A. flexuosa	0 0 0 1 0 0 0 0 0 0	Used used		Twigs inside, been used Mar 24

S51	[redacted]	Cup	A. flexuosa	0 0 0 0 0 0 0 0 0 0	unused unused		empty
S52	[redacted]	CuCo	A. flexuosa	0 0 0 0 0 0 0 0 0 0	unused unused		Empty
S53	[redacted]	Cup	A. flexuosa	0 0 0 0 0 0 0 0 0 0	unused unused		few leaves

S54	[redacted]		DoCo	A. flexuosa	0 0 0 0 0 0 0 0 0 0	unused unused	 check Nov	Coconut removed in Year One. No evidence of recent use, now empty
S55	[redacted]		DoCo	M. cuticularis	0 0 0 0 0 0 0 0 0 0	unused unused		No coco left. Now empty dome

S56	[redacted]		Nat	A. flexuosa	0 0 0 0 1 0 0 0 NF then 0	Used used		Large Agonis. Used in September 2021, but not found in Nov 23, Found and had lots of material in Mar 24
S57	[redacted]		CuCo	A. flexuosa	0 0 0 0 0 0 0 0 0 0	unused unused		Large Agonis, very full, old drey inserted into shelter, empty in Nov 23 and Mar 24

S58	[redacted]	Cup	A. flexuosa	0 0 0 0 0 0 0 0 0 0	Used unused			Some fresh leaves in Year One. Very few leaves in Year Two and Nov 23, empty in Mar 24.
S59a	[redacted]	Nat Now Buc	A. flexuosa	0 0 0 0 0 0 0 0 Repl. 0 0	Unused			Replaced with large plastic filter bucket 17/02/2023 Unused Nov 23 and Mar 24
S60	[redacted]	Cup	A. flexuosa	0 0 0 0 0 0 0 0 0 0	unused unused			Handful of old Agonis leaves – probably natural leaf fall

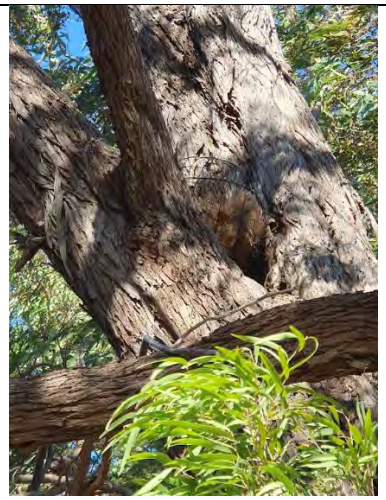
S61	[redacted]	DoCo	A. flexuosa	0 0 0 0 0 0 - - 0 0	unused unused		Coconut collapsed , v. little coco in Nov 23 or Mar 24
S62	[redacted]	DoCo	A. flexuosa	0 0 0 0 0 0 - - 0 0	unused used		Empty but scat below in Mar 24

S63	[redacted]		Hol	E. patens	0 0 0 1 0 0 - - 1 0	Used used	  Mar 24	Approx. 8m high, relocated from E. rudis in Links Ct. Occupied in August 2021, not in Year Two monitoring Then occ. In Nov 23 – log has shifted. Rope needs checking.
S64	[redacted]		Hol	E. patens	0 0 0 0 0 0 0 0 0 0	unused unused		relocated from E.

							 	rudis in Links Ct

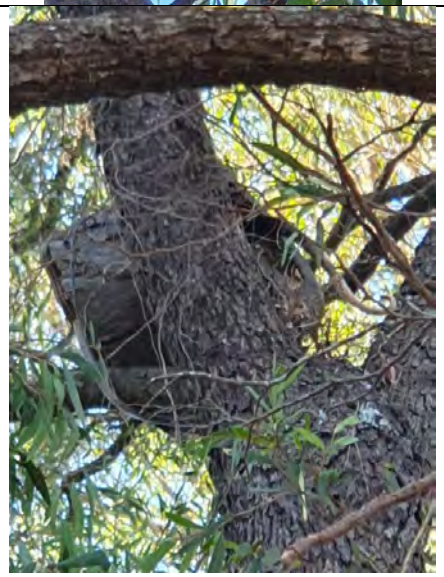
S65	[redacted]		DoCo	A. flexuosa	0 0 0 0 0 0 0 0 0 0	unused unused		V little coco remained in Nov 23, almost empty in Mar 24
S66	[redacted]		Hol	C. calophylla	0 0 0 0 0 0 1(B) 0 1 1	unused Used Used		Brushtail in Dec 2022, WRP in Nov 23 and Mar 24. Tail clearly visible in photo.

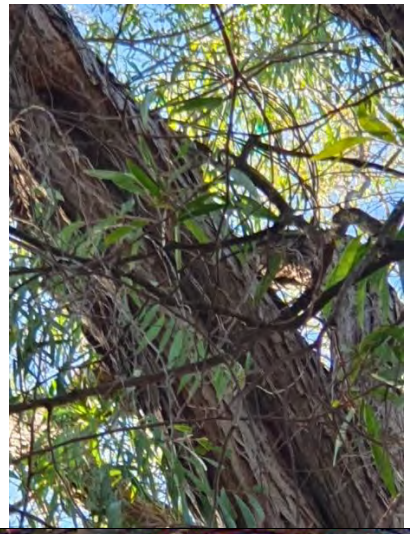
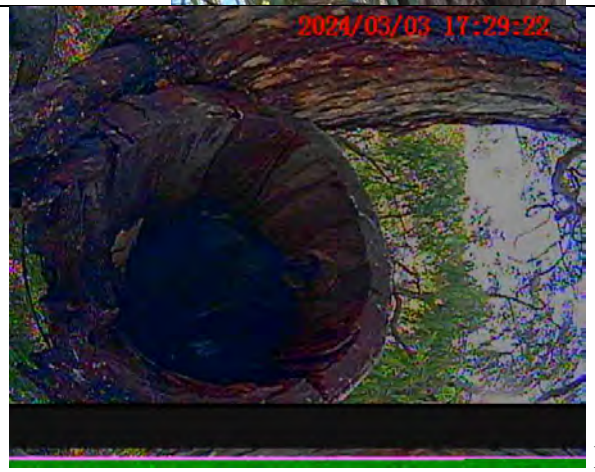
S67	[redacted]		Cup	E. marginata	0 0 0 0 0 0 0 0 0 0	unused unused		empty
S68	[redacted]		DoCo	A. flexuosa	0 0 0 0 0 0 0 0 0 0	Used unused		coconut taken and placed further up tree, some blown down, empty in Nov 23 and Mar 24

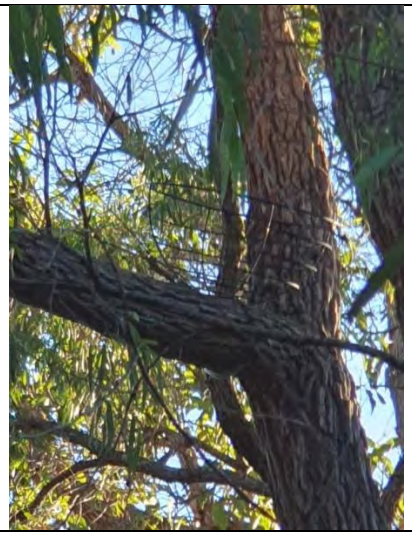
S69	[redacted]	DoCo	A. flexuosa	0 0 0 1 0 0 0 0 0 0	Used Used		natural drey inserted into artificial drey, Coconut collapsed in Jan 21, but occupied in August 21. Not occupied in Year Two or Three but looks used
S70	[redacted]	Hol	A. flexuosa	1 1 0 0 0 0 0 0 1 0	Used used	 Nov 23	Possum in base of log in Jan and Mar 21 and Nov 23, empty but used in Mar 24
S71	[redacted]	CuCo	A. flexuosa	0 0 1 1 0 1 0 0 1 1	Used used		coconut rearranged, removed

							 Nov 23  Mar 24	from base, occupied in April / May, August and Jan 2022, Nov 23 and Mar 24

S72a	[redacted]	Nat Now Buc		0 – 0 -0 0 - - - 0 0			Replaced with Large Filter Bucket, now 72R in Feb 23 – empty in Year three.
S73	[redacted]	Hol	A. flexuosa	0 0 0 0 0 1 0 0 1 1	Used unused used		. Occupied in Jan 2022 and Nov 23 – tail hanging out Mar 24, tail hanging out

S74	[redacted]	DoCo	E. rudis	0 0 0 0 0 0 1 1 1 1	Used Used Used		used in both sampling periods in Year 2 – occupied in Nov 23, but drey is damaged Patchy coco.
S75	[redacted]	Hol	A. flexuosa	0 0 0 0 0 1 0 0 0 1	Used used		Slightly green leaves in bottom, probably used in Jan 2021, occupied in Jan 2022, no WRP in Nov 23 but old BW nest in the hollow, WRP in Mar 24

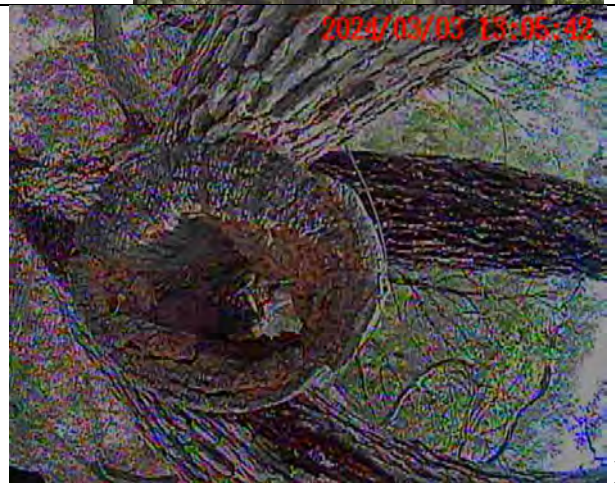
S76	[redacted]	DoCo	A. flexuosa	1 0 0 0 0 0 0 0 0 0	Used		coconut rearranged – visible from the outside, possum inside. Not recorded as occupied since Jan 21 No coconut left
S77	[redacted]	Hol	C. calophylla	1 2 1 0 0 1 1 1 0 1	Used Used Used	 Mar 24	Possum regularly recorded. The only short hollow which has recorded a mother and joey inside (Mar 21), Dead Bronzewing chick below, no WRP Nov 23, WRP Mar 24

								
S78	[redacted]		CuCo	C. calophylla	0 0 0 0 0 0 0 0 0 0	unused unused		very exposed location unused on all occasions

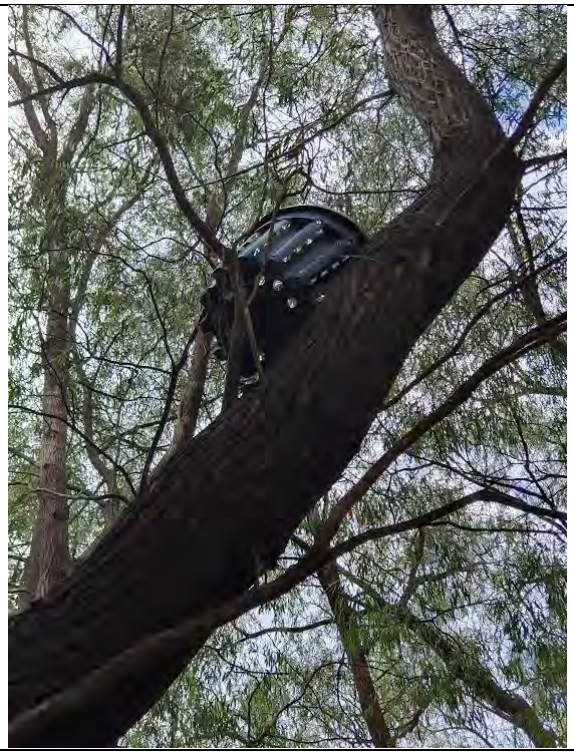
S79	[redacted]		Hol	E. rudis	1 0 1 0 0 0 1 1 1 1	Used Used Used	 Mar 24 	Possum recorded on both monitoring sessions in Year 2 and Year 3 Cap coming off – needs repair Image shows juvenile recorded in Mar 24

S80	[redacted]		DoCo	A. flexuosa	1 1 1 1 1 0 0 0 00	Used unused				In Year One had paperbark and coco lining. No lining left Nov 23 Empty Mar 24

S81	[redacted]		Hol	A. flexuosa	0 0 0 0 0 1 0 1 0 1	Used used	 Mar 24 	Empty Nov 23, WRP Mar 24, female grooming pouch

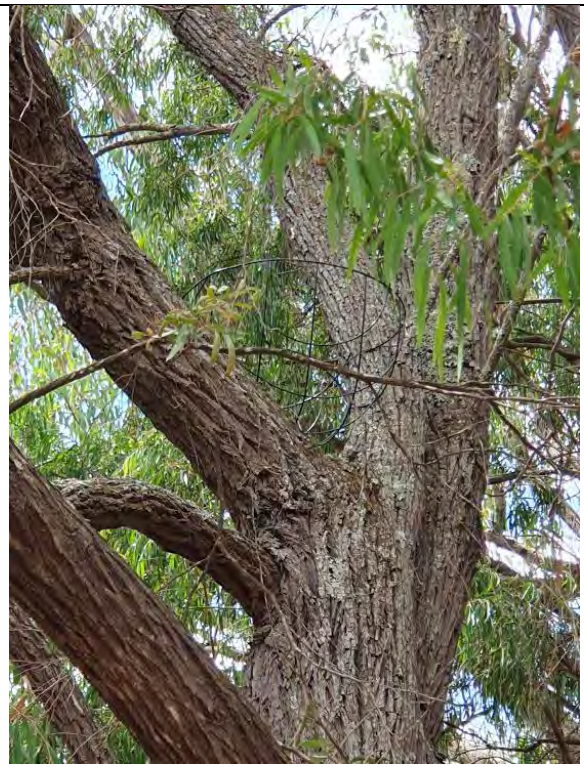
S82	[redacted]		Nat	A. flexuosa	0 0 0 0 0 0 0 0 -0	unused unused		Dry, collapsed, needs replacing in Year Two, not found in Nov 23, found in Mar 24 but disused
S83	[redacted]		Hol	C. calophylla	0 1 1 0 0 1 1 0 1 0	Used Used Used	 Mar 24	Occupied in all years Mar 24, hole in the back – needs repair

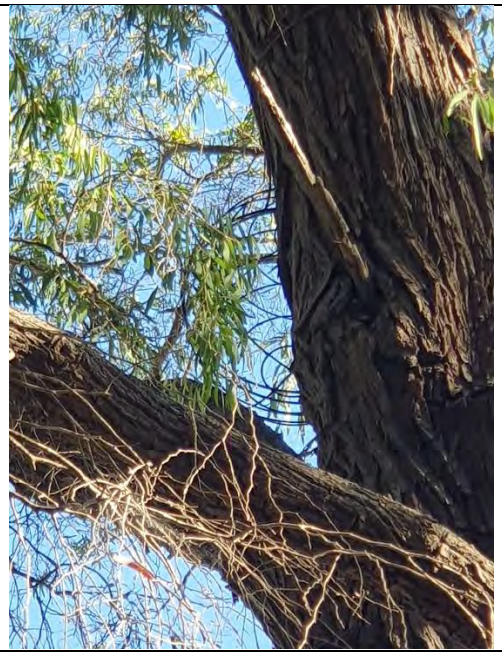
								
S84a	[redacted]		Nat now Buc		0 0 - - - - - - Repl. 0 0	unused unused		Replaced with Large Black Bucket S84R in Feb 23 unused in Year Three

S85	[redacted]		DoCo	E. marginata	0 0 0 0 0 0 0 0 0 0	unused unused		empty

S86	[redacted]		DoCo	C. calophylla	0 0 0 0 0 0 0 0 0 0	unused unused				No Coconut unused

S87	[redacted]		Cup	A. flexuosa	0 0 0 0 0 0 0 0 0 0	unused unused		Empty and not used.

S88	[redacted]		Cup	A. flexuosa	- - 0 0 0 0 0 0 0 0	Used unused			empty

Australian Government
Department of Agriculture, Water and the Environment

Ref: 2017/7932

Mr Sean Nicholson
Senior Environment Advisor
Assets Planning and Delivery
Water Corporation
Locked Mail Bag 2
Osborne Park Delivery Centre
OSBORNE PARK WA 6916

RE: EPBC 2017/7932 - Request to change compliance reporting

Dear Mr Nicholson

Thank you for your correspondence to the Department requesting changes to the compliance reporting for EPBC 2017/7932.

Officers of this Department have reviewed these requests and briefed me. As delegate of the Minister, I agree for the EPBC 2017/7932 compliance reporting dates to be aligned with the state clearing permit. Please note that in accordance with the relevant Annual compliance reporting condition, the Department must be notified by email that a compliance report has been published on the website and provide the weblink for the compliance report within five business days of the date of publication.

As you are aware, the Department has an active monitoring program which includes monitoring inspections, desk top document reviews and audits. Please ensure that you maintain accurate records of all activities associated with, or relevant to, the conditions of approval so that they can be made available to the Department on request.

Should you require any further information please contact Bayley Costin, Project Officer, Post Approvals Section, on 02 6274 1118 or by email: post.approval@awe.gov.au.

Yours sincerely

Kim Farrant
Assistant Secretary
Environment Assessments (Vic, Tas) and Post Approvals Branch
Environment Approvals Division

8 April 2022

Appendix E
Revegetation and rehabilitation

tranen revegetation southwest







Vasse Diversion Drain Upgrade Revegetation – Water Corporation

Post Activity Report #17: December 2022 to February 2023

Activity Date(s):	01/12/22 – 28/02/23	**Conducted By:**	Alex Johnston
Site Reference:	VDD Upgrade Revegetation	**Reviewed By:**	Matt Blunt
Area (ha):	14.5ha		

Action Taken

Date(s):	Activity	Description
06/12/22	Sign installation	Revegetation signs installed at strategic locations across revegetation sites.
05/01/23 & 16/01/23	Brushwall installation	Installation of matting and brushwall section on VDD Embankment.
17/01/23 – 18/01/23	Levee weed control	Slashing of all external levee embankments
25/01/23	Monitoring and reporting	Spring 2022 monitoring report submitted 25/01/23
06/12/22 03/01/23 – 11/01/23 01/02/23 – 02/02/23 24/02/23 – 28/02/23	Weed control (10 days – 189 hours	On-going management of weeds using various methods (manual, mechanical, herbicide) across all active revegetation areas. Additional woody weed control in Possum Corridor and Southern PEC.
18/01/23 – 20/01/23 27/02/23 – 28/02/23 (16/12/22 – 25/02/23)	Watering (2x site-wide events) & 6x QE Ave swale	Watering of mature trees (CPEC) and active revegetation zones. Additional fortnightly watering QE Ave swale (tanker).
09/12/22 19/01/23	Possum Infrastructure maintenance	Infrastructure assessment with arborist and adjustments to rope bridges (College Ave).

Recent site photos available on the C-D00116 Revegetation Work Sharefile

Previous Action Taken

Date(s):	Activity	Description
26/10/20 – 05/11/20	Vegetation salvage	Selective removal, transport and initial propagation of native species within clearing area. Performed in collaboration with Aboriginal businesses and GCLN.
26/10/20 – 02/11/20	Pathway construction and hardstand removal	Installation of 150m x 2m crushed limestone pathway through Quindalup Dune Zone. Removal and stockpiling of gravel material from former Water Corp Depot for later removal and replacement with appropriate topsoil.
14/10/20 – 15/10/20	Baseline monitoring	Performed baseline monitoring of all revegetation zones. 34 quadrats and 34 photo monitoring points + bushland condition monitoring.
01/10/20 – 20/11/20	Plant and embankment material procurement	Procurement and delivery of all embankment materials for future works. Confirmation of tubestock and mature tree orders for 1st year planting in 2021.
24/11/20 – 08/12/20	Brushlog fabrication	Construction of 300 Brushlog units. Pre-fabrication prior to install for safe and efficient transport and installation.
24/11/20 – 24/12/20	Weed control	Selective herbicide application, hand weeding and slashing. Focus on areas planned for revegetation in 2021.
24/11/20 – 21/12/20	Embankment regrading	Mechanical and manual regrading of embankments, exotic tree stump removal and various green waste removal.
26/11/20 – 23/12/20	Matting	Installed over 800m² of coir mesh across the western VDD Embankment zone.
02/12/20 – 23/12/20	Brushwall installation	50m Initial section of brushwall installed on western bank + 20m of embankment palisade.
04/01/21 – 21/01/21	Weed control	Manual, mechanical and chemical weed control along VDD embankments.
11/01/21 – 15/01/21	Brushwalling	Installation of 110lm of brushwall along western bank + 65lm of mid-slope brush palisade. Total brushwall is now 160lm + 85lm of brush palisade.
13/01/21 – 15/01/21	Matting	Installation of 1,200m² of coir mesh matting. Total matting area is now approx. 2,000m²
13/01/21 – 19/01/21	Weed control	Selective and targeted follow-up herbicide spraying across a number of revegetation areas.
19/01/21 – 18/02/21	Local provenance material collections	Establishment of project seed bank and selective collections of provenance seed from nearby reserves. 12 man-days completed in total. Partial processing of collected seed and seed bank storage as required. See attached status report.
22/01/21 – 22/02/21	Weed control	Follow-up herbicide application to areas to be revegetated in 2021.
22/01/21 – 08/02/21	Embankment regrading and matting	Continuation of bank preparation and matting on western embankment (200m²) and majority of eastern embankment (800m²). Total matting and embankment preparation areas is now approx. 3,000m²
22/01/21 – 22/02/21	Baseline monitoring report	Preparation and submission of baseline monitoring report. This report provides further definition of completion criteria and an overview of site conditions prior to commencement of on-ground works.

08/01/21 – 11/02/21	Relocation and respreading topsoil	Relocation of soil stockpiles in the Quindalup Dune zone to allow for ACM removal. Respreading soil following confirmation of ACM removal.
04/02/21 – 22/02/21	Mulch procurement and site preparation planning	Confirm mulch order and deposit for material. Planning for distribution and logistics of mulch cartage and stockpiling. Coordination and confirmation of machinery for spreading.
09/02/21 – 12/02/21	Aboriginal engagement – Roelands Village	Contribution to four days of machinery operation training for Roelands Village civil construction trainees. The works were undertaken to assist the Geographe Community Landcare Nursery increase nursery capacity to accommodate additional requirements for the project.
11/02/21 – 18/02/21	Greenwaste and woody weeds	Clearing and removal of Greenwaste (weed and dead material). 30m³ of weed material disposed of at waste facility and over 100m³ stockpiled on site for future removal and respreading of larger logs for habitat.
17/02/21	Aboriginal engagement – Undalup Association	On-country meeting and consultation with Cultural Custodians to discuss the project scope for the development of cultural / biodiversity nodes within the site. Confirmation to commence works 12/02/21.
23/02/21 – 23/03/21	Weed control	Weed control across various revegetation zones. Re-treating WPEC, CPEC, EPEC & QD zones. Herbicide spraying, manual and woody weeds
03/03/21 – 09/03/21	Palisade construction	Construction and completion of 3x palisade areas along the western embankment.
12/03/21 – 19/03/21	Aboriginal engagement	Two days of Undalup's indigenous ranger team (x3) performing site preparation tasks (weed control, rubbish removal and fuel load reduction) in the Southern PEC zone. Additional reporting to be provided in the next period.
17/03/21 – 22/03/21	Mulch installation	675m³ of mulch supplied and spread (mechanical and manual) across 9,000m² of the eastern PEC zone.
24/03/21 – 25/05/21	Weed control	On-going follow-up weed control across various revegetation zones. Re-treating WPEC, CPEC, EPEC & QD zones. Herbicide spraying, manual and woody weeds
24/03/21 – 07/05/21	Aboriginal engagement – Wadandi Rangers	On-going support for site works from Undalup Association's Wadandi rangers both on site and at GCLN. Please see attached progress reports from Undalup.
19/04/21 – 23/04/21	Ripping	Soil ripping via tractor mounted tine across Central PEC and Quindalup Dune revegetation zones. Approx. 1.5 ha covered.
13/05/21 – 21/05/21	Mulch installation	315m³ of mulch supplied and spread (mechanical and manual) across 6,000m² of the Quindalup Dune zone.
24/03/21 – 25/05/21	Procurement	Purchase and delivery of corflute tree guards, stakes and root barrier.
27/05/21	Procurement: Tree stake supply	Supply of all hardwood stakes (1800x50x50mm) for mature trees.
04/06/21 & 17/06/21	Weed control	On-going weed control focussing on the QD and VDD Embankment areas prior to planting
22/06/21 – 24/06/21	Procurement: Seedling supply	Supply of all seedlings (exc. lower embankment) for the Quindalup Dune and VDD Embankment zones. Total number of seedlings: 23,610

01/07/21	Matting	Completion of matting along the final section (700m²) of the VDD Embankment near the pedestrian bridge.
05/07/21 - 19/07/21	Planting	21,543 seedlings installed in the QD and VDD Embankment zones. Lower Embankment to be planted in spring. Refer to table attached for details.
08/07/21	Ripping	0.5ha of the Western PEC zone (Corner of College Ave / QE Ave) was ripped prior to mulch spreading.
12/07/21 - 16/07/21	Mulching	Mechanical spreading of mulch across the Central and Western PEC zones. Total of 7,000m² spread. Further manual spreading / trimming to be completed.
12/07/21	Tree removal and greenwaste removal	Removal of unstable tree at the Donovan property and removal of greenwaste from the Western PEC zone.
21/07/21 - 22/07/21	Plant deliveries and batching	Delivery and batching of remaining seedlings for 2021. See attached table for details
22/07/21 - 23/07/21	Fencing	QD and Embankment zone post & rail and public management fencing completed.
25/06/21 - 22/07/21	Weed control	Various follow-up herbicide weed control undertaken where possible, including: QD, VDD Embankments, Western PEC, Central PEC, Eastern PEC and Western Basin PEC.
25/06/21 - 22/07/21	Aboriginal engagement - Undalup Association	Undalup Wadandi Rangers assisting Geographe Community Landcare Nursery preparing stock for the project and assisting with capacity upgrades.
27/07/21	Slashing VDD Levees (separate PO)	Manual slashing (brushcutter) of VDD levee external banks adjacent to revegetation areas. Performed under separate work order.
27/07/21 - 28/07/21	Mulch spreading (manual)	Final manual trim of mulched areas in Central PEC and Western PEC planting areas. Additional assistance provided by Undalup Association.
30/07/21 - 13/08/21	Aboriginal engagement	Assistance with manual spreading of mulch at Western PEC. 2 days (30/08 & 13/08).
03/08/21 - 18/08/21	Weed control	Targeted spot spraying within 2021 planting sites over 4 days. Additional retreatment of 2022 planting sites (EPEC, Possum Corridor) blanket spraying.
05/08/21 - 20/08/21	C. procera monitoring	Commenced monitoring growth and health of known & reference populations of C. procera adjacent to construction boundary.
09/08/21 - 10/08/21	WPEC fencing	324m of fencing installed around Western PEC Restoration Zone. Inc. 1.2m ringlock + 900mm rabbit mesh skirt. 2m clearance from base of levee.
13/08/21	Mulch spreading	Transport and spreading of mulch from WPEC to QD Zone eastern bank.
13/08/21 - 19/08/21	Mature trees install	Install 214 mature trees along pathway in CPEC. Included root barrier, soil conditioner, Terracottem, mulching, stakes and ties.
23/08/21	CPEC planting	Commencement of planting along CPEC inc. tree guards and fertiliser tablets. Final planting list included below.
24/08/21 - 21/09/21	Weed control	Follow-up herbicide application to areas to be revegetated in 2021.

25/08/21 - 10/09/21	Planting and guard install	Install remaining plants and guards in CPEC and Western PEC Restoration Zone. Total of 14,617 plants and 11,261 guards installed.
30/08/21 - 13/09/21	Planting and guard install (Undalup Association)	Installation of plants and guards in WPEC Open zone. Total of 3,149 plants and 2,539 guards installed.
13/09/21 - 21/09/21	Planting and guard install (Undalup Association)	Installation of plants and guards in CPEC swale zone. Total of 6,000 plants installed in swale.
23/09/21	Tree install	Plant remaining mature tree in QD Zone and install signage.
(05/08/21) - 13/10/21	C. procera monitoring	Weekly inspections and recording of *Caladenia procera* population within the SPEC. Inspections conducted from August to October.
1/10/21	Weed control; tree guard maintenance	Manual and herbicide weed control. Removal and reinstatement of damaged tree guards. Central PEC
04/10/21	Weed control	Manual and herbicide weed control. QD & Western PEC.
14/10/21	Weed control	Manual and herbicide weed control. QD
20/10/21 - 21/10/21	Levee slashing	1/12 slashing of levee external embankments adjacent to revegetation sites.
21/10/21	Weed control	Manual and herbicide weed control. Western PEC
25/10/21 - 26/10/21	Planting	Completed planting of lower VDD Embankments (3,500 plants total).
10/11/21 - 11/11/21	Weed control	Manual and herbicide weed control. QD, WPEC & CPEC
10/11/21 & 15/11/21	Palisade construction	4/4 palisade area construction in Quindalup Dune.
16/11/21 - 17/11/21	Monitoring	Quadrat set-up and monitoring of all revegetation areas
20/11/21 - 30/11/21	Plant orders	Developing and ordering the tubestock planting list for 2022. 30% deposit required upfront to secure orders.
06/12/21 - 14/12/21	Weed control	Manual and herbicide weed control. QD, WPEC, CPEC and Eastern PEC.
06/12/21	Watering	Watering of all mature tree in CPEC. Total of 4000L
21/12/21; 4/01/22; 17/1/22	Watering (3x events)	Watering of mature trees (CPEC), WPEC and QD zones fortnightly. Total 12,000L used. Watering of BayOK included 17/01
22/12/21 - 18/01/22	Weed control (3x events)	Weed control (covering Spr-21 treatment) was utilised across all 2021 and 2022 revegetation sites. Manual, chemical and mechanical control.
07/01/22 & 19/01/22	Mulch deliveries and site preparation	Additional site preparation in EPEC and delivery of 210m³ of mulch delivered to site.
17/12/21 - 24/12/21	Plant procurement	Completion of plant procurement for 2022 including Stage 3 plants. 45,785 total plants
04/01/22 - 20/01/22	Monitoring / reporting	Processing and analysis of monitoring data and drafting of report.
18/10/21 – 22/10/21	Levee selective herbicide spraying	Selective spraying of broadleaf weeds on levees adjacent to reveg sites.
20/10/21 & 29/10/21; 02/11/21; 02/02/22; 08/02/22	Levee slashing (5x events (partially included in previous reports)	Spring 2021 and summer 2022 slashing. Brushcutting all external levee embankments adjacent to reveg areas.

25/01/22; 31/01/22; 04/02/22; 09/02/22; 17/02/22; 19/02/22	Weed control (6x events	Weed control (Summer-22 treatment) across all 2021 and 2022 revegetation sites. Manual, chemical and mechanical control.
03/02/22; 15/02/22 – 16/02/22	Watering	2x watering events over Feb-22. CPEC, WPEC and QD seedlings and mature trees
01/02/22 – 02/02/22	Mulch deliveries	Remaining mulch delivered to EPEC zone.
21/02/22 – 24/02/22	Mulch spreading	Machine spreading of mulch in EPEC.
03/03/22 – 13/03/22	Watering	Watering of mature trees (CPEC), WPEC and QD zones fortnightly. Total 6,000L used per event.
21/03/22 – 28/04/22	Weed control	Weed control (Remaining summer-22 treatment) across all 2021 and 2022 revegetation sites. Manual, chemical and mechanical control. Additional woody weed control CPEC and SPEC.
28/04/22 – 06/05/22	Tree Guard Maintenance	Tree guard maintenance and removal along CPEC. Approx. 3,500 guards removed.
20/04/22 – 18/05/22	Matting	Installation of 1,500m² of coir mesh installed along QE Ave Swale.
20/05/22 – 23/05/22	Seedling deliveries	Delivery of seedlings for 2022 planting works. Estimated final numbers at 45,785
01/05/22 – 23/05/22	Monitoring	Autumn-22 field vegetation monitoring.
02/06/22 – 29/06/22	Weed control	4x weed control events across QD, QE Ave swale, Central PEC & Eastern PEC. Inc. herbicide spraying and manual removal.
07/06/22 – 13/07/22	Planting and tree guard installation	Installation of seedlings to QD (infill), QE Ave Swale, Central PEC (infill) & Eastern PEC. Totals provided in attachment. Planting included augering/ripping & fertiliser tablet supply & install. Approx. 6k tree guards installed in selected areas
10/06/22 – 15/06/22	Tree guard maintenance	Removal of selected guards across Central PEC. Approx. 5,000 guards removed.
09/06/22 – 30/06/22	Fencing	Installation of 1,685lm of herbivore protection fencing across Eastern PEC.
01/06/22 – 01/07/22	Monitoring Reporting	Data input and draft report preparation (to be submitted).
20/07/22 11/08/22 – 15/08/22 01/09/22 – 14/09/22 27/09/22 – 30/09/22 18/10/22 – 19/10/22 24/10/22 – 26/10/22 08/11/22 14/11/22 28/11/22	Weed Control (16 days – 376hrs)	On-going management of weeds using various methods (manual, mechanical, herbicide) across all active revegetation areas: QD, WPEC, CPEC, EPEC, Possum Corridor). Very high seasonal weed abundance due to cooler conditions resulted in a protracted growing season for winter / spring weeds.
05/08/22 09/08/22 16/09/22 14/10/22 03/11/22 07/11/22	Tree Guard Removal	All guards progressively removed from CPEC and WPEC. Decision was made to remove all remaining guards in these areas due to vandalism and public concerns from plastic waste.

01/08/22 – 02/08/22 12/09/22 – 13/09/22	Levee weed management (selective herbicide spraying)	Broadleaf selective boom spraying of all external levee banks adjacent to revegetation sites.
05/10/22 – 12/10/22 27/10/22 14/11/22 – 15/11/22	Levee Weed Management (slashing)	Mechanical slashing of external levee banks adjacent to revegetation sites.
18/10/22 – 21/10/22	2023 Seedling orders	Developed planting plan and confirmed seedling orders for 2023.
02/11/22 – 04/11/22	Spring 2022 Monitoring	Field monitoring of all revegetation sites. Data analysis and report to be completed.

tranen revegetation southwest







Vasse Diversion Drain Upgrade Revegetation – Water Corporation

Post Activity Report #18: March – May 2023

Activity Date(s):	01/03/23 – 22/05/23	**Conducted By:**	Alex Johnston
Site Reference:	VDD Upgrade Revegetation	**Reviewed By:**	Matt Blunt
Area (ha):	14.5ha		

Action Taken

Date(s):	Activity	Description
01/03/23 – 08/03/23 23/03/23 – 03/04/23 14/04/23 28/04/23 – 02/05/23	Weed control (8 days; 180 hrs)	On-going management of weeds using various methods (manual, mechanical, herbicide) across all active revegetation areas: QD, WPEC, CPEC, EPEC, Possum Corridor).
13/03/23	Tree guard removal	All remaining guards in EPEC removed.
27/04/23 – 28/04/23	Slashing Levees	Slashing levees in areas adjacent to reveg sites
01/03/23 – 01/04/23	Watering (3x sitewide events + QE Ave additional)	Watering of mature trees (CPEC) and active revegetation zones. Additional weekly watering QE Ave swale (tanker).
11/05/23 – 12/05/23	Mulch installation (QD/QE Ave & Donovan Property)	Supply and spread of 110m³ of mulch across additional area between QE Ave swale & Donovan's property.
17/04/23 – 21/04/23	Fencing	Installed 1640 linear metres of fencing, including service location / pot-holing, significant hand digging, gates and corner strainers due to site restrictions / limitations. No rabbit skirt was included due to no feasible means to fully encapsulate area. Additional budget in Stg2 utilised to supplement separate PO for SPEC Fencing and Access works.
19/05/23	Seedling supply	Remaining value for supply of seedlings for 2023 installation.

Recent site photos available on the C-D00116 Revegetation Work Sharefile

Previous Action Taken

Date(s):	Activity	Description
26/10/20 – 05/11/20	Vegetation salvage	Selective removal, transport and initial propagation of native species within clearing area. Performed in collaboration with Aboriginal businesses and GCLN.
26/10/20 – 02/11/20	Pathway construction and hardstand removal	Installation of 150m x 2m crushed limestone pathway through Quindalup Dune Zone. Removal and stockpiling of gravel material from former Water Corp Depot for later removal and replacement with appropriate topsoil.
14/10/20 – 15/10/20	Baseline monitoring	Performed baseline monitoring of all revegetation zones. 34 quadrats and 34 photo monitoring points + bushland condition monitoring.
01/10/20 – 20/11/20	Plant and embankment material procurement	Procurement and delivery of all embankment materials for future works. Confirmation of tubestock and mature tree orders for 1st year planting in 2021.
24/11/20 – 08/12/20	Brushlog fabrication	Construction of 300 Brushlog units. Pre-fabrication prior to install for safe and efficient transport and installation.
24/11/20 – 24/12/20	Weed control	Selective herbicide application, hand weeding and slashing. Focus on areas planned for revegetation in 2021.
24/11/20 – 21/12/20	Embankment regrading	Mechanical and manual regrading of embankments, exotic tree stump removal and various green waste removal.
26/11/20 – 23/12/20	Matting	Installed over 800m² of coir mesh across the western VDD Embankment zone.
02/12/20 – 23/12/20	Brushwall installation	50m Initial section of brushwall installed on western bank + 20m of embankment palisade.
04/01/21 – 21/01/21	Weed control	Manual, mechanical and chemical weed control along VDD embankments.
11/01/21 – 15/01/21	Brushwalling	Installation of 110lm of brushwall along western bank + 65lm of mid-slope brush palisade. Total brushwall is now 160lm + 85lm of brush palisade.
13/01/21 – 15/01/21	Matting	Installation of 1,200m² of coir mesh matting. Total matting area is now approx. 2,000m²
13/01/21 – 19/01/21	Weed control	Selective and targeted follow-up herbicide spraying across a number of revegetation areas.
19/01/21 – 18/02/21	Local provenance material collections	Establishment of project seed bank and selective collections of provenance seed from nearby reserves. 12 man-days completed in total. Partial processing of collected seed and seed bank storage as required. See attached status report.
22/01/21 – 22/02/21	Weed control	Follow-up herbicide application to areas to be revegetated in 2021.
22/01/21 – 08/02/21	Embankment regrading and matting	Continuation of bank preparation and matting on western embankment (200m²) and majority of eastern embankment (800m²). Total matting and embankment preparation areas is now approx. 3,000m²
22/01/21 – 22/02/21	Baseline monitoring report	Preparation and submission of baseline monitoring report. This report provides further definition of completion criteria and an overview of site conditions prior to commencement of on-ground works.

08/01/21 – 11/02/21	Relocation and respreading topsoil	Relocation of soil stockpiles in the Quindalup Dune zone to allow for ACM removal. Respreading soil following confirmation of ACM removal.
04/02/21 – 22/02/21	Mulch procurement and site preparation planning	Confirm mulch order and deposit for material. Planning for distribution and logistics of mulch cartage and stockpiling. Coordination and confirmation of machinery for spreading.
09/02/21 – 12/02/21	Aboriginal engagement – Roelands Village	Contribution to four days of machinery operation training for Roelands Village civil construction trainees. The works were undertaken to assist the Geographe Community Landcare Nursery increase nursery capacity to accommodate additional requirements for the project.
11/02/21 – 18/02/21	Greenwaste and woody weeds	Clearing and removal of Greenwaste (weed and dead material). 30m³ of weed material disposed of at waste facility and over 100m³ stockpiled on site for future removal and respreading of larger logs for habitat.
17/02/21	Aboriginal engagement – Undalup Association	On-country meeting and consultation with Cultural Custodians to discuss the project scope for the development of cultural / biodiversity nodes within the site. Confirmation to commence works 12/02/21.
23/02/21 – 23/03/21	Weed control	Weed control across various revegetation zones. Re-treating WPEC, CPEC, EPEC & QD zones. Herbicide spraying, manual and woody weeds
03/03/21 – 09/03/21	Palisade construction	Construction and completion of 3x palisade areas along the western embankment.
12/03/21 – 19/03/21	Aboriginal engagement	Two days of Undalup's indigenous ranger team (x3) performing site preparation tasks (weed control, rubbish removal and fuel load reduction) in the Southern PEC zone. Additional reporting to be provided in the next period.
17/03/21 – 22/03/21	Mulch installation	675m³ of mulch supplied and spread (mechanical and manual) across 9,000m² of the eastern PEC zone.
24/03/21 – 25/05/21	Weed control	On-going follow-up weed control across various revegetation zones. Re-treating WPEC, CPEC, EPEC & QD zones. Herbicide spraying, manual and woody weeds
24/03/21 – 07/05/21	Aboriginal engagement – Wadandi Rangers	On-going support for site works from Undalup Association's Wadandi rangers both on site and at GCLN. Please see attached progress reports from Undalup.
19/04/21 – 23/04/21	Ripping	Soil ripping via tractor mounted tine across Central PEC and Quindalup Dune revegetation zones. Approx. 1.5 ha covered.
13/05/21 – 21/05/21	Mulch installation	315m³ of mulch supplied and spread (mechanical and manual) across 6,000m² of the Quindalup Dune zone.
24/03/21 – 25/05/21	Procurement	Purchase and delivery of corflute tree guards, stakes and root barrier.
27/05/21	Procurement: Tree stake supply	Supply of all hardwood stakes (1800x50x50mm) for mature trees.
04/06/21 & 17/06/21	Weed control	On-going weed control focussing on the QD and VDD Embankment areas prior to planting
22/06/21 – 24/06/21	Procurement: Seedling supply	Supply of all seedlings (exc. lower embankment) for the Quindalup Dune and VDD Embankment zones. Total number of seedlings: 23,610

01/07/21	Matting	Completion of matting along the final section (700m²) of the VDD Embankment near the pedestrian bridge.
05/07/21 - 19/07/21	Planting	21,543 seedlings installed in the QD and VDD Embankment zones. Lower Embankment to be planted in spring. Refer to table attached for details.
08/07/21	Ripping	0.5ha of the Western PEC zone (Corner of College Ave / QE Ave) was ripped prior to mulch spreading.
12/07/21 - 16/07/21	Mulching	Mechanical spreading of mulch across the Central and Western PEC zones. Total of 7,000m² spread. Further manual spreading / trimming to be completed.
12/07/21	Tree removal and greenwaste removal	Removal of unstable tree at the Donovan property and removal of greenwaste from the Western PEC zone.
21/07/21 - 22/07/21	Plant deliveries and batching	Delivery and batching of remaining seedlings for 2021. See attached table for details
22/07/21 - 23/07/21	Fencing	QD and Embankment zone post & rail and public management fencing completed.
25/06/21 - 22/07/21	Weed control	Various follow-up herbicide weed control undertaken where possible, including: QD, VDD Embankments, Western PEC, Central PEC, Eastern PEC and Western Basin PEC.
25/06/21 - 22/07/21	Aboriginal engagement - Undalup Association	Undalup Wadandi Rangers assisting Geographe Community Landcare Nursery preparing stock for the project and assisting with capacity upgrades.
27/07/21	Slashing VDD Levees (separate PO)	Manual slashing (brushcutter) of VDD levee external banks adjacent to revegetation areas. Performed under separate work order.
27/07/21 - 28/07/21	Mulch spreading (manual)	Final manual trim of mulched areas in Central PEC and Western PEC planting areas. Additional assistance provided by Undalup Association.
30/07/21 - 13/08/21	Aboriginal engagement	Assistance with manual spreading of mulch at Western PEC. 2 days (30/08 & 13/08).
03/08/21 - 18/08/21	Weed control	Targeted spot spraying within 2021 planting sites over 4 days. Additional retreatment of 2022 planting sites (EPEC, Possum Corridor) blanket spraying.
05/08/21 - 20/08/21	C. procera monitoring	Commenced monitoring growth and health of known & reference populations of C. procera adjacent to construction boundary.
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13/08/21 - 19/08/21	Mature trees install	Install 214 mature trees along pathway in CPEC. Included root barrier, soil conditioner, Terracottem, mulching, stakes and ties.
23/08/21	CPEC planting	Commencement of planting along CPEC inc. tree guards and fertiliser tablets. Final planting list included below.
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13/09/21 - 21/09/21	Planting and guard install (Undalup Association)	Installation of plants and guards in CPEC swale zone. Total of 6,000 plants installed in swale.
23/09/21	Tree install	Plant remaining mature tree in QD Zone and install signage.
(05/08/21) - 13/10/21	C. procera monitoring	Weekly inspections and recording of *Caladenia procera* population within the SPEC. Inspections conducted from August to October.
1/10/21	Weed control; tree guard maintenance	Manual and herbicide weed control. Removal and reinstatement of damaged tree guards. Central PEC
04/10/21	Weed control	Manual and herbicide weed control. QD & Western PEC.
14/10/21	Weed control	Manual and herbicide weed control. QD
20/10/21 - 21/10/21	Levee slashing	1/12 slashing of levee external embankments adjacent to revegetation sites.
21/10/21	Weed control	Manual and herbicide weed control. Western PEC
25/10/21 - 26/10/21	Planting	Completed planting of lower VDD Embankments (3,500 plants total).
10/11/21 - 11/11/21	Weed control	Manual and herbicide weed control. QD, WPEC & CPEC
10/11/21 & 15/11/21	Palisade construction	4/4 palisade area construction in Quindalup Dune.
16/11/21 - 17/11/21	Monitoring	Quadrat set-up and monitoring of all revegetation areas
20/11/21 - 30/11/21	Plant orders	Developing and ordering the tubestock planting list for 2022. 30% deposit required upfront to secure orders.
06/12/21 - 14/12/21	Weed control	Manual and herbicide weed control. QD, WPEC, CPEC and Eastern PEC.
06/12/21	Watering	Watering of all mature tree in CPEC. Total of 4000L
21/12/21; 4/01/22; 17/1/22	Watering (3x events)	Watering of mature trees (CPEC), WPEC and QD zones fortnightly. Total 12,000L used. Watering of BayOK included 17/01
22/12/21 - 18/01/22	Weed control (3x events)	Weed control (covering Spr-21 treatment) was utilised across all 2021 and 2022 revegetation sites. Manual, chemical and mechanical control.
07/01/22 & 19/01/22	Mulch deliveries and site preparation	Additional site preparation in EPEC and delivery of 210m^3 of mulch delivered to site.
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04/01/22 - 20/01/22	Monitoring / reporting	Processing and analysis of monitoring data and drafting of report.
18/10/21 – 22/10/21	Levee selective herbicide spraying	Selective spraying of broadleaf weeds on levees adjacent to reveg sites.
20/10/21 & 29/10/21; 02/11/21; 02/02/22; 08/02/22	Levee slashing (5x events (partially included in previous reports)	Spring 2021 and summer 2022 slashing. Brushcutting all external levee embankments adjacent to reveg areas.

25/01/22; 31/01/22; 04/02/22; 09/02/22; 17/02/22; 19/02/22	Weed control (6x events	Weed control (Summer-22 treatment) across all 2021 and 2022 revegetation sites. Manual, chemical and mechanical control.
03/02/22; 15/02/22 – 16/02/22	Watering	2x watering events over Feb-22. CPEC, WPEC and QD seedlings and mature trees
01/02/22 – 02/02/22	Mulch deliveries	Remaining mulch delivered to EPEC zone.
21/02/22 – 24/02/22	Mulch spreading	Machine spreading of mulch in EPEC.
03/03/22 – 13/03/22	Watering	Watering of mature trees (CPEC), WPEC and QD zones fortnightly. Total 6,000L used per event.
21/03/22 – 28/04/22	Weed control	Weed control (Remaining summer-22 treatment) across all 2021 and 2022 revegetation sites. Manual, chemical and mechanical control. Additional woody weed control CPEC and SPEC.
28/04/22 – 06/05/22	Tree Guard Maintenance	Tree guard maintenance and removal along CPEC. Approx. 3,500 guards removed.
20/04/22 – 18/05/22	Matting	Installation of 1,500m² of coir mesh installed along QE Ave Swale.
20/05/22 – 23/05/22	Seedling deliveries	Delivery of seedlings for 2022 planting works. Estimated final numbers at 45,785
01/05/22 – 23/05/22	Monitoring	Autumn-22 field vegetation monitoring.
02/06/22 – 29/06/22	Weed control	4x weed control events across QD, QE Ave swale, Central PEC & Eastern PEC. Inc. herbicide spraying and manual removal.
07/06/22 – 13/07/22	Planting and tree guard installation	Installation of seedlings to QD (infill), QE Ave Swale, Central PEC (infill) & Eastern PEC. Totals provided in attachment. Planting included augering/ripping & fertiliser tablet supply & install. Approx. 6k tree guards installed in selected areas
10/06/22 – 15/06/22	Tree guard maintenance	Removal of selected guards across Central PEC. Approx. 5,000 guards removed.
09/06/22 – 30/06/22	Fencing	Installation of 1,685lm of herbivore protection fencing across Eastern PEC.
01/06/22 – 01/07/22	Monitoring Reporting	Data input and draft report preparation (to be submitted).
20/07/22 11/08/22 – 15/08/22 01/09/22 – 14/09/22 27/09/22 – 30/09/22 18/10/22 – 19/10/22 24/10/22 – 26/10/22 08/11/22 14/11/22 28/11/22	Weed Control (16 days – 376hrs)	On-going management of weeds using various methods (manual, mechanical, herbicide) across all active revegetation areas: QD, WPEC, CPEC, EPEC, Possum Corridor). Very high seasonal weed abundance due to cooler conditions resulted in a protracted growing season for winter / spring weeds.
05/08/22 09/08/22 16/09/22 14/10/22 03/11/22 07/11/22	Tree Guard Removal	All guards progressively removed from CPEC and WPEC. Decision was made to remove all remaining guards in these areas due to vandalism and public concerns from plastic waste.

01/08/22 – 02/08/22 12/09/22 – 13/09/22	Levee weed management (selective herbicide spraying)	Broadleaf selective boom spraying of all external levee banks adjacent to revegetation sites.
05/10/22 – 12/10/22 27/10/22 14/11/22 – 15/11/22	Levee Weed Management (slashing)	Mechanical slashing of external levee banks adjacent to revegetation sites.
18/10/22 – 21/10/22	2023 Seedling orders	Developed planting plan and confirmed seedling orders for 2023.
02/11/22 – 04/11/22	Spring 2022 Monitoring	Field monitoring of all revegetation sites. Data analysis and report to be completed.
06/12/22	Sign installation	Revegetation signs installed at strategic locations across revegetation sites.
05/01/23 & 16/01/23	Brushwall installation	Installation of matting and brushwall section on VDD Embankment.
17/01/23 – 18/01/23	Levee weed control	Slashing of all external levee embankments
25/01/23	Monitoring and reporting	Spring 2022 monitoring report submitted 25/01/23
06/12/22 03/01/23 – 11/01/23 01/02/23 – 02/02/23 24/02/23 – 28/02/23	Weed control (10 days – 189 hours	On-going management of weeds using various methods (manual, mechanical, herbicide) across all active revegetation areas. Additional woody weed control in Possum Corridor and Southern PEC.
18/01/23 – 20/01/23 27/02/23 – 28/02/23 (16/12/22 – 25/02/23)	Watering (2x site-wide events) & 6x QE Ave swale	Watering of mature trees (CPEC) and active revegetation zones. Additional fortnightly watering QE Ave swale (tanker).
09/12/22 19/01/23	Possum Infrastructure maintenance	Infrastructure assessment with arborist and adjustments to rope bridges (College Ave).







Vasse Diversion Drain Upgrade Revegetation – Water Corporation

Post Activity Report #19: May – July 2023

Activity Date(s):	23/05/23 – 31/07/23	**Conducted By:**	Alex Johnston
Site Reference:	VDD Upgrade Revegetation	**Reviewed By:**	Matt Blunt
Area (ha):	14.5ha		

Action Taken

Date(s):	Activity	Description
23/05/23-24/05/23; 13/07/23	Levee Weed control	Removal of shrubs from levee and slashing works to external levee banks (CPEC)
28/05/23 – 28/06/23	Weed control (6 days; 132.5hrs)	Herbicide spot spraying and manual removal - all active revegetation sites
11/07/23 – 27/07/23	Seedling planting	15,067 seedlings installed (inc. augering & fertiliser) to QD, WPEC, CPEC and EPEC (refer to attached planting table)
23/07/23	Possum bridge maintenance	Repair to broken rope bridge. Additional adjustment to increase height.

Recent site photos available on the C-D00116 Revegetation Work Sharefile

Previous Action Taken

Date(s):	Activity	Description
26/10/20 – 05/11/20	Vegetation salvage	Selective removal, transport and initial propagation of native species within clearing area. Performed in collaboration with Aboriginal businesses and GCLN.
26/10/20 – 02/11/20	Pathway construction and hardstand removal	Installation of 150m x 2m crushed limestone pathway through Quindalup Dune Zone. Removal and stockpiling of gravel material from former Water Corp Depot for later removal and replacement with appropriate topsoil.
14/10/20 – 15/10/20	Baseline monitoring	Performed baseline monitoring of all revegetation zones. 34 quadrats and 34 photo monitoring points + bushland condition monitoring.
01/10/20 – 20/11/20	Plant and embankment material procurement	Procurement and delivery of all embankment materials for future works. Confirmation of tubestock and mature tree orders for 1st year planting in 2021.
24/11/20 – 08/12/20	Brushlog fabrication	Construction of 300 Brushlog units. Pre-fabrication prior to install for safe and efficient transport and installation.
24/11/20 – 24/12/20	Weed control	Selective herbicide application, hand weeding and slashing. Focus on areas planned for revegetation in 2021.
24/11/20 – 21/12/20	Embankment regrading	Mechanical and manual regrading of embankments, exotic tree stump removal and various green waste removal.
26/11/20 – 23/12/20	Matting	Installed over 800m² of coir mesh across the western VDD Embankment zone.
02/12/20 – 23/12/20	Brushwall installation	50m Initial section of brushwall installed on western bank + 20m of embankment palisade.
04/01/21 – 21/01/21	Weed control	Manual, mechanical and chemical weed control along VDD embankments.
11/01/21 – 15/01/21	Brushwalling	Installation of 110lm of brushwall along western bank + 65lm of mid-slope brush palisade. Total brushwall is now 160lm + 85lm of brush palisade.
13/01/21 – 15/01/21	Matting	Installation of 1,200m² of coir mesh matting. Total matting area is now approx. 2,000m²
13/01/21 – 19/01/21	Weed control	Selective and targeted follow-up herbicide spraying across a number of revegetation areas.
19/01/21 – 18/02/21	Local provenance material collections	Establishment of project seed bank and selective collections of provenance seed from nearby reserves. 12 man-days completed in total. Partial processing of collected seed and seed bank storage as required. See attached status report.
22/01/21 – 22/02/21	Weed control	Follow-up herbicide application to areas to be revegetated in 2021.
22/01/21 – 08/02/21	Embankment regrading and matting	Continuation of bank preparation and matting on western embankment (200m²) and majority of eastern embankment (800m²). Total matting and embankment preparation areas is now approx. 3,000m²
22/01/21 – 22/02/21	Baseline monitoring report	Preparation and submission of baseline monitoring report. This report provides further definition of completion criteria and an overview of site conditions prior to commencement of on-ground works.

08/01/21 – 11/02/21	Relocation and respreading topsoil	Relocation of soil stockpiles in the Quindalup Dune zone to allow for ACM removal. Respreading soil following confirmation of ACM removal.
04/02/21 – 22/02/21	Mulch procurement and site preparation planning	Confirm mulch order and deposit for material. Planning for distribution and logistics of mulch cartage and stockpiling. Coordination and confirmation of machinery for spreading.
09/02/21 – 12/02/21	Aboriginal engagement – Roelands Village	Contribution to four days of machinery operation training for Roelands Village civil construction trainees. The works were undertaken to assist the Geographe Community Landcare Nursery increase nursery capacity to accommodate additional requirements for the project.
11/02/21 – 18/02/21	Greenwaste and woody weeds	Clearing and removal of Greenwaste (weed and dead material). 30m³ of weed material disposed of at waste facility and over 100m³ stockpiled on site for future removal and respreading of larger logs for habitat.
17/02/21	Aboriginal engagement – Undalup Association	On-country meeting and consultation with Cultural Custodians to discuss the project scope for the development of cultural / biodiversity nodes within the site. Confirmation to commence works 12/02/21.
23/02/21 – 23/03/21	Weed control	Weed control across various revegetation zones. Re-treating WPEC, CPEC, EPEC & QD zones. Herbicide spraying, manual and woody weeds
03/03/21 – 09/03/21	Palisade construction	Construction and completion of 3x palisade areas along the western embankment.
12/03/21 – 19/03/21	Aboriginal engagement	Two days of Undalup's indigenous ranger team (x3) performing site preparation tasks (weed control, rubbish removal and fuel load reduction) in the Southern PEC zone. Additional reporting to be provided in the next period.
17/03/21 – 22/03/21	Mulch installation	675m³ of mulch supplied and spread (mechanical and manual) across 9,000m² of the eastern PEC zone.
24/03/21 – 25/05/21	Weed control	On-going follow-up weed control across various revegetation zones. Re-treating WPEC, CPEC, EPEC & QD zones. Herbicide spraying, manual and woody weeds
24/03/21 – 07/05/21	Aboriginal engagement – Wadandi Rangers	On-going support for site works from Undalup Association's Wadandi rangers both on site and at GCLN. Please see attached progress reports from Undalup.
19/04/21 – 23/04/21	Ripping	Soil ripping via tractor mounted tine across Central PEC and Quindalup Dune revegetation zones. Approx. 1.5 ha covered.
13/05/21 – 21/05/21	Mulch installation	315m³ of mulch supplied and spread (mechanical and manual) across 6,000m² of the Quindalup Dune zone.
24/03/21 – 25/05/21	Procurement	Purchase and delivery of corflute tree guards, stakes and root barrier.
27/05/21	Procurement: Tree stake supply	Supply of all hardwood stakes (1800x50x50mm) for mature trees.
04/06/21 & 17/06/21	Weed control	On-going weed control focussing on the QD and VDD Embankment areas prior to planting
22/06/21 – 24/06/21	Procurement: Seedling supply	Supply of all seedlings (exc. lower embankment) for the Quindalup Dune and VDD Embankment zones. Total number of seedlings: 23,610

01/07/21	Matting	Completion of matting along the final section (700m²) of the VDD Embankment near the pedestrian bridge.
05/07/21 - 19/07/21	Planting	21,543 seedlings installed in the QD and VDD Embankment zones. Lower Embankment to be planted in spring. Refer to table attached for details.
08/07/21	Ripping	0.5ha of the Western PEC zone (Corner of College Ave / QE Ave) was ripped prior to mulch spreading.
12/07/21 - 16/07/21	Mulching	Mechanical spreading of mulch across the Central and Western PEC zones. Total of 7,000m² spread. Further manual spreading / trimming to be completed.
12/07/21	Tree removal and greenwaste removal	Removal of unstable tree at the Donovan property and removal of greenwaste from the Western PEC zone.
21/07/21 - 22/07/21	Plant deliveries and batching	Delivery and batching of remaining seedlings for 2021. See attached table for details
22/07/21 - 23/07/21	Fencing	QD and Embankment zone post & rail and public management fencing completed.
25/06/21 - 22/07/21	Weed control	Various follow-up herbicide weed control undertaken where possible, including: QD, VDD Embankments, Western PEC, Central PEC, Eastern PEC and Western Basin PEC.
25/06/21 - 22/07/21	Aboriginal engagement - Undalup Association	Undalup Wadandi Rangers assisting Geographe Community Landcare Nursery preparing stock for the project and assisting with capacity upgrades.
27/07/21	Slashing VDD Levees (separate PO)	Manual slashing (brushcutter) of VDD levee external banks adjacent to revegetation areas. Performed under separate work order.
27/07/21 - 28/07/21	Mulch spreading (manual)	Final manual trim of mulched areas in Central PEC and Western PEC planting areas. Additional assistance provided by Undalup Association.
30/07/21 - 13/08/21	Aboriginal engagement	Assistance with manual spreading of mulch at Western PEC. 2 days (30/08 & 13/08).
03/08/21 - 18/08/21	Weed control	Targeted spot spraying within 2021 planting sites over 4 days. Additional retreatment of 2022 planting sites (EPEC, Possum Corridor) blanket spraying.
05/08/21 - 20/08/21	C. procera monitoring	Commenced monitoring growth and health of known & reference populations of C. procera adjacent to construction boundary.
09/08/21 - 10/08/21	WPEC fencing	324m of fencing installed around Western PEC Restoration Zone. Inc. 1.2m ringlock + 900mm rabbit mesh skirt. 2m clearance from base of levee.
13/08/21	Mulch spreading	Transport and spreading of mulch from WPEC to QD Zone eastern bank.
13/08/21 - 19/08/21	Mature trees install	Install 214 mature trees along pathway in CPEC. Included root barrier, soil conditioner, Terracottem, mulching, stakes and ties.
23/08/21	CPEC planting	Commencement of planting along CPEC inc. tree guards and fertiliser tablets. Final planting list included below.
24/08/21 - 21/09/21	Weed control	Follow-up herbicide application to areas to be revegetated in 2021.

25/08/21 - 10/09/21	Planting and guard install	Install remaining plants and guards in CPEC and Western PEC Restoration Zone. Total of 14,617 plants and 11,261 guards installed.
30/08/21 - 13/09/21	Planting and guard install (Undalup Association)	Installation of plants and guards in WPEC Open zone. Total of 3,149 plants and 2,539 guards installed.
13/09/21 - 21/09/21	Planting and guard install (Undalup Association)	Installation of plants and guards in CPEC swale zone. Total of 6,000 plants installed in swale.
23/09/21	Tree install	Plant remaining mature tree in QD Zone and install signage.
(05/08/21) - 13/10/21	C. procera monitoring	Weekly inspections and recording of *Caladenia procera* population within the SPEC. Inspections conducted from August to October.
1/10/21	Weed control; tree guard maintenance	Manual and herbicide weed control. Removal and reinstatement of damaged tree guards. Central PEC
04/10/21	Weed control	Manual and herbicide weed control. QD & Western PEC.
14/10/21	Weed control	Manual and herbicide weed control. QD
20/10/21 - 21/10/21	Levee slashing	1/12 slashing of levee external embankments adjacent to revegetation sites.
21/10/21	Weed control	Manual and herbicide weed control. Western PEC
25/10/21 - 26/10/21	Planting	Completed planting of lower VDD Embankments (3,500 plants total).
10/11/21 - 11/11/21	Weed control	Manual and herbicide weed control. QD, WPEC & CPEC
10/11/21 & 15/11/21	Palisade construction	4/4 palisade area construction in Quindalup Dune.
16/11/21 - 17/11/21	Monitoring	Quadrat set-up and monitoring of all revegetation areas
20/11/21 - 30/11/21	Plant orders	Developing and ordering the tubestock planting list for 2022. 30% deposit required upfront to secure orders.
06/12/21 - 14/12/21	Weed control	Manual and herbicide weed control. QD, WPEC, CPEC and Eastern PEC.
06/12/21	Watering	Watering of all mature tree in CPEC. Total of 4000L
21/12/21; 4/01/22; 17/1/22	Watering (3x events)	Watering of mature trees (CPEC), WPEC and QD zones fortnightly. Total 12,000L used. Watering of BayOK included 17/01
22/12/21 - 18/01/22	Weed control (3x events)	Weed control (covering Spr-21 treatment) was utilised across all 2021 and 2022 revegetation sites. Manual, chemical and mechanical control.
07/01/22 & 19/01/22	Mulch deliveries and site preparation	Additional site preparation in EPEC and delivery of 210m^3 of mulch delivered to site.
17/12/21 - 24/12/21	Plant procurement	Completion of plant procurement for 2022 including Stage 3 plants. 45,785 total plants
04/01/22 - 20/01/22	Monitoring / reporting	Processing and analysis of monitoring data and drafting of report.
18/10/21 – 22/10/21	Levee selective herbicide spraying	Selective spraying of broadleaf weeds on levees adjacent to reveg sites.
20/10/21 & 29/10/21; 02/11/21; 02/02/22; 08/02/22	Levee slashing (5x events (partially included in previous reports)	Spring 2021 and summer 2022 slashing. Brushcutting all external levee embankments adjacent to reveg areas.

25/01/22; 31/01/22; 04/02/22; 09/02/22; 17/02/22; 19/02/22	Weed control (6x events	Weed control (Summer-22 treatment) across all 2021 and 2022 revegetation sites. Manual, chemical and mechanical control.
03/02/22; 15/02/22 – 16/02/22	Watering	2x watering events over Feb-22. CPEC, WPEC and QD seedlings and mature trees
01/02/22 – 02/02/22	Mulch deliveries	Remaining mulch delivered to EPEC zone.
21/02/22 – 24/02/22	Mulch spreading	Machine spreading of mulch in EPEC.
03/03/22 – 13/03/22	Watering	Watering of mature trees (CPEC), WPEC and QD zones fortnightly. Total 6,000L used per event.
21/03/22 – 28/04/22	Weed control	Weed control (Remaining summer-22 treatment) across all 2021 and 2022 revegetation sites. Manual, chemical and mechanical control. Additional woody weed control CPEC and SPEC.
28/04/22 – 06/05/22	Tree Guard Maintenance	Tree guard maintenance and removal along CPEC. Approx. 3,500 guards removed.
20/04/22 – 18/05/22	Matting	Installation of 1,500m² of coir mesh installed along QE Ave Swale.
20/05/22 – 23/05/22	Seedling deliveries	Delivery of seedlings for 2022 planting works. Estimated final numbers at 45,785
01/05/22 – 23/05/22	Monitoring	Autumn-22 field vegetation monitoring.
02/06/22 – 29/06/22	Weed control	4x weed control events across QD, QE Ave swale, Central PEC & Eastern PEC. Inc. herbicide spraying and manual removal.
07/06/22 – 13/07/22	Planting and tree guard installation	Installation of seedlings to QD (infill), QE Ave Swale, Central PEC (infill) & Eastern PEC. Totals provided in attachment. Planting included augering/ripping & fertiliser tablet supply & install. Approx. 6k tree guards installed in selected areas
10/06/22 – 15/06/22	Tree guard maintenance	Removal of selected guards across Central PEC. Approx. 5,000 guards removed.
09/06/22 – 30/06/22	Fencing	Installation of 1,685lm of herbivore protection fencing across Eastern PEC.
01/06/22 – 01/07/22	Monitoring Reporting	Data input and draft report preparation (to be submitted).
20/07/22 11/08/22 – 15/08/22 01/09/22 – 14/09/22 27/09/22 – 30/09/22 18/10/22 – 19/10/22 24/10/22 – 26/10/22 08/11/22 14/11/22 28/11/22	Weed Control (16 days – 376hrs)	On-going management of weeds using various methods (manual, mechanical, herbicide) across all active revegetation areas: QD, WPEC, CPEC, EPEC, Possum Corridor). Very high seasonal weed abundance due to cooler conditions resulted in a protracted growing season for winter / spring weeds.
05/08/22 09/08/22 16/09/22 14/10/22 03/11/22 07/11/22	Tree Guard Removal	All guards progressively removed from CPEC and WPEC. Decision was made to remove all remaining guards in these areas due to vandalism and public concerns from plastic waste.

01/08/22 – 02/08/22 12/09/22 – 13/09/22	Levee weed management (selective herbicide spraying)	Broadleaf selective boom spraying of all external levee banks adjacent to revegetation sites.
05/10/22 – 12/10/22 27/10/22 14/11/22 – 15/11/22	Levee Weed Management (slashing)	Mechanical slashing of external levee banks adjacent to revegetation sites.
18/10/22 – 21/10/22	2023 Seedling orders	Developed planting plan and confirmed seedling orders for 2023.
02/11/22 – 04/11/22	Spring 2022 Monitoring	Field monitoring of all revegetation sites. Data analysis and report to be completed.
06/12/22	Sign installation	Revegetation signs installed at strategic locations across revegetation sites.
05/01/23 & 16/01/23	Brushwall installation	Installation of matting and brushwall section on VDD Embankment.
17/01/23 – 18/01/23	Levee weed control	Slashing of all external levee embankments
25/01/23	Monitoring and reporting	Spring 2022 monitoring report submitted 25/01/23
06/12/22 03/01/23 – 11/01/23 01/02/23 – 02/02/23 24/02/23 – 28/02/23	Weed control (10 days – 189 hours	On-going management of weeds using various methods (manual, mechanical, herbicide) across all active revegetation areas. Additional woody weed control in Possum Corridor and Southern PEC.
18/01/23 – 20/01/23 27/02/23 – 28/02/23 (16/12/22 – 25/02/23)	Watering (2x site-wide events) & 6x QE Ave swale	Watering of mature trees (CPEC) and active revegetation zones. Additional fortnightly watering QE Ave swale (tanker).
09/12/22 19/01/23	Possum Infrastructure maintenance	Infrastructure assessment with arborist and adjustments to rope bridges (College Ave).
01/03/23 – 08/03/23 23/03/23 – 03/04/23 14/04/23 28/04/23 – 02/05/23	Weed control (8 days; 180 hrs)	On-going management of weeds using various methods (manual, mechanical, herbicide) across all active revegetation areas: QD, WPEC, CPEC, EPEC, Possum Corridor).
13/03/23	Tree guard removal	All remaining guards in EPEC removed.
27/04/23 – 28/04/23	Slashing Levees	Slashing levees in areas adjacent to reveg sites
01/03/23 – 01/04/23	Watering (3x sitewide events + QE Ave additional)	Watering of mature trees (CPEC) and active revegetation zones. Additional weekly watering QE Ave swale (tanker).
11/05/23 – 12/05/23	Mulch installation (QD/QE Ave & Donovan Property)	Supply and spread of 110m³ of mulch across additional area between QE Ave swale & Donovan's property.
17/04/23 – 21/04/23	Fencing	Installed 1640 linear metres of fencing, including service location / pot-holing, significant hand digging, gates and corner strainers due to site restrictions / limitations. No rabbit skirt was included due to no feasible means to fully encapsulate area. Additional budget in Stg2 utilised to supplement separate PO for SPEC Fencing and Access works.
19/05/23	Seedling supply	Remaining value for supply of seedlings for 2023 installation.

VDD Upgrade Revegetation 2023 Final Planting List

Species	Quindalup Dune Open	Quindalup Dune Restoration	Western PEC Restoration (sun)	Western PEC Restoration (shade)	Central PEC Restoration (upper)	Central PEC Restoration (lower)	Eastern PEC Low Fuel (infill)	Eastern PEC Low Fuel (inital)	Eastern PEC Open	Eastern PEC Restoration	Eastern PEC Restoration (college)	Total
Tree Species												
Banksia grandis					63							**63**
Banksia littoralis						63						**63**
Corymbia calophylla					72							**72**
Eucalyptus decipiens					63							**63**
Eucalyptus rudis						72						**72**
Sub-Total	**0**	**0**	**0**	**0**	**198**	**135**	**0**	**0**	**0**	**0**	**0**	**333**
Shrub Species												
Acacia pulchella			250	63	311				150	500	126	**1,400**
Acacia stenoptera			240	80	280				228	420	80	**1,328**
Adenanthos meisneri					40						40	**80**
Chorizema diversifolium			80							120		**200**
Daviesia physodes			100		200				80	180	40	**600**
Diplolaena dampieri		63										**63**
Hakea prostrata					63							**63**
Hakea varia					63							**63**
Hibbertia cuneiformis			160	80	280						80	**600**
Hibbertia racemosa			160	40	270						80	**550**
Jacksonia furcellata					63				126	126	63	**378**
Kunzea glabrescens					144							**144**
Logania vaginalis			40							160		**200**
Lysiandra calycinus	160	280	160	240	200				320	480	80	**1,920**
Pimelea argentea	40	120										**160**
Pimelea sylvestris			40	40						80		**160**
Spyridium globulosum			72	72						0		**144**
Sub-Total	**200**	**463**	**1,302**	**615**	**1,914**	**0**	**0**	**0**	**904**	**2,066**	**589**	**8,053**
Herbs and Groundcover Species												
Conostylis aculeata					126							**126**
Dampiera alata									80	120	80	**280**
Dampiera linearis				126					126	126	126	**504**
Dianella brevicaulis					100		120	40	80	120	40	**500**
Hardenbergia comptoniana					165		126	63			63	**417**
Kennedia prostrata				200	126		389	63	630	492	126	**2,026**
Lomandra preissii			40	40					160	220	40	**500**
Patersonia occidentalis			0		63			63				**126**
Scaevola calliptera			0	126			189	63	461	400	63	**1,302**
Sub-Total	**0**	**0**	**40**	**492**	**580**	**0**	**824**	**292**	**1,537**	**1,478**	**538**	**5,781**
Rushes and Sedges												
Baumea juncea						200				200		**400**
Gahnia trifida						160			140	200		**500**
Sub-Total	**0**	**0**	**0**	**0**	**0**	**360**	**0**	**0**	**140**	**400**	**0**	**900**
TOTAL	**200**	**463**	**1,342**	**1,107**	**2,692**	**495**	**824**	**292**	**2,581**	**3,944**	**1,127**	**15,067**







Vasse Diversion Drain Upgrade Revegetation – Water Corporation

Post Activity Report #20: August - September 2023

Activity Date(s):	01/08/23 – 02/10/23	**Conducted By:**	Alex Johnston
Site Reference:	VDD Upgrade Revegetation	**Reviewed By:**	Matt Blunt
Area (ha):	14.5ha		

Action Taken

Date(s):	Activity	Description
07/08/23 – 14/08/23 11/09/23 – 18/09/23	Weed control (9x days – 214.5hrs)	Herbicide spraying and manual weed control across all active and upcoming (2024) reveg sites.
29/08/23 – 05/09/23	Seedling supply	Arrange and confirm orders for 2024 planting. Total 30,742 seedlings (30% deposit invoice paid).
26/09/23	Levee slashing	Performed final slashing along levee embankment prior to reveg prep.
26/09/23	Levee revegetation materials	Ordered and received 94x coir mesh rolls + pins for installing on levees in 2023. Remainder in 2024.
02/10/23	Mature Trees	Infill planting 16x mature peppermint trees in CPEC.

Recent site photos available on the C-D00116 Revegetation Work Sharefile

Previous Action Taken

Date(s):	Activity	Description
26/10/20 – 05/11/20	Vegetation salvage	Selective removal, transport and initial propagation of native species within clearing area. Performed in collaboration with Aboriginal businesses and GCLN.
26/10/20 – 02/11/20	Pathway construction and hardstand removal	Installation of 150m x 2m crushed limestone pathway through Quindalup Dune Zone. Removal and stockpiling of gravel material from former Water Corp Depot for later removal and replacement with appropriate topsoil.
14/10/20 – 15/10/20	Baseline monitoring	Performed baseline monitoring of all revegetation zones. 34 quadrats and 34 photo monitoring points + bushland condition monitoring.
01/10/20 – 20/11/20	Plant and embankment material procurement	Procurement and delivery of all embankment materials for future works. Confirmation of tubestock and mature tree orders for 1st year planting in 2021.
24/11/20 – 08/12/20	Brushlog fabrication	Construction of 300 Brushlog units. Pre-fabrication prior to install for safe and efficient transport and installation.
24/11/20 – 24/12/20	Weed control	Selective herbicide application, hand weeding and slashing. Focus on areas planned for revegetation in 2021.
24/11/20 – 21/12/20	Embankment regrading	Mechanical and manual regrading of embankments, exotic tree stump removal and various green waste removal.
26/11/20 – 23/12/20	Matting	Installed over 800m² of coir mesh across the western VDD Embankment zone.
02/12/20 – 23/12/20	Brushwall installation	50m Initial section of brushwall installed on western bank + 20m of embankment palisade.
04/01/21 – 21/01/21	Weed control	Manual, mechanical and chemical weed control along VDD embankments.
11/01/21 – 15/01/21	Brushwalling	Installation of 110lm of brushwall along western bank + 65lm of mid-slope brush palisade. Total brushwall is now 160lm + 85lm of brush palisade.
13/01/21 – 15/01/21	Matting	Installation of 1,200m² of coir mesh matting. Total matting area is now approx. 2,000m²
13/01/21 – 19/01/21	Weed control	Selective and targeted follow-up herbicide spraying across a number of revegetation areas.
19/01/21 – 18/02/21	Local provenance material collections	Establishment of project seed bank and selective collections of provenance seed from nearby reserves. 12 man-days completed in total. Partial processing of collected seed and seed bank storage as required. See attached status report.
22/01/21 – 22/02/21	Weed control	Follow-up herbicide application to areas to be revegetated in 2021.
22/01/21 – 08/02/21	Embankment regrading and matting	Continuation of bank preparation and matting on western embankment (200m²) and majority of eastern embankment (800m²). Total matting and embankment preparation areas is now approx. 3,000m²
22/01/21 – 22/02/21	Baseline monitoring report	Preparation and submission of baseline monitoring report. This report provides further definition of completion criteria and an overview of site conditions prior to commencement of on-ground works.

08/01/21 – 11/02/21	Relocation and respreading topsoil	Relocation of soil stockpiles in the Quindalup Dune zone to allow for ACM removal. Respreading soil following confirmation of ACM removal.
04/02/21 – 22/02/21	Mulch procurement and site preparation planning	Confirm mulch order and deposit for material. Planning for distribution and logistics of mulch cartage and stockpiling. Coordination and confirmation of machinery for spreading.
09/02/21 – 12/02/21	Aboriginal engagement – Roelands Village	Contribution to four days of machinery operation training for Roelands Village civil construction trainees. The works were undertaken to assist the Geographe Community Landcare Nursery increase nursery capacity to accommodate additional requirements for the project.
11/02/21 – 18/02/21	Greenwaste and woody weeds	Clearing and removal of Greenwaste (weed and dead material). 30m³ of weed material disposed of at waste facility and over 100m³ stockpiled on site for future removal and respreading of larger logs for habitat.
17/02/21	Aboriginal engagement – Undalup Association	On-country meeting and consultation with Cultural Custodians to discuss the project scope for the development of cultural / biodiversity nodes within the site. Confirmation to commence works 12/02/21.
23/02/21 – 23/03/21	Weed control	Weed control across various revegetation zones. Re-treating WPEC, CPEC, EPEC & QD zones. Herbicide spraying, manual and woody weeds
03/03/21 – 09/03/21	Palisade construction	Construction and completion of 3x palisade areas along the western embankment.
12/03/21 – 19/03/21	Aboriginal engagement	Two days of Undalup's indigenous ranger team (x3) performing site preparation tasks (weed control, rubbish removal and fuel load reduction) in the Southern PEC zone. Additional reporting to be provided in the next period.
17/03/21 – 22/03/21	Mulch installation	675m³ of mulch supplied and spread (mechanical and manual) across 9,000m² of the eastern PEC zone.
24/03/21 – 25/05/21	Weed control	On-going follow-up weed control across various revegetation zones. Re-treating WPEC, CPEC, EPEC & QD zones. Herbicide spraying, manual and woody weeds
24/03/21 – 07/05/21	Aboriginal engagement – Wadandi Rangers	On-going support for site works from Undalup Association's Wadandi rangers both on site and at GCLN. Please see attached progress reports from Undalup.
19/04/21 – 23/04/21	Ripping	Soil ripping via tractor mounted tine across Central PEC and Quindalup Dune revegetation zones. Approx. 1.5 ha covered.
13/05/21 – 21/05/21	Mulch installation	315m³ of mulch supplied and spread (mechanical and manual) across 6,000m² of the Quindalup Dune zone.
24/03/21 – 25/05/21	Procurement	Purchase and delivery of corflute tree guards, stakes and root barrier.
27/05/21	Procurement: Tree stake supply	Supply of all hardwood stakes (1800x50x50mm) for mature trees.
04/06/21 & 17/06/21	Weed control	On-going weed control focussing on the QD and VDD Embankment areas prior to planting
22/06/21 – 24/06/21	Procurement: Seedling supply	Supply of all seedlings (exc. lower embankment) for the Quindalup Dune and VDD Embankment zones. Total number of seedlings: 23,610

01/07/21	Matting	Completion of matting along the final section (700m²) of the VDD Embankment near the pedestrian bridge.
05/07/21 - 19/07/21	Planting	21,543 seedlings installed in the QD and VDD Embankment zones. Lower Embankment to be planted in spring. Refer to table attached for details.
08/07/21	Ripping	0.5ha of the Western PEC zone (Corner of College Ave / QE Ave) was ripped prior to mulch spreading.
12/07/21 - 16/07/21	Mulching	Mechanical spreading of mulch across the Central and Western PEC zones. Total of 7,000m² spread. Further manual spreading / trimming to be completed.
12/07/21	Tree removal and greenwaste removal	Removal of unstable tree at the Donovan property and removal of greenwaste from the Western PEC zone.
21/07/21 - 22/07/21	Plant deliveries and batching	Delivery and batching of remaining seedlings for 2021. See attached table for details
22/07/21 - 23/07/21	Fencing	QD and Embankment zone post & rail and public management fencing completed.
25/06/21 - 22/07/21	Weed control	Various follow-up herbicide weed control undertaken where possible, including: QD, VDD Embankments, Western PEC, Central PEC, Eastern PEC and Western Basin PEC.
25/06/21 - 22/07/21	Aboriginal engagement - Undalup Association	Undalup Wadandi Rangers assisting Geographe Community Landcare Nursery preparing stock for the project and assisting with capacity upgrades.
27/07/21	Slashing VDD Levees (separate PO)	Manual slashing (brushcutter) of VDD levee external banks adjacent to revegetation areas. Performed under separate work order.
27/07/21 - 28/07/21	Mulch spreading (manual)	Final manual trim of mulched areas in Central PEC and Western PEC planting areas. Additional assistance provided by Undalup Association.
30/07/21 - 13/08/21	Aboriginal engagement	Assistance with manual spreading of mulch at Western PEC. 2 days (30/08 & 13/08).
03/08/21 - 18/08/21	Weed control	Targeted spot spraying within 2021 planting sites over 4 days. Additional retreatment of 2022 planting sites (EPEC, Possum Corridor) blanket spraying.
05/08/21 - 20/08/21	C. procera monitoring	Commenced monitoring growth and health of known & reference populations of C. procera adjacent to construction boundary.
09/08/21 - 10/08/21	WPEC fencing	324m of fencing installed around Western PEC Restoration Zone. Inc. 1.2m ringlock + 900mm rabbit mesh skirt. 2m clearance from base of levee.
13/08/21	Mulch spreading	Transport and spreading of mulch from WPEC to QD Zone eastern bank.
13/08/21 - 19/08/21	Mature trees install	Install 214 mature trees along pathway in CPEC. Included root barrier, soil conditioner, Terracottem, mulching, stakes and ties.
23/08/21	CPEC planting	Commencement of planting along CPEC inc. tree guards and fertiliser tablets. Final planting list included below.
24/08/21 - 21/09/21	Weed control	Follow-up herbicide application to areas to be revegetated in 2021.

25/08/21 - 10/09/21	Planting and guard install	Install remaining plants and guards in CPEC and Western PEC Restoration Zone. Total of 14,617 plants and 11,261 guards installed.
30/08/21 - 13/09/21	Planting and guard install (Undalup Association)	Installation of plants and guards in WPEC Open zone. Total of 3,149 plants and 2,539 guards installed.
13/09/21 - 21/09/21	Planting and guard install (Undalup Association)	Installation of plants and guards in CPEC swale zone. Total of 6,000 plants installed in swale.
23/09/21	Tree install	Plant remaining mature tree in QD Zone and install signage.
(05/08/21) - 13/10/21	C. procera monitoring	Weekly inspections and recording of *Caladenia procera* population within the SPEC. Inspections conducted from August to October.
1/10/21	Weed control; tree guard maintenance	Manual and herbicide weed control. Removal and reinstatement of damaged tree guards. Central PEC
04/10/21	Weed control	Manual and herbicide weed control. QD & Western PEC.
14/10/21	Weed control	Manual and herbicide weed control. QD
20/10/21 - 21/10/21	Levee slashing	1/12 slashing of levee external embankments adjacent to revegetation sites.
21/10/21	Weed control	Manual and herbicide weed control. Western PEC
25/10/21 - 26/10/21	Planting	Completed planting of lower VDD Embankments (3,500 plants total).
10/11/21 - 11/11/21	Weed control	Manual and herbicide weed control. QD, WPEC & CPEC
10/11/21 & 15/11/21	Palisade construction	4/4 palisade area construction in Quindalup Dune.
16/11/21 - 17/11/21	Monitoring	Quadrat set-up and monitoring of all revegetation areas
20/11/21 - 30/11/21	Plant orders	Developing and ordering the tubestock planting list for 2022. 30% deposit required upfront to secure orders.
06/12/21 - 14/12/21	Weed control	Manual and herbicide weed control. QD, WPEC, CPEC and Eastern PEC.
06/12/21	Watering	Watering of all mature tree in CPEC. Total of 4000L
21/12/21; 4/01/22; 17/1/22	Watering (3x events)	Watering of mature trees (CPEC), WPEC and QD zones fortnightly. Total 12,000L used. Watering of BayOK included 17/01
22/12/21 - 18/01/22	Weed control (3x events)	Weed control (covering Spr-21 treatment) was utilised across all 2021 and 2022 revegetation sites. Manual, chemical and mechanical control.
07/01/22 & 19/01/22	Mulch deliveries and site preparation	Additional site preparation in EPEC and delivery of 210m^3 of mulch delivered to site.
17/12/21 - 24/12/21	Plant procurement	Completion of plant procurement for 2022 including Stage 3 plants. 45,785 total plants
04/01/22 - 20/01/22	Monitoring / reporting	Processing and analysis of monitoring data and drafting of report.
18/10/21 – 22/10/21	Levee selective herbicide spraying	Selective spraying of broadleaf weeds on levees adjacent to reveg sites.
20/10/21 & 29/10/21; 02/11/21; 02/02/22; 08/02/22	Levee slashing (5x events (partially included in previous reports)	Spring 2021 and summer 2022 slashing. Brushcutting all external levee embankments adjacent to reveg areas.

25/01/22; 31/01/22; 04/02/22; 09/02/22; 17/02/22; 19/02/22	Weed control (6x events	Weed control (Summer-22 treatment) across all 2021 and 2022 revegetation sites. Manual, chemical and mechanical control.
03/02/22; 15/02/22 – 16/02/22	Watering	2x watering events over Feb-22. CPEC, WPEC and QD seedlings and mature trees
01/02/22 – 02/02/22	Mulch deliveries	Remaining mulch delivered to EPEC zone.
21/02/22 – 24/02/22	Mulch spreading	Machine spreading of mulch in EPEC.
03/03/22 – 13/03/22	Watering	Watering of mature trees (CPEC), WPEC and QD zones fortnightly. Total 6,000L used per event.
21/03/22 – 28/04/22	Weed control	Weed control (Remaining summer-22 treatment) across all 2021 and 2022 revegetation sites. Manual, chemical and mechanical control. Additional woody weed control CPEC and SPEC.
28/04/22 – 06/05/22	Tree Guard Maintenance	Tree guard maintenance and removal along CPEC. Approx. 3,500 guards removed.
20/04/22 – 18/05/22	Matting	Installation of 1,500m² of coir mesh installed along QE Ave Swale.
20/05/22 – 23/05/22	Seedling deliveries	Delivery of seedlings for 2022 planting works. Estimated final numbers at 45,785
01/05/22 – 23/05/22	Monitoring	Autumn-22 field vegetation monitoring.
02/06/22 – 29/06/22	Weed control	4x weed control events across QD, QE Ave swale, Central PEC & Eastern PEC. Inc. herbicide spraying and manual removal.
07/06/22 – 13/07/22	Planting and tree guard installation	Installation of seedlings to QD (infill), QE Ave Swale, Central PEC (infill) & Eastern PEC. Totals provided in attachment. Planting included augering/ripping & fertiliser tablet supply & install. Approx. 6k tree guards installed in selected areas
10/06/22 – 15/06/22	Tree guard maintenance	Removal of selected guards across Central PEC. Approx. 5,000 guards removed.
09/06/22 – 30/06/22	Fencing	Installation of 1,685lm of herbivore protection fencing across Eastern PEC.
01/06/22 – 01/07/22	Monitoring Reporting	Data input and draft report preparation (to be submitted).
20/07/22 11/08/22 – 15/08/22 01/09/22 – 14/09/22 27/09/22 – 30/09/22 18/10/22 – 19/10/22 24/10/22 – 26/10/22 08/11/22 14/11/22 28/11/22	Weed Control (16 days – 376hrs)	On-going management of weeds using various methods (manual, mechanical, herbicide) across all active revegetation areas: QD, WPEC, CPEC, EPEC, Possum Corridor). Very high seasonal weed abundance due to cooler conditions resulted in a protracted growing season for winter / spring weeds.
05/08/22 09/08/22 16/09/22 14/10/22 03/11/22 07/11/22	Tree Guard Removal	All guards progressively removed from CPEC and WPEC. Decision was made to remove all remaining guards in these areas due to vandalism and public concerns from plastic waste.

01/08/22 – 02/08/22 12/09/22 – 13/09/22	Levee weed management (selective herbicide spraying)	Broadleaf selective boom spraying of all external levee banks adjacent to revegetation sites.
05/10/22 – 12/10/22 27/10/22 14/11/22 – 15/11/22	Levee Weed Management (slashing)	Mechanical slashing of external levee banks adjacent to revegetation sites.
18/10/22 – 21/10/22	2023 Seedling orders	Developed planting plan and confirmed seedling orders for 2023.
02/11/22 – 04/11/22	Spring 2022 Monitoring	Field monitoring of all revegetation sites. Data analysis and report to be completed.
06/12/22	Sign installation	Revegetation signs installed at strategic locations across revegetation sites.
05/01/23 & 16/01/23	Brushwall installation	Installation of matting and brushwall section on VDD Embankment.
17/01/23 – 18/01/23	Levee weed control	Slashing of all external levee embankments
25/01/23	Monitoring and reporting	Spring 2022 monitoring report submitted 25/01/23
06/12/22 03/01/23 – 11/01/23 01/02/23 – 02/02/23 24/02/23 – 28/02/23	Weed control (10 days – 189 hours	On-going management of weeds using various methods (manual, mechanical, herbicide) across all active revegetation areas. Additional woody weed control in Possum Corridor and Southern PEC.
18/01/23 – 20/01/23 27/02/23 – 28/02/23 (16/12/22 – 25/02/23)	Watering (2x site-wide events) & 6x QE Ave swale	Watering of mature trees (CPEC) and active revegetation zones. Additional fortnightly watering QE Ave swale (tanker).
09/12/22 19/01/23	Possum Infrastructure maintenance	Infrastructure assessment with arborist and adjustments to rope bridges (College Ave).
01/03/23 – 08/03/23 23/03/23 – 03/04/23 14/04/23 28/04/23 – 02/05/23	Weed control (8 days; 180 hrs)	On-going management of weeds using various methods (manual, mechanical, herbicide) across all active revegetation areas: QD, WPEC, CPEC, EPEC, Possum Corridor).
13/03/23	Tree guard removal	All remaining guards in EPEC removed.
27/04/23 – 28/04/23	Slashing Levees	Slashing levees in areas adjacent to reveg sites
01/03/23 – 01/04/23	Watering (3x sitewide events + QE Ave additional)	Watering of mature trees (CPEC) and active revegetation zones. Additional weekly watering QE Ave swale (tanker).
11/05/23 – 12/05/23	Mulch installation (QD/QE Ave & Donovan Property)	Supply and spread of 110m³ of mulch across additional area between QE Ave swale & Donovan's property.
17/04/23 – 21/04/23	Fencing	Installed 1640 linear metres of fencing, including service location / pot-holing, significant hand digging, gates and corner strainers due to site restrictions / limitations. No rabbit skirt was included due to no feasible means to fully encapsulate area. Additional budget in Stg2 utilised to supplement separate PO for SPEC Fencing and Access works.
19/05/23	Seedling supply	Remaining value for supply of seedlings for 2023 installation.

23/05/23-24/05/23; 13/07/23	Levee Weed control	Removal of shrubs from levee and slashing works to external levee banks (CPEC)
28/05/23 – 28/06/23	Weed control (6 days; 132.5hrs)	Herbicide spot spraying and manual removal - all active revegetation sites
11/07/23 – 27/07/23	Seedling planting	15,067 seedlings installed (inc. augering & fertiliser) to QD, WPEC, CPEC and EPEC (refer to attached planting table)
23/07/23	Possum bridge maintenance	Repair to broken rope bridge. Additional adjustment to increase height.

VDD Upgrade Revegetation 2023 Final Planting List

Species	Quindalup Dune Open	Quindalup Dune Restoration	Western PEC Restoration (sun)	Western PEC Restoration (shade)	Central PEC Restoration (upper)	Central PEC Restoration (lower)	Eastern PEC Low Fuel (infill)	Eastern PEC Low Fuel (inital)	Eastern PEC Open	Eastern PEC Restoration	Eastern PEC Restoration (college)	Total
Tree Species												
Banksia grandis					63							**63**
Banksia littoralis						63						**63**
Corymbia calophylla					72							**72**
Eucalyptus decipiens					63							**63**
Eucalyptus rudis						72						**72**
Sub-Total	**0**	**0**	**0**	**0**	**198**	**135**	**0**	**0**	**0**	**0**	**0**	**333**
Shrub Species												
Acacia pulchella			250	63	311				150	500	126	**1,400**
Acacia stenoptera			240	80	280				228	420	80	**1,328**
Adenanthos meisneri					40						40	**80**
Chorizema diversifolium			80							120		**200**
Daviesia physodes			100		200				80	180	40	**600**
Diplolaena dampieri		63										**63**
Hakea prostrata					63							**63**
Hakea varia					63							**63**
Hibbertia cuneiformis			160	80	280						80	**600**
Hibbertia racemosa			160	40	270						80	**550**
Jacksonia furcellata					63				126	126	63	**378**
Kunzea glabrescens					144							**144**
Logania vaginalis			40							160		**200**
Lysiandra calycinus	160	280	160	240	200				320	480	80	**1,920**
Pimelea argentea	40	120										**160**
Pimelea sylvestris			40	40						80		**160**
Spyridium globulosum			72	72						0		**144**
Sub-Total	**200**	**463**	**1,302**	**615**	**1,914**	**0**	**0**	**0**	**904**	**2,066**	**589**	**8,053**
Herbs and Groundcover Species												
Conostylis aculeata					126							**126**
Dampiera alata									80	120	80	**280**
Dampiera linearis				126					126	126	126	**504**
Dianella brevicaulis					100		120	40	80	120	40	**500**
Hardenbergia comptoniana					165		126	63			63	**417**
Kennedia prostrata				200	126		389	63	630	492	126	**2,026**
Lomandra preissii			40	40					160	220	40	**500**
Patersonia occidentalis			0		63			63				**126**
Scaevola calliptera			0	126			189	63	461	400	63	**1,302**
Sub-Total	**0**	**0**	**40**	**492**	**580**	**0**	**824**	**292**	**1,537**	**1,478**	**538**	**5,781**
Rushes and Sedges												
Baumea juncea						200				200		**400**
Gahnia trifida						160			140	200		**500**
Sub-Total	**0**	**0**	**0**	**0**	**0**	**360**	**0**	**0**	**140**	**400**	**0**	**900**
TOTAL	**200**	**463**	**1,342**	**1,107**	**2,692**	**495**	**824**	**292**	**2,581**	**3,944**	**1,127**	**15,067**

tranen revegetation southwest







Vasse Diversion Drain Upgrade Revegetation – Water Corporation

Post Activity Report #21: October - December 2023

Activity Date(s):	01/08/23 – 02/10/23	**Conducted By:**	Alex Johnston
Site Reference:	VDD Upgrade Revegetation	**Reviewed By:**	Matt Blunt
Area (ha):	14.5ha		

Action Taken

Date(s):	Activity	Description
19/10/23 – 31/10/23 & 14/11/23 – 27/11/23	Weed control (12x days – 193 hrs)	Herbicide spraying and manual weed control across all active and upcoming (2024) reveg sites.
24/10/23 – 27/10/23	Levee vegetation removal	Removal, treatment and mulching of all shrubs along southern VDD levee embankment and base clearance area.
15/11/23 & 29/11/23	Revegetation monitoring	Spring field monitoring. Data and report to be completed but preliminary results very positive
31/10/23 – 13/12/23	Levee matting	Matting external levee embankments adjacent to reveg areas: WPEC & CPEC. Total of 6,635m² complete. Remaining area of 2,965m² to be complete in 2024.
28/11/23	Watering	Hand watering of mature trees and reveg along CPEC.
7/11/23, 22/11/23 & 24/11/23	Seed & cutting collection / processing	6 staff days of provenance collections to commence season. Additional reporting will be provided following completion of processing.

Recent site photos available on the C-D00116 Revegetation Work Sharefile

Previous Action Taken

Date(s):	Activity	Description
26/10/20 – 05/11/20	Vegetation salvage	Selective removal, transport and initial propagation of native species within clearing area. Performed in collaboration with Aboriginal businesses and GCLN.
26/10/20 – 02/11/20	Pathway construction and hardstand removal	Installation of 150m x 2m crushed limestone pathway through Quindalup Dune Zone. Removal and stockpiling of gravel material from former Water Corp Depot for later removal and replacement with appropriate topsoil.
14/10/20 – 15/10/20	Baseline monitoring	Performed baseline monitoring of all revegetation zones. 34 quadrats and 34 photo monitoring points + bushland condition monitoring.
01/10/20 – 20/11/20	Plant and embankment material procurement	Procurement and delivery of all embankment materials for future works. Confirmation of tubestock and mature tree orders for 1st year planting in 2021.
24/11/20 – 08/12/20	Brushlog fabrication	Construction of 300 Brushlog units. Pre-fabrication prior to install for safe and efficient transport and installation.
24/11/20 – 24/12/20	Weed control	Selective herbicide application, hand weeding and slashing. Focus on areas planned for revegetation in 2021.
24/11/20 – 21/12/20	Embankment regrading	Mechanical and manual regrading of embankments, exotic tree stump removal and various green waste removal.
26/11/20 – 23/12/20	Matting	Installed over 800m² of coir mesh across the western VDD Embankment zone.
02/12/20 – 23/12/20	Brushwall installation	50m Initial section of brushwall installed on western bank + 20m of embankment palisade.
04/01/21 – 21/01/21	Weed control	Manual, mechanical and chemical weed control along VDD embankments.
11/01/21 – 15/01/21	Brushwalling	Installation of 110lm of brushwall along western bank + 65lm of mid-slope brush palisade. Total brushwall is now 160lm + 85lm of brush palisade.
13/01/21 – 15/01/21	Matting	Installation of 1,200m² of coir mesh matting. Total matting area is now approx. 2,000m²
13/01/21 – 19/01/21	Weed control	Selective and targeted follow-up herbicide spraying across a number of revegetation areas.
19/01/21 – 18/02/21	Local provenance material collections	Establishment of project seed bank and selective collections of provenance seed from nearby reserves. 12 man-days completed in total. Partial processing of collected seed and seed bank storage as required. See attached status report.
22/01/21 – 22/02/21	Weed control	Follow-up herbicide application to areas to be revegetated in 2021.
22/01/21 – 08/02/21	Embankment regrading and matting	Continuation of bank preparation and matting on western embankment (200m²) and majority of eastern embankment (800m²). Total matting and embankment preparation areas is now approx. 3,000m²
22/01/21 – 22/02/21	Baseline monitoring report	Preparation and submission of baseline monitoring report. This report provides further definition of completion criteria and an overview of site conditions prior to commencement of on-ground works.

08/01/21 – 11/02/21	Relocation and respreading topsoil	Relocation of soil stockpiles in the Quindalup Dune zone to allow for ACM removal. Respreading soil following confirmation of ACM removal.
04/02/21 – 22/02/21	Mulch procurement and site preparation planning	Confirm mulch order and deposit for material. Planning for distribution and logistics of mulch cartage and stockpiling. Coordination and confirmation of machinery for spreading.
09/02/21 – 12/02/21	Aboriginal engagement – Roelands Village	Contribution to four days of machinery operation training for Roelands Village civil construction trainees. The works were undertaken to assist the Geographe Community Landcare Nursery increase nursery capacity to accommodate additional requirements for the project.
11/02/21 – 18/02/21	Greenwaste and woody weeds	Clearing and removal of Greenwaste (weed and dead material). 30m³ of weed material disposed of at waste facility and over 100m³ stockpiled on site for future removal and respreading of larger logs for habitat.
17/02/21	Aboriginal engagement – Undalup Association	On-country meeting and consultation with Cultural Custodians to discuss the project scope for the development of cultural / biodiversity nodes within the site. Confirmation to commence works 12/02/21.
23/02/21 – 23/03/21	Weed control	Weed control across various revegetation zones. Re-treating WPEC, CPEC, EPEC & QD zones. Herbicide spraying, manual and woody weeds
03/03/21 – 09/03/21	Palisade construction	Construction and completion of 3x palisade areas along the western embankment.
12/03/21 – 19/03/21	Aboriginal engagement	Two days of Undalup's indigenous ranger team (x3) performing site preparation tasks (weed control, rubbish removal and fuel load reduction) in the Southern PEC zone. Additional reporting to be provided in the next period.
17/03/21 – 22/03/21	Mulch installation	675m³ of mulch supplied and spread (mechanical and manual) across 9,000m² of the eastern PEC zone.
24/03/21 – 25/05/21	Weed control	On-going follow-up weed control across various revegetation zones. Re-treating WPEC, CPEC, EPEC & QD zones. Herbicide spraying, manual and woody weeds
24/03/21 – 07/05/21	Aboriginal engagement – Wadandi Rangers	On-going support for site works from Undalup Association's Wadandi rangers both on site and at GCLN. Please see attached progress reports from Undalup.
19/04/21 – 23/04/21	Ripping	Soil ripping via tractor mounted tine across Central PEC and Quindalup Dune revegetation zones. Approx. 1.5 ha covered.
13/05/21 – 21/05/21	Mulch installation	315m³ of mulch supplied and spread (mechanical and manual) across 6,000m² of the Quindalup Dune zone.
24/03/21 – 25/05/21	Procurement	Purchase and delivery of corflute tree guards, stakes and root barrier.
27/05/21	Procurement: Tree stake supply	Supply of all hardwood stakes (1800x50x50mm) for mature trees.
04/06/21 & 17/06/21	Weed control	On-going weed control focussing on the QD and VDD Embankment areas prior to planting
22/06/21 – 24/06/21	Procurement: Seedling supply	Supply of all seedlings (exc. lower embankment) for the Quindalup Dune and VDD Embankment zones. Total number of seedlings: 23,610

01/07/21	Matting	Completion of matting along the final section (700m²) of the VDD Embankment near the pedestrian bridge.
05/07/21 - 19/07/21	Planting	21,543 seedlings installed in the QD and VDD Embankment zones. Lower Embankment to be planted in spring. Refer to table attached for details.
08/07/21	Ripping	0.5ha of the Western PEC zone (Corner of College Ave / QE Ave) was ripped prior to mulch spreading.
12/07/21 - 16/07/21	Mulching	Mechanical spreading of mulch across the Central and Western PEC zones. Total of 7,000m² spread. Further manual spreading / trimming to be completed.
12/07/21	Tree removal and greenwaste removal	Removal of unstable tree at the Donovan property and removal of greenwaste from the Western PEC zone.
21/07/21 - 22/07/21	Plant deliveries and batching	Delivery and batching of remaining seedlings for 2021. See attached table for details
22/07/21 - 23/07/21	Fencing	QD and Embankment zone post & rail and public management fencing completed.
25/06/21 - 22/07/21	Weed control	Various follow-up herbicide weed control undertaken where possible, including: QD, VDD Embankments, Western PEC, Central PEC, Eastern PEC and Western Basin PEC.
25/06/21 - 22/07/21	Aboriginal engagement - Undalup Association	Undalup Wadandi Rangers assisting Geographe Community Landcare Nursery preparing stock for the project and assisting with capacity upgrades.
27/07/21	Slashing VDD Levees (separate PO)	Manual slashing (brushcutter) of VDD levee external banks adjacent to revegetation areas. Performed under separate work order.
27/07/21 - 28/07/21	Mulch spreading (manual)	Final manual trim of mulched areas in Central PEC and Western PEC planting areas. Additional assistance provided by Undalup Association.
30/07/21 - 13/08/21	Aboriginal engagement	Assistance with manual spreading of mulch at Western PEC. 2 days (30/08 & 13/08).
03/08/21 - 18/08/21	Weed control	Targeted spot spraying within 2021 planting sites over 4 days. Additional retreatment of 2022 planting sites (EPEC, Possum Corridor) blanket spraying.
05/08/21 - 20/08/21	C. procera monitoring	Commenced monitoring growth and health of known & reference populations of C. procera adjacent to construction boundary.
09/08/21 - 10/08/21	WPEC fencing	324m of fencing installed around Western PEC Restoration Zone. Inc. 1.2m ringlock + 900mm rabbit mesh skirt. 2m clearance from base of levee.
13/08/21	Mulch spreading	Transport and spreading of mulch from WPEC to QD Zone eastern bank.
13/08/21 - 19/08/21	Mature trees install	Install 214 mature trees along pathway in CPEC. Included root barrier, soil conditioner, Terracottem, mulching, stakes and ties.
23/08/21	CPEC planting	Commencement of planting along CPEC inc. tree guards and fertiliser tablets. Final planting list included below.
24/08/21 - 21/09/21	Weed control	Follow-up herbicide application to areas to be revegetated in 2021.

25/08/21 - 10/09/21	Planting and guard install	Install remaining plants and guards in CPEC and Western PEC Restoration Zone. Total of 14,617 plants and 11,261 guards installed.
30/08/21 - 13/09/21	Planting and guard install (Undalup Association)	Installation of plants and guards in WPEC Open zone. Total of 3,149 plants and 2,539 guards installed.
13/09/21 - 21/09/21	Planting and guard install (Undalup Association)	Installation of plants and guards in CPEC swale zone. Total of 6,000 plants installed in swale.
23/09/21	Tree install	Plant remaining mature tree in QD Zone and install signage.
(05/08/21) - 13/10/21	C. procera monitoring	Weekly inspections and recording of *Caladenia procera* population within the SPEC. Inspections conducted from August to October.
1/10/21	Weed control; tree guard maintenance	Manual and herbicide weed control. Removal and reinstatement of damaged tree guards. Central PEC
04/10/21	Weed control	Manual and herbicide weed control. QD & Western PEC.
14/10/21	Weed control	Manual and herbicide weed control. QD
20/10/21 - 21/10/21	Levee slashing	1/12 slashing of levee external embankments adjacent to revegetation sites.
21/10/21	Weed control	Manual and herbicide weed control. Western PEC
25/10/21 - 26/10/21	Planting	Completed planting of lower VDD Embankments (3,500 plants total).
10/11/21 - 11/11/21	Weed control	Manual and herbicide weed control. QD, WPEC & CPEC
10/11/21 & 15/11/21	Palisade construction	4/4 palisade area construction in Quindalup Dune.
16/11/21 - 17/11/21	Monitoring	Quadrat set-up and monitoring of all revegetation areas
20/11/21 - 30/11/21	Plant orders	Developing and ordering the tubestock planting list for 2022. 30% deposit required upfront to secure orders.
06/12/21 - 14/12/21	Weed control	Manual and herbicide weed control. QD, WPEC, CPEC and Eastern PEC.
06/12/21	Watering	Watering of all mature tree in CPEC. Total of 4000L
21/12/21; 4/01/22; 17/1/22	Watering (3x events)	Watering of mature trees (CPEC), WPEC and QD zones fortnightly. Total 12,000L used. Watering of BayOK included 17/01
22/12/21 - 18/01/22	Weed control (3x events)	Weed control (covering Spr-21 treatment) was utilised across all 2021 and 2022 revegetation sites. Manual, chemical and mechanical control.
07/01/22 & 19/01/22	Mulch deliveries and site preparation	Additional site preparation in EPEC and delivery of 210m^3 of mulch delivered to site.
17/12/21 - 24/12/21	Plant procurement	Completion of plant procurement for 2022 including Stage 3 plants. 45,785 total plants
04/01/22 - 20/01/22	Monitoring / reporting	Processing and analysis of monitoring data and drafting of report.
18/10/21 – 22/10/21	Levee selective herbicide spraying	Selective spraying of broadleaf weeds on levees adjacent to reveg sites.
20/10/21 & 29/10/21; 02/11/21; 02/02/22; 08/02/22	Levee slashing (5x events (partially included in previous reports)	Spring 2021 and summer 2022 slashing. Brushcutting all external levee embankments adjacent to reveg areas.

25/01/22; 31/01/22; 04/02/22; 09/02/22; 17/02/22; 19/02/22	Weed control (6x events	Weed control (Summer-22 treatment) across all 2021 and 2022 revegetation sites. Manual, chemical and mechanical control.
03/02/22; 15/02/22 – 16/02/22	Watering	2x watering events over Feb-22. CPEC, WPEC and QD seedlings and mature trees
01/02/22 – 02/02/22	Mulch deliveries	Remaining mulch delivered to EPEC zone.
21/02/22 – 24/02/22	Mulch spreading	Machine spreading of mulch in EPEC.
03/03/22 – 13/03/22	Watering	Watering of mature trees (CPEC), WPEC and QD zones fortnightly. Total 6,000L used per event.
21/03/22 – 28/04/22	Weed control	Weed control (Remaining summer-22 treatment) across all 2021 and 2022 revegetation sites. Manual, chemical and mechanical control. Additional woody weed control CPEC and SPEC.
28/04/22 – 06/05/22	Tree Guard Maintenance	Tree guard maintenance and removal along CPEC. Approx. 3,500 guards removed.
20/04/22 – 18/05/22	Matting	Installation of 1,500m² of coir mesh installed along QE Ave Swale.
20/05/22 – 23/05/22	Seedling deliveries	Delivery of seedlings for 2022 planting works. Estimated final numbers at 45,785
01/05/22 – 23/05/22	Monitoring	Autumn-22 field vegetation monitoring.
02/06/22 – 29/06/22	Weed control	4x weed control events across QD, QE Ave swale, Central PEC & Eastern PEC. Inc. herbicide spraying and manual removal.
07/06/22 – 13/07/22	Planting and tree guard installation	Installation of seedlings to QD (infill), QE Ave Swale, Central PEC (infill) & Eastern PEC. Totals provided in attachment. Planting included augering/ripping & fertiliser tablet supply & install. Approx. 6k tree guards installed in selected areas
10/06/22 – 15/06/22	Tree guard maintenance	Removal of selected guards across Central PEC. Approx. 5,000 guards removed.
09/06/22 – 30/06/22	Fencing	Installation of 1,685lm of herbivore protection fencing across Eastern PEC.
01/06/22 – 01/07/22	Monitoring Reporting	Data input and draft report preparation (to be submitted).
20/07/22 11/08/22 – 15/08/22 01/09/22 – 14/09/22 27/09/22 – 30/09/22 18/10/22 – 19/10/22 24/10/22 – 26/10/22 08/11/22 14/11/22 28/11/22	Weed Control (16 days – 376hrs)	On-going management of weeds using various methods (manual, mechanical, herbicide) across all active revegetation areas: QD, WPEC, CPEC, EPEC, Possum Corridor). Very high seasonal weed abundance due to cooler conditions resulted in a protracted growing season for winter / spring weeds.
05/08/22 09/08/22 16/09/22 14/10/22 03/11/22 07/11/22	Tree Guard Removal	All guards progressively removed from CPEC and WPEC. Decision was made to remove all remaining guards in these areas due to vandalism and public concerns from plastic waste.

01/08/22 – 02/08/22 12/09/22 – 13/09/22	Levee weed management (selective herbicide spraying)	Broadleaf selective boom spraying of all external levee banks adjacent to revegetation sites.
05/10/22 – 12/10/22 27/10/22 14/11/22 – 15/11/22	Levee Weed Management (slashing)	Mechanical slashing of external levee banks adjacent to revegetation sites.
18/10/22 – 21/10/22	2023 Seedling orders	Developed planting plan and confirmed seedling orders for 2023.
02/11/22 – 04/11/22	Spring 2022 Monitoring	Field monitoring of all revegetation sites. Data analysis and report to be completed.
06/12/22	Sign installation	Revegetation signs installed at strategic locations across revegetation sites.
05/01/23 & 16/01/23	Brushwall installation	Installation of matting and brushwall section on VDD Embankment.
17/01/23 – 18/01/23	Levee weed control	Slashing of all external levee embankments
25/01/23	Monitoring and reporting	Spring 2022 monitoring report submitted 25/01/23
06/12/22 03/01/23 – 11/01/23 01/02/23 – 02/02/23 24/02/23 – 28/02/23	Weed control (10 days – 189 hours	On-going management of weeds using various methods (manual, mechanical, herbicide) across all active revegetation areas. Additional woody weed control in Possum Corridor and Southern PEC.
18/01/23 – 20/01/23 27/02/23 – 28/02/23 (16/12/22 – 25/02/23)	Watering (2x site-wide events) & 6x QE Ave swale	Watering of mature trees (CPEC) and active revegetation zones. Additional fortnightly watering QE Ave swale (tanker).
09/12/22 19/01/23	Possum Infrastructure maintenance	Infrastructure assessment with arborist and adjustments to rope bridges (College Ave).
01/03/23 – 08/03/23 23/03/23 – 03/04/23 14/04/23 28/04/23 – 02/05/23	Weed control (8 days; 180 hrs)	On-going management of weeds using various methods (manual, mechanical, herbicide) across all active revegetation areas: QD, WPEC, CPEC, EPEC, Possum Corridor).
13/03/23	Tree guard removal	All remaining guards in EPEC removed.
27/04/23 – 28/04/23	Slashing Levees	Slashing levees in areas adjacent to reveg sites
01/03/23 – 01/04/23	Watering (3x sitewide events + QE Ave additional)	Watering of mature trees (CPEC) and active revegetation zones. Additional weekly watering QE Ave swale (tanker).
11/05/23 – 12/05/23	Mulch installation (QD/QE Ave & Donovan Property)	Supply and spread of 110m³ of mulch across additional area between QE Ave swale & Donovan's property.
17/04/23 – 21/04/23	Fencing	Installed 1640 linear metres of fencing, including service location / pot-holing, significant hand digging, gates and corner strainers due to site restrictions / limitations. No rabbit skirt was included due to no feasible means to fully encapsulate area. Additional budget in Stg2 utilised to supplement separate PO for SPEC Fencing and Access works.
19/05/23	Seedling supply	Remaining value for supply of seedlings for 2023 installation.

23/05/23-24/05/23; 13/07/23	Levee Weed control	Removal of shrubs from levee and slashing works to external levee banks (CPEC)
28/05/23 – 28/06/23	Weed control (6 days; 132.5hrs)	Herbicide spot spraying and manual removal - all active revegetation sites
11/07/23 – 27/07/23	Seedling planting	15,067 seedlings installed (inc. augering & fertiliser) to QD, WPEC, CPEC and EPEC (refer to attached planting table)
23/07/23	Possum bridge maintenance	Repair to broken rope bridge. Additional adjustment to increase height.
07/08/23 – 14/08/23 11/09/23 – 18/09/23	Weed control (9x days – 214.5hrs)	Herbicide spraying and manual weed control across all active and upcoming (2024) reveg sites.
29/08/23 – 05/09/23	Seedling supply	Arrange and confirm orders for 2024 planting. Total 30,742 seedlings (30% deposit invoice paid).
26/09/23	Levee slashing	Performed final slashing along levee embankment prior to reveg prep.
26/09/23	Levee revegetation materials	Ordered and received 94x coir mesh rolls + pins for installing on levees in 2023. Remainder in 2024.
02/10/23	Mature Trees	Infill planting 16x mature peppermint trees in CPEC.

VDD Upgrade Revegetation 2023 Final Planting List

Species	Quindalup Dune Open	Quindalup Dune Restoration	Western PEC Restoration (sun)	Western PEC Restoration (shade)	Central PEC Restoration (upper)	Central PEC Restoration (lower)	Eastern PEC Low Fuel (infill)	Eastern PEC Low Fuel (inital)	Eastern PEC Open	Eastern PEC Restoration	Eastern PEC Restoration (college)	Total
Tree Species												
Banksia grandis					63							**63**
Banksia littoralis						63						**63**
Corymbia calophylla					72							**72**
Eucalyptus decipiens					63							**63**
Eucalyptus rudis						72						**72**
Sub-Total	**0**	**0**	**0**	**0**	**198**	**135**	**0**	**0**	**0**	**0**	**0**	**333**
Shrub Species												
Acacia pulchella			250	63	311				150	500	126	**1,400**
Acacia stenoptera			240	80	280				228	420	80	**1,328**
Adenanthos meisneri					40						40	**80**
Chorizema diversifolium			80							120		**200**
Daviesia physodes			100		200				80	180	40	**600**
Diplolaena dampieri		63										**63**
Hakea prostrata					63							**63**
Hakea varia					63							**63**
Hibbertia cuneiformis			160	80	280						80	**600**
Hibbertia racemosa			160	40	270						80	**550**
Jacksonia furcellata					63				126	126	63	**378**
Kunzea glabrescens					144							**144**
Logania vaginalis			40							160		**200**
Lysiandra calycinus	160	280	160	240	200				320	480	80	**1,920**
Pimelea argentea	40	120										**160**
Pimelea sylvestris			40	40						80		**160**
Spyridium globulosum			72	72						0		**144**
Sub-Total	**200**	**463**	**1,302**	**615**	**1,914**	**0**	**0**	**0**	**904**	**2,066**	**589**	**8,053**
Herbs and Groundcover Species												
Conostylis aculeata					126							**126**
Dampiera alata									80	120	80	**280**
Dampiera linearis				126					126	126	126	**504**
Dianella brevicaulis					100		120	40	80	120	40	**500**
Hardenbergia comptoniana					165		126	63			63	**417**
Kennedia prostrata				200	126		389	63	630	492	126	**2,026**
Lomandra preissii			40	40					160	220	40	**500**
Patersonia occidentalis			0		63			63				**126**
Scaevola calliptera			0	126			189	63	461	400	63	**1,302**
Sub-Total	**0**	**0**	**40**	**492**	**580**	**0**	**824**	**292**	**1,537**	**1,478**	**538**	**5,781**
Rushes and Sedges												
Baumea juncea						200				200		**400**
Gahnia trifida						160			140	200		**500**
Sub-Total	**0**	**0**	**0**	**0**	**0**	**360**	**0**	**0**	**140**	**400**	**0**	**900**
TOTAL	**200**	**463**	**1,342**	**1,107**	**2,692**	**495**	**824**	**292**	**2,581**	**3,944**	**1,127**	**15,067**

tranen revegetation southwest







Vasse Diversion Drain Upgrade Revegetation – Water Corporation

Post Activity Report #22: January – March 2024

Activity Date(s):	01/01/24 – 31/03/24	**Conducted By:**	Alex Johnston
Site Reference:	VDD Upgrade Revegetation	**Reviewed By:**	Matt Blunt
Area (ha):	14.5ha		

Action Taken

Date(s):	Activity	Description
22/02/24 – 12/03/24	Embankment matting	Installation of remaining 2,965m² of coir matting. Associated weed control and monitoring of vegetation.
03/01/24 – 20/03/24	Weed control (12 days; 112hrs)	Herbicide and manual weed control across all sites.
22/01/24 – 28/03/24	Watering (6x events)	Watering QE Ave swale (tanker), CPEC and QD. Inc. liquid fertiliser application
05/01/24 – 19/01/24	Embankment maintenance	Minor repairs to embankment matting. Inc. some additional peripheral to scope works: slashing, mulch trimming, tree guard removal.
14/02/22 – 13/02/24	Seed collection and processing	Total of 38 collection days over two seasons (2022-23 & 2023-24). Total seed collected >6kg from 49 species. refer to attached seed bank report.
01/01/24 – 31/03/24	Seedling supply	Managing seedling supply and coordinating with nurseries for 2024 planting.

Recent site photos available on the C-D00116 Revegetation Work Sharefile

Previous Action Taken

Date(s):	Activity	Description
26/10/20 – 05/11/20	Vegetation salvage	Selective removal, transport and initial propagation of native species within clearing area. Performed in collaboration with Aboriginal businesses and GCLN.
26/10/20 – 02/11/20	Pathway construction and hardstand removal	Installation of 150m x 2m crushed limestone pathway through Quindalup Dune Zone. Removal and stockpiling of gravel material from former Water Corp Depot for later removal and replacement with appropriate topsoil.
14/10/20 – 15/10/20	Baseline monitoring	Performed baseline monitoring of all revegetation zones. 34 quadrats and 34 photo monitoring points + bushland condition monitoring.
01/10/20 – 20/11/20	Plant and embankment material procurement	Procurement and delivery of all embankment materials for future works. Confirmation of tubestock and mature tree orders for 1st year planting in 2021.
24/11/20 – 08/12/20	Brushlog fabrication	Construction of 300 Brushlog units. Pre-fabrication prior to install for safe and efficient transport and installation.
24/11/20 – 24/12/20	Weed control	Selective herbicide application, hand weeding and slashing. Focus on areas planned for revegetation in 2021.
24/11/20 – 21/12/20	Embankment regrading	Mechanical and manual regrading of embankments, exotic tree stump removal and various green waste removal.
26/11/20 – 23/12/20	Matting	Installed over 800m² of coir mesh across the western VDD Embankment zone.
02/12/20 – 23/12/20	Brushwall installation	50m Initial section of brushwall installed on western bank + 20m of embankment palisade.
04/01/21 – 21/01/21	Weed control	Manual, mechanical and chemical weed control along VDD embankments.
11/01/21 – 15/01/21	Brushwalling	Installation of 110lm of brushwall along western bank + 65lm of mid-slope brush palisade. Total brushwall is now 160lm + 85lm of brush palisade.
13/01/21 – 15/01/21	Matting	Installation of 1,200m² of coir mesh matting. Total matting area is now approx. 2,000m²
13/01/21 – 19/01/21	Weed control	Selective and targeted follow-up herbicide spraying across a number of revegetation areas.
19/01/21 – 18/02/21	Local provenance material collections	Establishment of project seed bank and selective collections of provenance seed from nearby reserves. 12 man-days completed in total. Partial processing of collected seed and seed bank storage as required. See attached status report.
22/01/21 – 22/02/21	Weed control	Follow-up herbicide application to areas to be revegetated in 2021.
22/01/21 – 08/02/21	Embankment regrading and matting	Continuation of bank preparation and matting on western embankment (200m²) and majority of eastern embankment (800m²). Total matting and embankment preparation areas is now approx. 3,000m²
22/01/21 – 22/02/21	Baseline monitoring report	Preparation and submission of baseline monitoring report. This report provides further definition of completion criteria and an overview of site conditions prior to commencement of on-ground works.

08/01/21 – 11/02/21	Relocation and respreading topsoil	Relocation of soil stockpiles in the Quindalup Dune zone to allow for ACM removal. Respreading soil following confirmation of ACM removal.
04/02/21 – 22/02/21	Mulch procurement and site preparation planning	Confirm mulch order and deposit for material. Planning for distribution and logistics of mulch cartage and stockpiling. Coordination and confirmation of machinery for spreading.
09/02/21 – 12/02/21	Aboriginal engagement – Roelands Village	Contribution to four days of machinery operation training for Roelands Village civil construction trainees. The works were undertaken to assist the Geographe Community Landcare Nursery increase nursery capacity to accommodate additional requirements for the project.
11/02/21 – 18/02/21	Greenwaste and woody weeds	Clearing and removal of Greenwaste (weed and dead material). 30m³ of weed material disposed of at waste facility and over 100m³ stockpiled on site for future removal and respreading of larger logs for habitat.
17/02/21	Aboriginal engagement – Undalup Association	On-country meeting and consultation with Cultural Custodians to discuss the project scope for the development of cultural / biodiversity nodes within the site. Confirmation to commence works 12/02/21.
23/02/21 – 23/03/21	Weed control	Weed control across various revegetation zones. Re-treating WPEC, CPEC, EPEC & QD zones. Herbicide spraying, manual and woody weeds
03/03/21 – 09/03/21	Palisade construction	Construction and completion of 3x palisade areas along the western embankment.
12/03/21 – 19/03/21	Aboriginal engagement	Two days of Undalup's indigenous ranger team (x3) performing site preparation tasks (weed control, rubbish removal and fuel load reduction) in the Southern PEC zone. Additional reporting to be provided in the next period.
17/03/21 – 22/03/21	Mulch installation	675m³ of mulch supplied and spread (mechanical and manual) across 9,000m² of the eastern PEC zone.
24/03/21 – 25/05/21	Weed control	On-going follow-up weed control across various revegetation zones. Re-treating WPEC, CPEC, EPEC & QD zones. Herbicide spraying, manual and woody weeds
24/03/21 – 07/05/21	Aboriginal engagement – Wadandi Rangers	On-going support for site works from Undalup Association's Wadandi rangers both on site and at GCLN. Please see attached progress reports from Undalup.
19/04/21 – 23/04/21	Ripping	Soil ripping via tractor mounted tine across Central PEC and Quindalup Dune revegetation zones. Approx. 1.5 ha covered.
13/05/21 – 21/05/21	Mulch installation	315m³ of mulch supplied and spread (mechanical and manual) across 6,000m² of the Quindalup Dune zone.
24/03/21 – 25/05/21	Procurement	Purchase and delivery of corflute tree guards, stakes and root barrier.
27/05/21	Procurement: Tree stake supply	Supply of all hardwood stakes (1800x50x50mm) for mature trees.
04/06/21 & 17/06/21	Weed control	On-going weed control focussing on the QD and VDD Embankment areas prior to planting
22/06/21 – 24/06/21	Procurement: Seedling supply	Supply of all seedlings (exc. lower embankment) for the Quindalup Dune and VDD Embankment zones. Total number of seedlings: 23,610

01/07/21	Matting	Completion of matting along the final section (700m²) of the VDD Embankment near the pedestrian bridge.
05/07/21 - 19/07/21	Planting	21,543 seedlings installed in the QD and VDD Embankment zones. Lower Embankment to be planted in spring. Refer to table attached for details.
08/07/21	Ripping	0.5ha of the Western PEC zone (Corner of College Ave / QE Ave) was ripped prior to mulch spreading.
12/07/21 - 16/07/21	Mulching	Mechanical spreading of mulch across the Central and Western PEC zones. Total of 7,000m² spread. Further manual spreading / trimming to be completed.
12/07/21	Tree removal and greenwaste removal	Removal of unstable tree at the Donovan property and removal of greenwaste from the Western PEC zone.
21/07/21 - 22/07/21	Plant deliveries and batching	Delivery and batching of remaining seedlings for 2021. See attached table for details
22/07/21 - 23/07/21	Fencing	QD and Embankment zone post & rail and public management fencing completed.
25/06/21 - 22/07/21	Weed control	Various follow-up herbicide weed control undertaken where possible, including: QD, VDD Embankments, Western PEC, Central PEC, Eastern PEC and Western Basin PEC.
25/06/21 - 22/07/21	Aboriginal engagement - Undalup Association	Undalup Wadandi Rangers assisting Geographe Community Landcare Nursery preparing stock for the project and assisting with capacity upgrades.
27/07/21	Slashing VDD Levees (separate PO)	Manual slashing (brushcutter) of VDD levee external banks adjacent to revegetation areas. Performed under separate work order.
27/07/21 - 28/07/21	Mulch spreading (manual)	Final manual trim of mulched areas in Central PEC and Western PEC planting areas. Additional assistance provided by Undalup Association.
30/07/21 - 13/08/21	Aboriginal engagement	Assistance with manual spreading of mulch at Western PEC. 2 days (30/08 & 13/08).
03/08/21 - 18/08/21	Weed control	Targeted spot spraying within 2021 planting sites over 4 days. Additional retreatment of 2022 planting sites (EPEC, Possum Corridor) blanket spraying.
05/08/21 - 20/08/21	C. procera monitoring	Commenced monitoring growth and health of known & reference populations of C. procera adjacent to construction boundary.
09/08/21 - 10/08/21	WPEC fencing	324m of fencing installed around Western PEC Restoration Zone. Inc. 1.2m ringlock + 900mm rabbit mesh skirt. 2m clearance from base of levee.
13/08/21	Mulch spreading	Transport and spreading of mulch from WPEC to QD Zone eastern bank.
13/08/21 - 19/08/21	Mature trees install	Install 214 mature trees along pathway in CPEC. Included root barrier, soil conditioner, Terracottem, mulching, stakes and ties.
23/08/21	CPEC planting	Commencement of planting along CPEC inc. tree guards and fertiliser tablets. Final planting list included below.
24/08/21 - 21/09/21	Weed control	Follow-up herbicide application to areas to be revegetated in 2021.

25/08/21 - 10/09/21	Planting and guard install	Install remaining plants and guards in CPEC and Western PEC Restoration Zone. Total of 14,617 plants and 11,261 guards installed.
30/08/21 - 13/09/21	Planting and guard install (Undalup Association)	Installation of plants and guards in WPEC Open zone. Total of 3,149 plants and 2,539 guards installed.
13/09/21 - 21/09/21	Planting and guard install (Undalup Association)	Installation of plants and guards in CPEC swale zone. Total of 6,000 plants installed in swale.
23/09/21	Tree install	Plant remaining mature tree in QD Zone and install signage.
(05/08/21) - 13/10/21	C. procera monitoring	Weekly inspections and recording of *Caladenia procera* population within the SPEC. Inspections conducted from August to October.
1/10/21	Weed control; tree guard maintenance	Manual and herbicide weed control. Removal and reinstatement of damaged tree guards. Central PEC
04/10/21	Weed control	Manual and herbicide weed control. QD & Western PEC.
14/10/21	Weed control	Manual and herbicide weed control. QD
20/10/21 - 21/10/21	Levee slashing	1/12 slashing of levee external embankments adjacent to revegetation sites.
21/10/21	Weed control	Manual and herbicide weed control. Western PEC
25/10/21 - 26/10/21	Planting	Completed planting of lower VDD Embankments (3,500 plants total).
10/11/21 - 11/11/21	Weed control	Manual and herbicide weed control. QD, WPEC & CPEC
10/11/21 & 15/11/21	Palisade construction	4/4 palisade area construction in Quindalup Dune.
16/11/21 - 17/11/21	Monitoring	Quadrat set-up and monitoring of all revegetation areas
20/11/21 - 30/11/21	Plant orders	Developing and ordering the tubestock planting list for 2022. 30% deposit required upfront to secure orders.
06/12/21 - 14/12/21	Weed control	Manual and herbicide weed control. QD, WPEC, CPEC and Eastern PEC.
06/12/21	Watering	Watering of all mature tree in CPEC. Total of 4000L
21/12/21; 4/01/22; 17/1/22	Watering (3x events)	Watering of mature trees (CPEC), WPEC and QD zones fortnightly. Total 12,000L used. Watering of BayOK included 17/01
22/12/21 - 18/01/22	Weed control (3x events)	Weed control (covering Spr-21 treatment) was utilised across all 2021 and 2022 revegetation sites. Manual, chemical and mechanical control.
07/01/22 & 19/01/22	Mulch deliveries and site preparation	Additional site preparation in EPEC and delivery of 210m^3 of mulch delivered to site.
17/12/21 - 24/12/21	Plant procurement	Completion of plant procurement for 2022 including Stage 3 plants. 45,785 total plants
04/01/22 - 20/01/22	Monitoring / reporting	Processing and analysis of monitoring data and drafting of report.
18/10/21 – 22/10/21	Levee selective herbicide spraying	Selective spraying of broadleaf weeds on levees adjacent to reveg sites.
20/10/21 & 29/10/21; 02/11/21; 02/02/22; 08/02/22	Levee slashing (5x events (partially included in previous reports)	Spring 2021 and summer 2022 slashing. Brushcutting all external levee embankments adjacent to reveg areas.

25/01/22; 31/01/22; 04/02/22; 09/02/22; 17/02/22; 19/02/22	Weed control (6x events	Weed control (Summer-22 treatment) across all 2021 and 2022 revegetation sites. Manual, chemical and mechanical control.
03/02/22; 15/02/22 – 16/02/22	Watering	2x watering events over Feb-22. CPEC, WPEC and QD seedlings and mature trees
01/02/22 – 02/02/22	Mulch deliveries	Remaining mulch delivered to EPEC zone.
21/02/22 – 24/02/22	Mulch spreading	Machine spreading of mulch in EPEC.
03/03/22 – 13/03/22	Watering	Watering of mature trees (CPEC), WPEC and QD zones fortnightly. Total 6,000L used per event.
21/03/22 – 28/04/22	Weed control	Weed control (Remaining summer-22 treatment) across all 2021 and 2022 revegetation sites. Manual, chemical and mechanical control. Additional woody weed control CPEC and SPEC.
28/04/22 – 06/05/22	Tree Guard Maintenance	Tree guard maintenance and removal along CPEC. Approx. 3,500 guards removed.
20/04/22 – 18/05/22	Matting	Installation of 1,500m² of coir mesh installed along QE Ave Swale.
20/05/22 – 23/05/22	Seedling deliveries	Delivery of seedlings for 2022 planting works. Estimated final numbers at 45,785
01/05/22 – 23/05/22	Monitoring	Autumn-22 field vegetation monitoring.
02/06/22 – 29/06/22	Weed control	4x weed control events across QD, QE Ave swale, Central PEC & Eastern PEC. Inc. herbicide spraying and manual removal.
07/06/22 – 13/07/22	Planting and tree guard installation	Installation of seedlings to QD (infill), QE Ave Swale, Central PEC (infill) & Eastern PEC. Totals provided in attachment. Planting included augering/ripping & fertiliser tablet supply & install. Approx. 6k tree guards installed in selected areas
10/06/22 – 15/06/22	Tree guard maintenance	Removal of selected guards across Central PEC. Approx. 5,000 guards removed.
09/06/22 – 30/06/22	Fencing	Installation of 1,685lm of herbivore protection fencing across Eastern PEC.
01/06/22 – 01/07/22	Monitoring Reporting	Data input and draft report preparation (to be submitted).
20/07/22 11/08/22 – 15/08/22 01/09/22 – 14/09/22 27/09/22 – 30/09/22 18/10/22 – 19/10/22 24/10/22 – 26/10/22 08/11/22 14/11/22 28/11/22	Weed Control (16 days – 376hrs)	On-going management of weeds using various methods (manual, mechanical, herbicide) across all active revegetation areas: QD, WPEC, CPEC, EPEC, Possum Corridor). Very high seasonal weed abundance due to cooler conditions resulted in a protracted growing season for winter / spring weeds.
05/08/22 09/08/22 16/09/22 14/10/22 03/11/22 07/11/22	Tree Guard Removal	All guards progressively removed from CPEC and WPEC. Decision was made to remove all remaining guards in these areas due to vandalism and public concerns from plastic waste.

01/08/22 – 02/08/22 12/09/22 – 13/09/22	Levee weed management (selective herbicide spraying)	Broadleaf selective boom spraying of all external levee banks adjacent to revegetation sites.
05/10/22 – 12/10/22 27/10/22 14/11/22 – 15/11/22	Levee Weed Management (slashing)	Mechanical slashing of external levee banks adjacent to revegetation sites.
18/10/22 – 21/10/22	2023 Seedling orders	Developed planting plan and confirmed seedling orders for 2023.
02/11/22 – 04/11/22	Spring 2022 Monitoring	Field monitoring of all revegetation sites. Data analysis and report to be completed.
06/12/22	Sign installation	Revegetation signs installed at strategic locations across revegetation sites.
05/01/23 & 16/01/23	Brushwall installation	Installation of matting and brushwall section on VDD Embankment.
17/01/23 – 18/01/23	Levee weed control	Slashing of all external levee embankments
25/01/23	Monitoring and reporting	Spring 2022 monitoring report submitted 25/01/23
06/12/22 03/01/23 – 11/01/23 01/02/23 – 02/02/23 24/02/23 – 28/02/23	Weed control (10 days – 189 hours	On-going management of weeds using various methods (manual, mechanical, herbicide) across all active revegetation areas. Additional woody weed control in Possum Corridor and Southern PEC.
18/01/23 – 20/01/23 27/02/23 – 28/02/23 (16/12/22 – 25/02/23)	Watering (2x site-wide events) & 6x QE Ave swale	Watering of mature trees (CPEC) and active revegetation zones. Additional fortnightly watering QE Ave swale (tanker).
09/12/22 19/01/23	Possum Infrastructure maintenance	Infrastructure assessment with arborist and adjustments to rope bridges (College Ave).
01/03/23 – 08/03/23 23/03/23 – 03/04/23 14/04/23 28/04/23 – 02/05/23	Weed control (8 days; 180 hrs)	On-going management of weeds using various methods (manual, mechanical, herbicide) across all active revegetation areas: QD, WPEC, CPEC, EPEC, Possum Corridor).
13/03/23	Tree guard removal	All remaining guards in EPEC removed.
27/04/23 – 28/04/23	Slashing Levees	Slashing levees in areas adjacent to reveg sites
01/03/23 – 01/04/23	Watering (3x sitewide events + QE Ave additional)	Watering of mature trees (CPEC) and active revegetation zones. Additional weekly watering QE Ave swale (tanker).
11/05/23 – 12/05/23	Mulch installation (QD/QE Ave & Donovan Property)	Supply and spread of 110m³ of mulch across additional area between QE Ave swale & Donovan's property.
17/04/23 – 21/04/23	Fencing	Installed 1640 linear metres of fencing, including service location / pot-holing, significant hand digging, gates and corner strainers due to site restrictions / limitations. No rabbit skirt was included due to no feasible means to fully encapsulate area. Additional budget in Stg2 utilised to supplement separate PO for SPEC Fencing and Access works.
19/05/23	Seedling supply	Remaining value for supply of seedlings for 2023 installation.

23/05/23-24/05/23; 13/07/23	Levee Weed control	Removal of shrubs from levee and slashing works to external levee banks (CPEC)
28/05/23 – 28/06/23	Weed control (6 days; 132.5hrs)	Herbicide spot spraying and manual removal - all active revegetation sites
11/07/23 – 27/07/23	Seedling planting	15,067 seedlings installed (inc. augering & fertiliser) to QD, WPEC, CPEC and EPEC (refer to attached planting table)
23/07/23	Possum bridge maintenance	Repair to broken rope bridge. Additional adjustment to increase height.
07/08/23 – 14/08/23 11/09/23 – 18/09/23	Weed control (9x days – 214.5hrs)	Herbicide spraying and manual weed control across all active and upcoming (2024) reveg sites.
29/08/23 – 05/09/23	Seedling supply	Arrange and confirm orders for 2024 planting. Total 30,742 seedlings (30% deposit invoice paid).
26/09/23	Levee slashing	Performed final slashing along levee embankment prior to reveg prep.
26/09/23	Levee revegetation materials	Ordered and received 94x coir mesh rolls + pins for installing on levees in 2023. Remainder in 2024.
02/10/23	Mature Trees	Infill planting 16x mature peppermint trees in CPEC.
19/10/23 – 31/10/23 & 14/11/23 – 27/11/23	Weed control (12x days – 193 hrs)	Herbicide spraying and manual weed control across all active and upcoming (2024) reveg sites.
24/10/23 – 27/10/23	Levee vegetation removal	Removal, treatment and mulching of all shrubs along southern VDD levee embankment and base clearance area.
15/11/23 & 29/11/23	Revegetation monitoring	Spring field monitoring. Data and report to be completed but preliminary results very positive
31/10/23 – 13/12/23	Levee matting	Matting external levee embankments adjacent to reveg areas: WPEC & CPEC. Total of 6,635m² complete. Remaining area of 2,965m² to be complete in 2024.
28/11/23	Watering	Hand watering of mature trees and reveg along CPEC.
7/11/23, 22/11/23 & 24/11/23	Seed & cutting collection / processing	6 staff days of provenance collections to commence season. Additional reporting will be provided following completion of processing.

Seed Collected To Date By Project - Species Total

Project ID: P875C **Project Name:** VDD Upgrade Revegetation Implementation

Species	Total Weight (g)	Total Batches	Batches Processed
Acacia cochlearis	20.0	1	1
Agrostocrinum hirsutum	96.5	3	3
Agrostocrinum scabrum	7.4	2	2
Alyxia buxifolia	603.0	1	1
Anigozanthos manglesii	383.7	7	7
Austrostipa flavescens	3.3	3	2
Austrostipa semibarbata	13.5	1	1
Austrostipa sp.	26.7	3	3
Burchardia congesta	53.3	7	7
Cassytha pomiformis	2.9	1	1
Chamaescilla corymbosa	52.3	3	3
Clematis pubescens	8.7	1	1
Corymbia calophylla	174.0	1	1
Daviesia physodes	0.1	1	1
Dianella brevicaulis	7.5	1	1
Dichopogon capillipes	106.7	4	4
Diplolaena dampieri	6.6	1	1
Eucalyptus decipiens	126.2	2	2
Eucalyptus rudis	122.2	3	3
Gompholobium capitatum	0.1	1	1
Gompholobium tomentosum	24.2	3	3
Hakea lissocarpha	50.1	3	3
Hakea prostrata	2.3	1	1
Hakea varia	45.9	2	2
Hardenbergia comptoniana	234.0	1	1

Seed Collected To Date By Project - Species Total

Project ID: P875C **Project Name:** VDD Upgrade Revegetation Implementation

Species	Total Weight (g)	Total Batches	Batches Processed
Hovea trisperma	13.9	4	4
Hypolaena exsulca	0.8	1	1
Jacksonia furcellata	11.1	2	2
Kennedia coccinea	83.2	1	1
Kennedia prostrata	256.2	3	3
Lepidosperma squamatum	11.0	2	2
Leucopogon parviflorus	0.8	1	1
Lomandra caespitosa	3.4	1	1
Lomandra micrantha	190.3	4	4
Lomandra nigricans	0.4	1	1
Lomandra preissii	0.2	2	2
Lysiandra calycina	408.4	3	3
Phlebocarya ciliata	11.4	1	1
Pimelea rosea	78.3	4	4
Rytidosperma caespitosum	0.3	1	1
Sowerbaea laxiflora	5.5	3	3
Stackhousia monogyna	126.3	3	3
Thysanotus patersonii	0.2	2	2
Thysanotus sparteus	0.2	1	1
Tricoryne elatior	69.0	2	2
Tripterococcus brunonis	21.4	5	5
Xanthorrhoea brunonis	2,020.0	2	2
Xanthorrhoea gracilis	420.0	1	1
Xanthorrhoea preissii	532.2	2	2

Seed Collected To Date By Project - Species Total

Project ID: P875C **Project Name:** VDD Upgrade Revegetation Implementation

Overall Totals	**6,435.7**	**109**	**108**

Total no. of Species: **49**

tranen
revegetation southwest



Vasse Diversion Drain Upgrade Revegetation
Autumn 2023 Vegetation Monitoring Report

Water Corporation

P875C-08-Rev0

September 2023

PERTH

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1 INTRODUCTION

The Vasse Diversion Drain (VDD) is a 100-year-old strategic infrastructure corridor, constructed in the 1920s to create more arable land in the catchment. Its primary function now, is to prevent flooding of the Busselton Township. Water Corporation have upgraded the drain and associated infrastructure to better accommodate future flood events.

The upgrade works required the clearing of 2.16 ha of existing vegetation, much of which was in a degraded state, although some of which is classified as locally and nationally significant habitat.

Tranen Revegetation Southwest (Tranen) was commissioned by Water Corporation to prepare a Revegetation Plan for environmental offset works across approximately 14 ha related to the Vasse Diversion Drain (VDD) Upgrade Project CPS8191/1.

The revegetation works have the following objectives:

1. Mitigate the effects of vegetation clearing within the local area and maximise local environmental benefits
2. Build on existing and previous successful environmental enhancement projects undertaken locally
3. Enhance habitat for the western ringtail possum (WRP) and provide connectivity between areas of local distribution, and
4. Facilitate better connection and engagement between the local environment and community.

The overarching strategy for the revegetation works is to re-create naturally occurring and connected vegetation communities that are appropriate for their geographic location, support long-term ecological function and provide suitable habitat for critical species.

The revegetation plan was designed to consider key management requirements for native vegetation in an urban context. Due to a number of factors requiring consideration, additional layers of complexity were inherent in the development of an appropriate revegetation strategy.

The revegetation seeks to progressively establish focal areas of high biodiversity, with native vegetation forming a discontinuous mosaic-like corridor of variable structural composition and biological complexity, to reflect natural vegetation community structure. The offset sites are to be maintained for a minimum of ten years to ensure that a long-term sustainable outcome is achieved.

1.1 Current Project Status

Revegetation works commenced in spring 2020. This is the fifth vegetation monitoring report prepared for the project, the first of which was a baseline survey completed in spring 2020, prior to clearing works.

Revegetation works are being undertaken over several years due to the variable completion timing of staged construction works, and the offset sites covering variable conditions and environments.

The data presented in this report provides an indication of progress towards meeting the completion criteria and is a means to demonstrate if the project is currently on the correct trajectory to meeting these targets by the end of the ten-year monitoring and maintenance period.

Table 1 Revegetation Site Status Autumn 2023

Item	Zone	Site Preparation	Initial Planting	Monitoring Quadrat(s)
1.0	Zone 1 - Quindalup Dune	Complete	Complete	Q1 - Q4
2.0	Zone 2 - VDD Embankments	Complete	Complete	Q5 - Q8
3.0	Zone 3 - QE Ave Swale	Complete	Complete	Q9 - Q11
4.0	Zone 4 - PEC Upland			
4.1	Zone 4.1 - Possum Corridor PEC	Commenced	Not Commenced	Q15 - Q17
4.2	Zone 4.2 - Western PEC	Complete	Commenced	Q12 - Q14
4.3	Zone 4.3 - Central PEC	Complete	Complete	Q18 - Q20
4.4	Zone 4.4 - Eastern PEC	Complete	Complete	Q21 - Q31
4.5	Zone 4.5 - Southern PEC	Commenced	Not Commenced	N/A
5.0	Zone 5 - Drainage PEC			
5.1	Zone 5.1 - Western Basin PEC	Complete	Complete	Q32
5.2	Zone 5.2 - Southern Swale PEC	Commenced	Not Commenced	Q33 - Q34

1.2 Project Background

The project area (the "site") is separated into five key management zones based on existing and expected (in degraded areas) vegetation communities. Some are further broken down into sub-zones with different management and rehabilitation strategies.

Initial revegetation quantities and planting densities for these zones were determined based on the pre-existing native vegetation cover and the percentage of each zone available for intensive revegetation works. These are summarised as follows:

- Zone 1 – Quindalup Dune
- Zone 2 – VDD Embankments
- Zone 3 – Queen Elizabeth Avenue Swale (QE Ave Swale)
- Zone 4 – PEC Upland
    - Zone 4.1 – Possum Corridor PEC
    - Zone 4.2 – Western PEC
    - Zone 4.3 – Central PEC
    - Zone 4.4 – Eastern PEC
    - Zone 4.5 – Southern PEC
- Zone 5 – Drainage PEC
    - Zone 5.1 – Western Basin PEC, and
    - Zone 5.2 – Southern Swale PEC.

Prior to the commencement of revegetation works, Tranen undertook a baseline vegetation survey to establish monitoring quadrats across the revegetation areas and perform an assessment of vegetation condition. These quadrats were established temporarily prior to commencing of civil works and have been reinstated following completion of these works in the same location where possible. A subsequent ten-year monitoring program commenced in spring 2021, with monitoring undertaken biannually for the first two years and annually for the remaining eight years. The following is a summary of the planned monitoring schedule:

1. Spring 2020 (baseline)
2. Spring 2021
3. Autumn 2022
4. Spring 2022
5. Autumn 2023 – Current assessment
6. Spring 2023
7. Spring 2024
8. Spring 2025
9. Spring 2026
10. Spring 2027
11. Spring 2028
12. Spring 2029
13. Spring 2030, and
14. Spring 2031.

This, the fifth of 14 scheduled assessments, was undertaken between the 23rd and 24th May 2023 by Alex Johnston of Tranen Revegetation Southwest.

1.3 Approval Conditions and Completion Criteria

This project has been assessed Bilaterally by the Department of Water and Environment Regulation (DWER) Native Vegetation branch under Part V of the EP Act [WA] and by the Department of Agriculture, Water and Environment (DAWE) under the EPBC Act 1999 [cth].

The development of this plan has been guided by the approved clearing permit issued by DWER. The permit includes the provision of the Completion Criteria required to be achieved at the end of the project period. The following is an excerpt from Section 17 of the permit:

Table 2 Completion Criteria - DWER Clearing Permit CPS 8191/1

Criterion	Aspect	Scale	Completion Criteria Description	Monitoring Frequency
1	Per cent *weed* cover	Average of *quadrat* data and site traverse	<15 per cent weed cover across all sites	Bi-annually in the first 2 years, and annually for the next 8 years
2	Declared *weeds*	Site traverse	Absence of declared weeds	Bi-annually in the first 2 years, and annually for the next 8 years
3	Per cent bare ground	Average of *quadrat* data and site traverse	Per cent of bare ground to be no greater than that recorded in the *pre clearing surveys*.	Bi-annually in the first 2 years, and annually for the next 8 years
4	Vegetation condition	Site traverse	The condition of the vegetation to be in a good to very good condition on average across the revegetation area (Keighery 1994).	Bi-annually in the first 2 years, and annually for the next 8 years
5	Native vegetation cover/density	Average of *quadrat* data	>70 per cent native cover	Bi-annually in the first 2 years, and annually for the next 8 years
6	Species richness	Average of *quadrat* data	>70 per cent of species planted represented across all sites respectively (PEC, GCWS & QD) as outlined in the species list provided in the Project Revegetation Plan	Bi-annually in the first 2 years, and annually for the next 8 years
7	*Conospermum caeruleum var. Busselton*	Site traverse / direct survival observation	>50 per cent survival rate to be achieved	Bi-annually in the first 2 years, and annually for the next 8 years

1.4 Definition and Clarification of Completion Criteria

Further clarification for the application of the key Completion Criteria has been prepared to precisely define the attributes to be measured and how this will be assessed for the duration of the project period. A summary of the baseline quadrat data and directly comparable applicable Completion Criteria is provided in Appendix 4. The following sections provide the definition and interpretation of criteria with further clarification of how the quantitative data is proposed to be measured and analysed.

1.4.1 Native Vegetation Cover

Native vegetation cover is defined by the projected foliage cover of all living above-ground biomass (including, but not limited to, foliage, reproductive structures and stems) of plants considered indigenous to the given location. This includes overall cover from all representative strata. However, existing mature canopy cover (overstorey) will be excluded from initial assessments so that cover assessments do not misrepresent the progress of rehabilitation efforts. Mature Native Canopy Cover will initially be captured as additional data, but not considered in the Native Vegetation Cover assessments. This data will only be reviewed if it is believed that the established vegetation is affecting progress by competing with and influencing the development of new plants.

Native vegetation cover, as defined above, is measured as a proportional representation of area in percent cover. The requisite Completion Criteria is for >70% cover as a mean percentage cover of all monitoring quadrats.

1.4.2 Weed Cover and Declared Weeds

Weeds are defined as per the Clearing Permit as "*not indigenous to the area concerned*". Cover is defined as per the native vegetation cover interpretation above.

Weed cover as defined above is measured as a proportional representation of area in percent cover. The requisite completion criteria is for <15% cover as a mean percentage cover of all monitoring quadrats. No stem counts, individual species cover, species rankings or similar have been incorporated into the capture of data.

Declared weeds known to exist on site are currently: Arum Lily (*Zantedeschia aethiopica*) and Bridal Creeper (*Asparagus asparagoides* [WONS]). These are assessed for presence / absence during quadrat assessment and will be mapped via site traverse for distribution in future assessments across site annually during growth/reproductive phase (spring).

1.4.3 Bare Ground Cover

Bare ground cover is defined as exposed soil / substrate not covered by native vegetation, weeds, litter, mulch or other organic material measured as a percentage.

The requisite completion criterion for bare ground cover is determined as a mean percentage cover of all monitoring quadrats to be no greater cover than that determined during "pre-clearing surveys". In the absence of this data from previous surveys, the initial baseline data captured during this assessment will become the target going forwards. The Completion Criteria is therefore defined as <16% Bare Ground Cover, as determined during this assessment.

It should be noted that bare ground cover in analogous natural vegetation communities may reflect higher levels of bare ground cover and this is to be considered as part of the overall assessment of this target.

1.4.4 Native Species Richness

Native species richness is defined as the total number of unique native species identified within the monitoring quadrats. The Completion Criteria requires establishment of >70% of species used in the rehabilitation of each distinct vegetation community. The following provides a summary of the requirements for each vegetation community:

Table 3 Completion Criteria – Native Species Richness

Vegetation Community	Total No. Species for Revegetation	No. Species Required (Completion Criteria)
Quindalup Dune (QD)	17	12
Geographe Coastal Wetland System (GCWS)	18	13
Priority Ecological Community (PEC)	48	34
Project Total	66	-

The total number of species for revegetation is based on the primary species list provided in the revegetation plan and overall project totals are not included as part of the completion criteria. Any additional native species indigenous to the area that have self-recruited but are not included in the primary species list will be counted towards the species richness totals.

1.4.5 Vegetation Condition

Vegetation Condition is defined as the rating given to native vegetation in reference to the impact of disturbance on each of the vegetation strata and the ability of the community to regenerate, as per the most widely accepted scale, the “Keighery Vegetation Condition Scale” (Keighery 1994). This scale provides an indicative assessment of vegetation condition across the site, which is subjective based on the survey method, precision and scale of the assessment.

Future assessments of vegetation condition, particularly in the early stages of establishment, will need to be considered in the context of establishing vegetation, as this is difficult to accurately define within the parameters of the Keighery scale. The focus of future assessments will be on the vegetation’s demonstration of successional establishment and progress on a trajectory to ultimately meet the definitions set out in the Keighery scale.

Vegetation condition is to be surveyed at a broad level to determine average condition across defined revegetation areas based on the criteria provided above. The Completion Criteria states a condition of “Good” to “Very Good” on average across the revegetation area, which has been interpreted as >50% of total area classified as “Good” condition or better.

1.4.6 Conospermum caeruleum var. Busselton

The Completion Criterion for *C. caeruleum var. Busselton* is defined by a >50% survival to be achieved and measured through a count of all individuals present. Due to the ambiguity in the wording of the criterion, it is interpreted as a survival rate of >50% for originally planned numbers of the species (300 individuals), which equates to a minimum of 150 individuals surviving at the end of the project period. Mapping of individuals through geospatial data capture will be presented as part of on-going assessments.

2 MONITORING METHODOLOGY

The success of revegetation works is determined through analysing a combination of quantitative and qualitative assessment methodologies. This combined approach provides a comprehensive overview of the trajectory of revegetation works and how this is compares to the completion criteria. Quantitative data is collected through monitoring quadrats and site traverses, with a qualitative assessment undertaken during each assessment event to provide a broader overview of the progress of revegetation works. Photo monitoring of both quadrats and general images of site during traverses will provide additional qualitative information to assist with developing an overall assessment.

2.1 Monitoring Quadrat Establishment

Thirty-four (34) 5 m x 5 m monitoring quadrats were installed on site, with placement determined through a process of stratified random sampling. Quadrat locations were randomly distributed across all key revegetation zones based on their respective area and level of planned revegetation input to ensure adequate representation of revegetation progress across the entire site. The locations of each quadrat are presented on a drawing in Appendix 1.

Each quadrat was marked with galvanised steel droppers in each corner, orientated in a north, south, east, west configuration where possible. The co-ordinates for each quadrat were marked with a GPS at the central point of the quadrat, and the quadrats will be reinstated in the same locations. The co-ordinates for the quadrats and photo points are shown in Table 4.

An image of each quadrat was also taken, orientated to best capture the entire monitoring quadrat and the surround revegetation area, to provide context to the quadrat location and an improved overview of each particular monitoring location.

Table 4 GPS Coordinates of Quadrats in Revegetation Zones

Quadrat GPS Coordinates (GDA 94, MGA Zone 50)			
Quadrat Name	**Easting**	**Northing**	**Revegetation Zone (Composition)**
Q1	344553	6274563	QD Open
Q2	344555	6274502	QD Rest
Q3	344552	6274444	QD Open
Q4	344557	6274372	QD Rest
Q5	344565	6274601	VDD ER
Q6	344571	6274423	VDD ER
Q7	344597	6274682	VDD ER
Q8	344603	6274406	VDD ER
Q9	344610	6274307	QEA SR
Q10	344609	6274193	QEA SR
Q11	344618	6274057	QEA SR
Q12	344680	6273941	W PEC Rest
Q13	344593	6273934	W PEC Rest
Q14	344728	6273805	W PEC Open
Q15	344813	6273905	PC Open
Q16	345136	6273854	PC Open
Q17	345822	6273648	PC Open
Q18	345388	6273795	C PEC Rest
Q19	345646	6273757	C PEC Rest
Q20	346013	6273493	C PEC Rest
Q21	346353	6273273	E PEC LF
Q22	346312	6273517	E PEC Open
Q23	346222	6273402	E PEC Open
Q24	346351	6273239	E PEC Open
Q25	346548	6273149	E PEC Open
Q26	346678	6273194	E PEC Open
Q27	346179	6273391	E PEC Rest
Q28	346292	6273439	E PEC Rest
Q29	346246	6273332	E PEC Rest
Q30	346398	6273211	E PEC Rest
Q31	346438	6273152	E PEC Rest
Q32	344675	6273819	WB PEC Drain
Q33	345807	6273553	SS PEC Drain
Q34	345998	6273412	SS PEC Drain

2.1.1 Modification of Quadrat Locations

The location of four quadrats (Q3, Q8, Q31 & Q33) were modified since the baseline monitoring event in spring 2020. This was due to changes to site access and modification to revegetation design since construction works were completed. This will not have any material

effect on the data as there have been no changes to vegetation classifications or revegetation zones.

2.2 Quadrat Monitoring Methodology

The following quantitative and qualitative data were recorded within each quadrat during this baseline assessment. All individual quadrat recording sheets are provided in Appendix 5.

Quantitative data:

- Native species present
- Overall native vegetation cover (excluding mature native canopy cover)
- Mature native canopy cover
- Weed species present
- Overall weed species cover, and
- Total bare ground cover (excludes foliage, litter, mulch etc.).

Qualitative data:

- Current site conditions (topography, adjacent infrastructure, signs of disturbance, etc.)
- Presence of fauna, disease, pests, and
- Additional notes as required.

2.3 Site Traverse Methodology

Site traverses are to be conducted to identify the presence of *C. caeruleum var. Busselton* and declared weeds within the entire site as they may occur outside of the quadrats. They will also be used to provide a qualitative assessment of overall progress of the revegetation works, to determine if zone progress is accurately reflected in the quadrat data, and for overall site condition ratings. This is to be undertaken as a general observational on-foot traverse of the site with data recorded in the form of photographs, qualitative notes and georeferenced data points of observed declared weeds and *C. caeruleum* var. Busselton where appropriate.

Site images captured as part of the site traverses are provided in Appendix 7.

2.4 Vegetation Condition Assessment Methodology

Vegetation condition was assessed and mapped using a combination of desktop and ground-truthing methods. The data was collated and refined to provide an average condition rating across distinct areas, maintaining consistency with the revegetation classifications and zones where possible. Each feature mapped was attributed with a condition rating utilising the Keighery Vegetation Condition Scale. As the assessment of vegetation condition can be subjective and with the potential for it to be infinitely refined in scale, this broader assessment methodology provides an efficient means to capture the key data and present clearly defined areas to allow for effective comparisons in future assessments. There is also some inherent difficulty in assessing areas currently undergoing revegetation due to the Keighery Scale intended to be utilised to assess mature vegetation communities. The definition of condition ratings do not always accurately classify sites that are establishing and should therefore be considered indicative only.

3 RESULTS AND DISCUSSION

A summary of all key quantitative data is presented in Appendix 4. The following presents the results and analysis of each data attribute assessed as part of this monitoring event. Data is now presented and grouped by Revegetation Zone using mean values of quadrat data in each zone for clarity in presentation and analysis purposes.

3.1 Native Vegetation Cover

Figure 1 details the vegetation cover of all native species (excluding existing mature canopy) recorded in the quadrats of each revegetation zone.

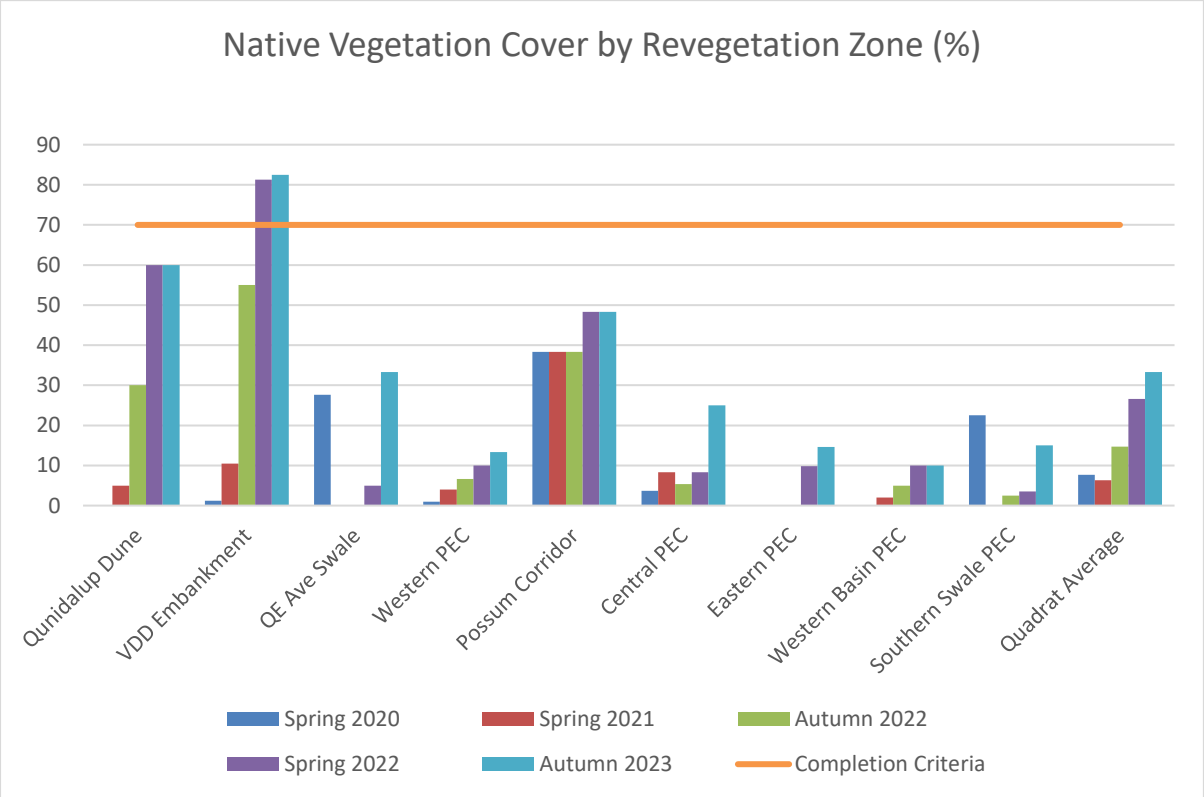


Figure 1 Quadrat Data – Native Vegetation Cover

Average native vegetation cover across all quadrats was 33%, up from 27% cover in spring 2022. All Revegetation Zones showed an increase in cover or remain unchanged, with the QE Ave Swale and Central PEC zones recording the most significant increases (28% and 17% respectively). The only revegetation zone currently meeting the criteria is the VDD Embankment Zone, which continues to exceed the completion criteria, with cover recorded at an average of 83% across the quadrats.

Average native vegetation cover across the site remains significantly below the Completion Criteria of 70%, which is a result of the immaturity of seedlings in many of the revegetation zones. The highest overall cover was recorded in the Quindalup Dune and VDD Embankment zones due to the rapidly growing nature of coastal-type species and the maturity of the vegetation (18 months old at the time of this assessment). However, this was no longer the largest increase in cover as this vegetation has met 100% cover in some areas and cannot increase beyond this statistically. The most significant increase occurred in the QE Ave Swale zone, primarily due to the growth of wetland-type vegetation in warmer conditions when there

is suitable available water. This was a result of frequent summer watering performed as part of the maintenance program. Watering was particularly intensive for this zone due to the highly variable nature of water availability in modified stormwater drainage swales (submerged in winter to completely dry soil in summer) and the need to ensure adequately developed root systems during establishment to ensure resilience in future dry periods.

The primary indicator of cover increase trajectory is the rate of increase, which was near to doubling each successive monitoring event since spring 2021. Autumn monitoring produced a more moderated cover increase due to some plant losses, particularly for vegetation experiencing its second summer (typically highest rate of losses expected). Of particular note, no rainfall was recorded between December 2022 and February 2023 in Busselton, and only 38mm recorded for a 5-month period between November and March. In addition, at the time of the monitoring, only 85mm of rainfall had been recorded for all of 2023, with the long-term average for this period being over 180mm (BOM 2023). These dry conditions contributed to some plant losses and the subsequent reduction in cover experienced in some distinct areas of site.

In addition, a large proportion of quadrats, reflective of relative area and revegetation intensity, are located in the Eastern PEC zone (11 of 34 quadrats), which was only planted in winter 2022 (9 months prior to this assessment). Therefore, only a minor increase in cover was recorded and future growth is anticipated to significantly increase as the plants establish and mature. Due to the proportion of the revegetation area this zone represents, any increases will have a significant influence on the overall native cover metric for the site.

Still remaining as a key factor influencing overall native cover is the progress of active revegetation works, which are being staged over multiple seasons due to site constraints and allowing for adequate site preparation. Some smaller zones are yet to be revegetated and will contribute to cover increases once planted and established in subsequent years. It is anticipated, and demonstrated in the data, that recent revegetation areas will only exhibit minor increases in vegetation cover during the early stages of establishment. Growth rates and cover of establishing vegetation are expected to accelerate over the next few years as the plants continue to establish and mature. In the converse, the same rate of cover increase is also expected to decrease as vegetation moves closer to 100% cover. This trend is expected to follow a logistic curve (S-curve or sigmoid) where the rate of increase will reverse once cover reaches the point of inflection, with a subsequent slowing of cover increase as it approaches 100%. A key factor determining this statistical behaviour is due to some quadrats achieving 100% cover and therefore, even though vegetation continues to mature, it does not contribute statistically any further. This is demonstrated in the Quindalup Dune and VDD Embankment zones where three quadrats have reached 100% cover but the overall average cover statistic shows little to no change.

To reiterate comments in the previous report regarding native cover, the data presented at this stage does not include existing mature canopy cover, which was recorded independently at 28% (no change from previous assessment). This mature canopy data can provide a skewed representation of rehabilitation success when included in the early phases of establishment. The omission of this attribute is critical for the assessment of the current ecological condition of the site, and for guiding remedial activity. Initially, the mature trees provide some habitat for the WRP but do not provide overall ecosystem services or connectivity across multiple vegetation strata, or connectivity across the greater landscape. Once the vegetation derived from rehabilitation reaches maturity, the canopy cover from pre-existing vegetation will be included in the assessments to provide an overall representation of native vegetation cover.

3.2 Weeds

Figure 2 details the cover of all weed species recorded in the quadrats of each revegetation zone.

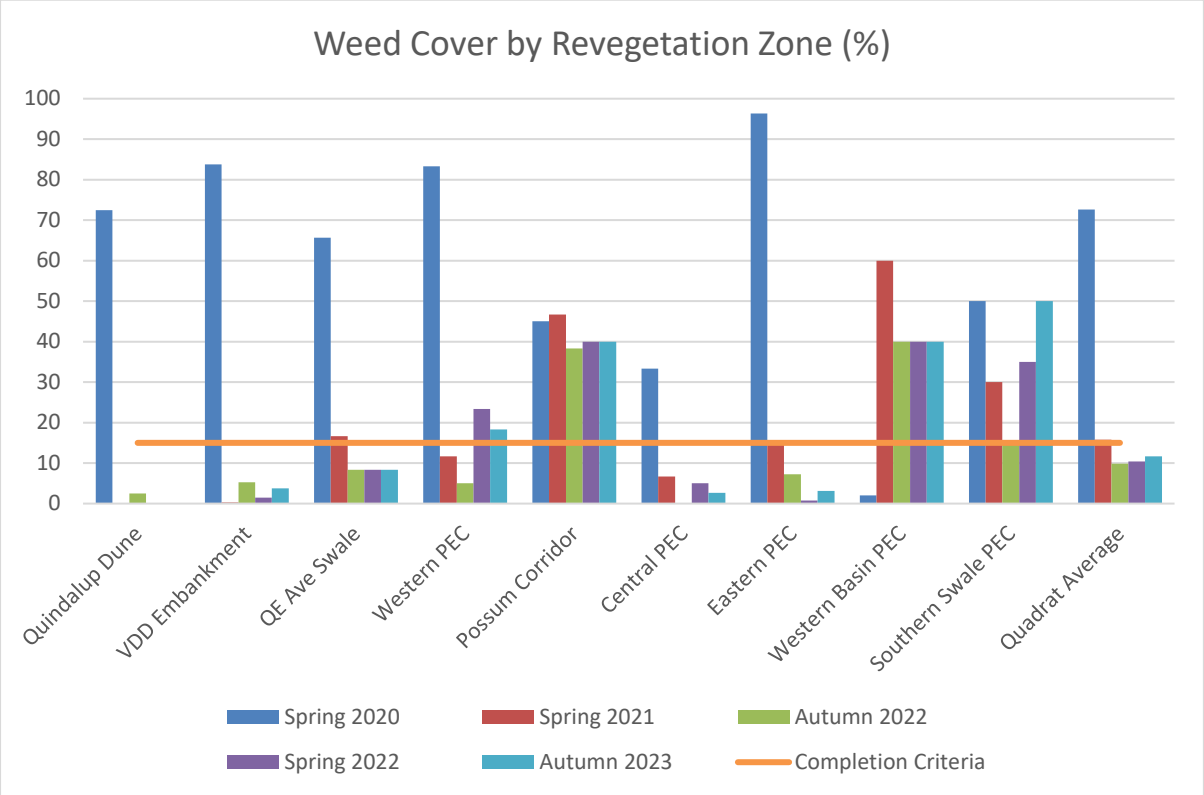


Figure 2 Quadrat Data – Weed Cover

Average weed cover across the quadrats is 12%, an increase of 2% since spring 2022. 13 revegetation zones demonstrated an increase in weed cover, six showing a reduction and 15 with no measurable change. The highest average cover recorded was 50% recorded in the Southern Swale PEC zone. Average weed cover recorded in the quadrats has remained effectively the same, with weed cover criteria still being met across the site on average and in 80% of quadrats individually.

The primary areas where weed cover remains significantly above the completion criteria is in the Possum Corridor and Western and Southern Swale PEC zones. These areas have not been subject to any intensive revegetation works to date and only represent a very minor proportion of the overall site. The Possum Corridor in particular has high remaining weed cover and is also remnant vegetation. The weed management approach is different for this zone as it requires a very cautious and methodical approach to reduce weeds to avoid off-target damage from herbicides. More significant reductions in weed cover are expected as the weed program is expanded more widely across site in future.

As the previous monitoring period occurred in spring, a direct comparison of weed cover from the previous assessment is not particularly informative, as weed species composition and growth conditions are significantly different. The minor change in weed cover over the last three assessments is likely a result of seasonal and annual variations in weather conditions resulting in minor variations in weed abundance and growth behaviour. The timing of weed control events immediately before the monitoring also has a significant impact on the data,

with this event occurring over a month since the previous weed control event, resulting in higher than typical weed abundance.

No specific dominant weed species is evident in the data and species composition is more variable across the site, depending on location, although perennial grasses are no longer considered dominant due to ongoing targeted control efforts. Weed species distribution continues to be variable in general due to weed succession as a result of the removal of dominant grasses.

3.2.1 Declared Weeds

Both declared weeds known to occur on site (*Zantedeschia aethiopica* and *Asparagus asparagoides*) were not visible during the autumn 2023 monitoring period and therefore not assessed as part of this event. The next assessment of these weeds will occur in spring 2023.

3.3 Bare Ground Cover

Figure 3 details the bare ground cover recorded in the quadrats of each revegetation zone.

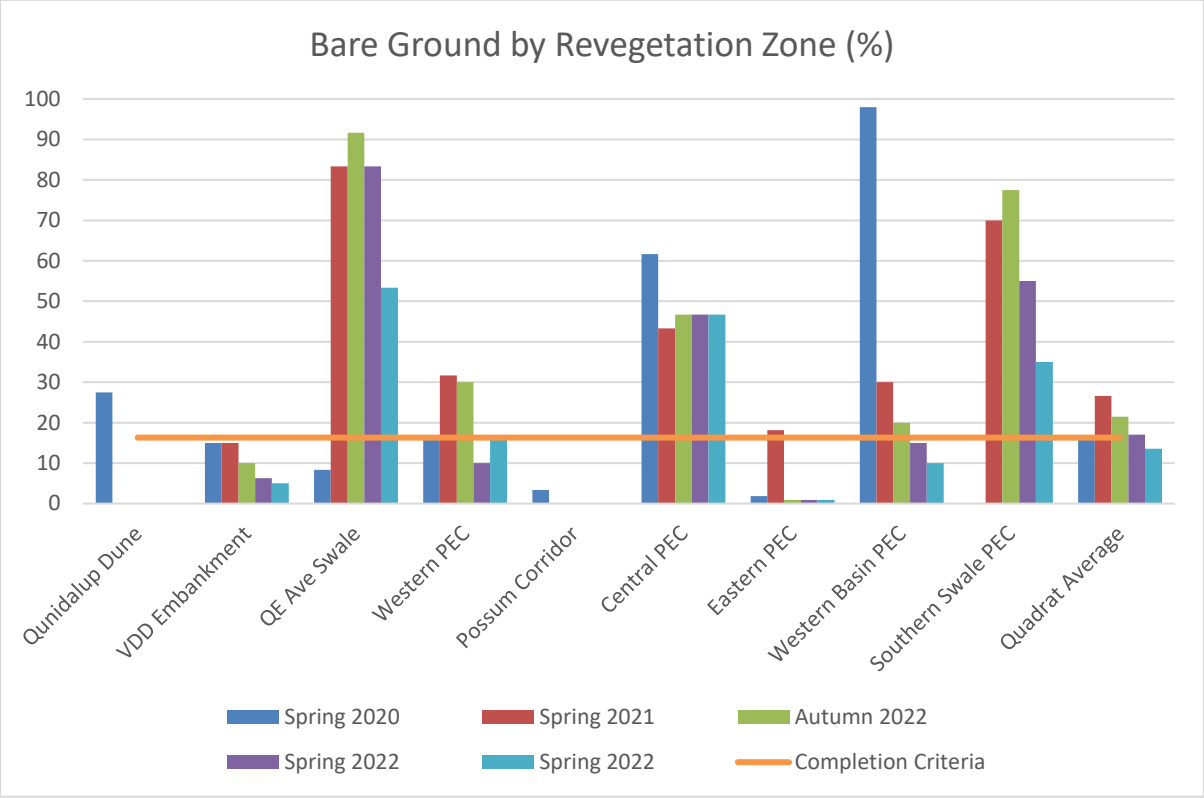


Figure 3 Quadrat Data – Bare Ground Cover

Bare ground cover varied significantly across the quadrats, with an overall average cover of 13%, down from 17% recorded in spring 2022. The most significant decrease was recoded in the QE Ave Swale zone (from 83% to 53%). Bare ground cover increased in the Western PEC zone due to disturbance from works activities by others occurring in Q13 reducing weed cover.

Average bare ground cover is now below the completion criteria of 16.3% The decrease in bare ground is primarily a result of the increase in native vegetation cover and natural litter accumulation across the site more generally, particularly in the QE Ave Swale zone, which also correlated with the greatest increase in native vegetation cover.

3.4 Species Richness

Figure 4 provides a collation of quadrat data based on vegetation communities to reflect the respective completion criteria for each.

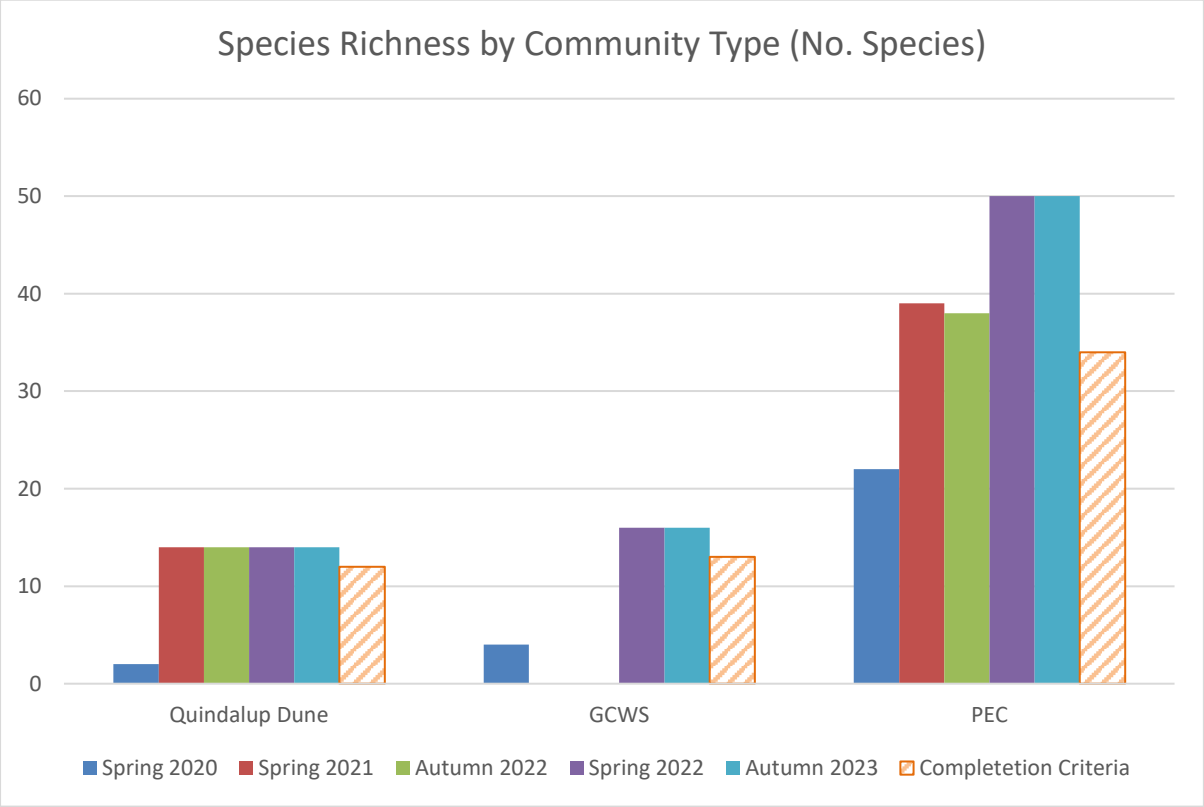


Figure 4 Quadrat Data – Species Richness by Community Type

Overall species richness decreased slightly from 61 species in spring 2022 to 58 species in autumn 2023. All revegetation zones recorded the same number of species as the spring 2022 assessment. This is generally attributed to no planting works occurring between events and no widespread loss or gain of any particular individual species.

Quindalup Dune: A total of 14 species were recorded across the quadrats (the same as autumn 2022), which represents all species included in the revegetation planting and indicates appropriate distribution and survival of planted species. Sites within this vegetation community are meeting the species richness criterion of 12 species.

Geographe Coastal Wetland System: A total of 16 species were recorded across the quadrats (the same as spring 2022), which represents 84% of all species included in the revegetation planting (16 of 19) and indicates appropriate distribution and survival of planted species. Sites within this vegetation community are meeting the species richness criterion of 13 species.

Priority Ecological Community: A total of 48 species were recorded across the quadrats (down from 50 in spring 2022), which includes all planted species and a number of additional native species naturally occurring in these areas. The minor reduction in species was the absence of seasonally visible species (geophytes)., specifically *Caladenia* spp. Sites within this community are currently meeting the completion criterion for species richness of 34 species.

3.5 Vegetation Condition

Figure 5 details the vegetation condition percentage comparison recorded across all revegetation areas for autumn 2023 Figure 6 shows the relative proportions of each zone meeting the target (good / very good condition) and not (completely degraded / degraded). A map of vegetation condition is provided in Appendix 2.

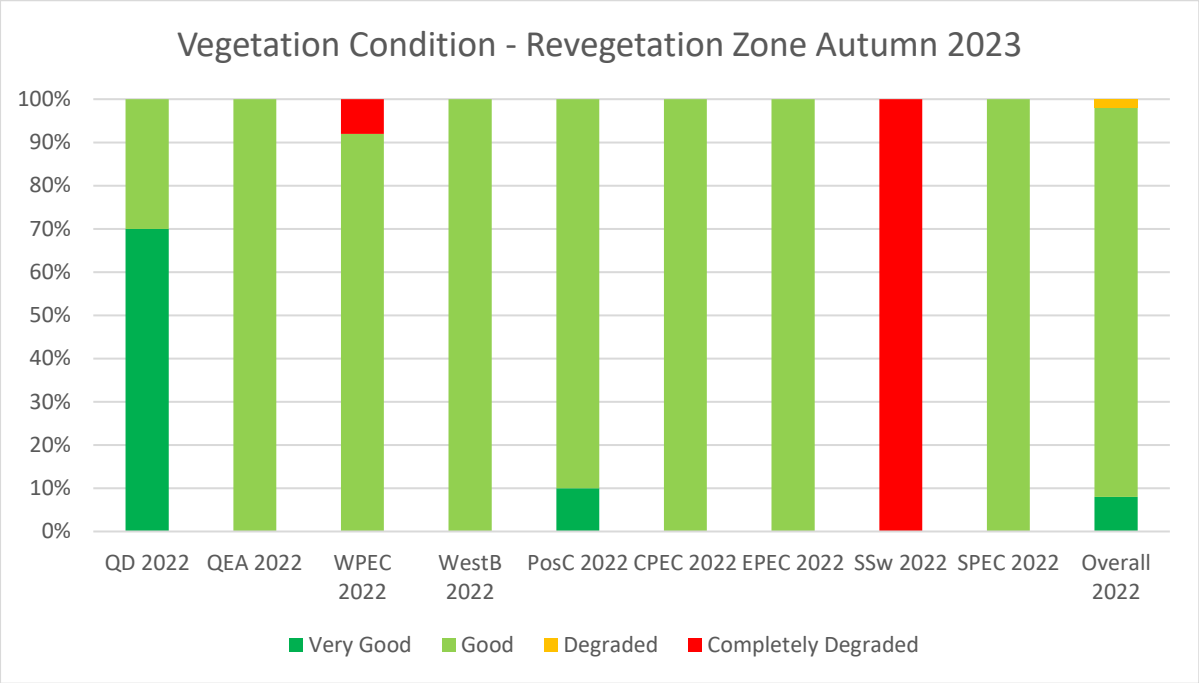


Figure 5 Vegetation Condition – Autumn 2023

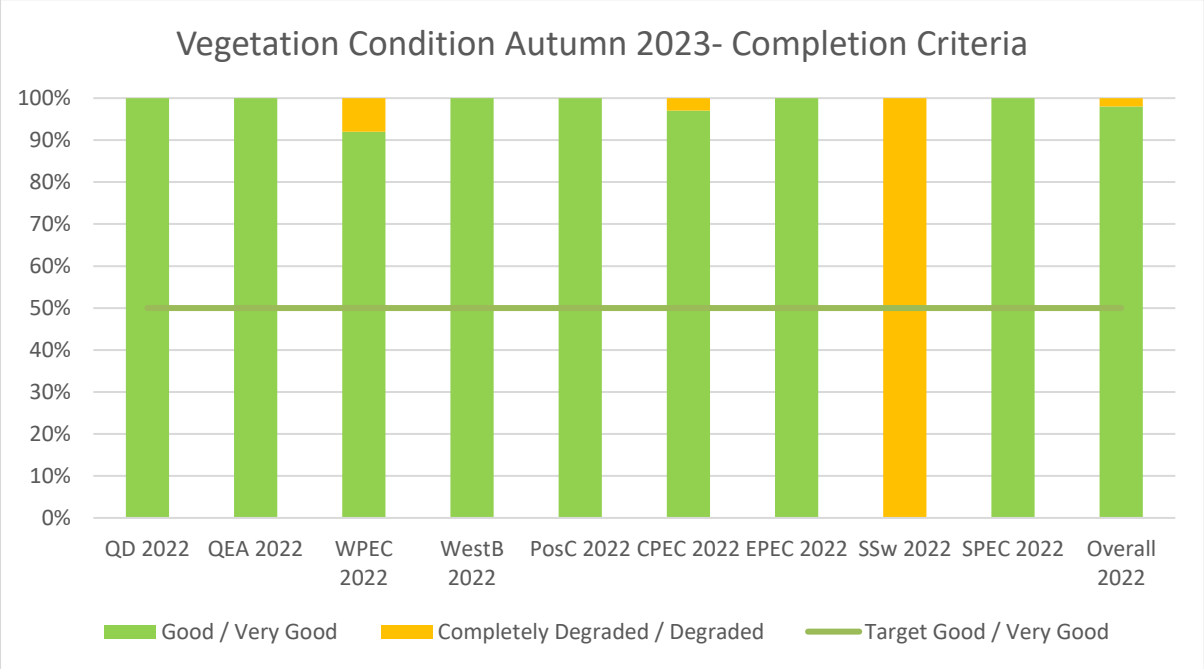


Figure 6 Vegetation Condition Autumn 2023 – Completion Criteria

Overall, 98% of the total area was assessed as being in good condition or above, the same as assessed in spring 2022. No material changes in vegetation condition were noted during the assessment, such as vegetation composition, weed abundance or signs of disturbance.

It should be noted that the Keighery Scale and other analogous measures of vegetation condition are generally designed to be applicable to established bushland vegetation and not areas that are in the process of establishment / revegetation. This assessment should be considered in this context when interpreting this data. During the condition assessment, consideration was primarily focussed on the key attributes of disturbance and vegetation structure and also how the site demonstrates potential to achieve a condition level in future (ecosystem resilience).

4 CONCLUSIONS

In summary, this monitoring event is only the fourth assessment to take place following completion of all construction; therefore, it is still preliminary in nature. Direct revegetation works implemented to date for the revegetation offset now represent approximately 60% of the overall project area. Where revegetation works have been conducted, significant improvements across most quantifiable metrics have been observed, as well as qualitatively across the site. Significant revegetation works will continue to be implemented in subsequent years, with the aim of completing all initial revegetation works by the end of 2025.

The overall results from this assessment indicate the site is progressing positively towards meeting the ten-year completion criteria and already indicates a significant improvement over baseline conditions and those observed in previous monitoring events. The results remain relatively variable across respective revegetation zones as it is only relatively early in the project timeline.

All criteria are currently being met apart from native vegetation cover, which is projected to be achieved over a longer timescale. Works will continue to ensure that the exceedance of these targets are maintained for the entire project period. Native vegetation cover remains comparatively low but in line with expectations for this early stage of development. This criterion takes significant time to be achieved as plants take years to mature. Growth rates and more accurate conclusions on progress for this metric will be made in subsequent assessments.

The criterion for *Conospermum caeruleum var. Busselton* was not assessed at this time. This species is currently in production at nurseries and was not ready for planting in 2023. This will be assessed in future events once the plants have been installed.

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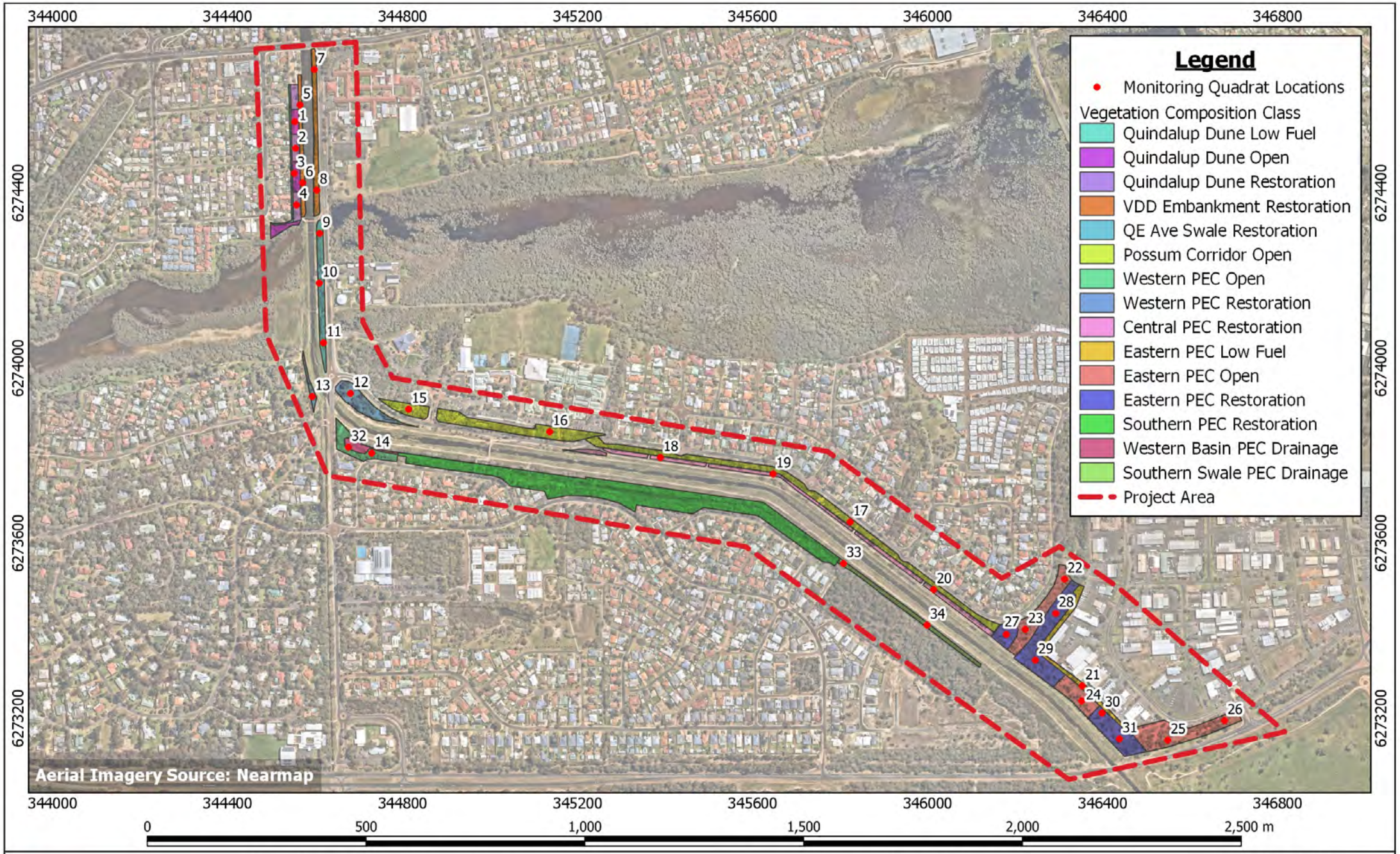
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Appendix 1 Map of Monitoring Locations



tranen
revegetation southwest

Project: VDD Upgrade Revegetation
Project Number: P875C
Client: Water Corporation

Drawing: Monitoring Quadrat Locations
Drawing Number: P875C-02
Revision: 0

Date: 04/01/21
Drawn By: AJ

Appendix 2 Vegetation Condition Mapping

Legend

Spring 2022 Vegetation Condition

- Very Good
- Good
- Degraded
- Completely Degraded
- Monitoring Quadrat Locations

Aerial Imagery Source: Nearmap

0 600 1,200 1,800 2,400 3,000 m

tranen revegetation southwest

Project: VDD Upgrade Revegetation
Project Number: P875C
Client: Water Corporation

Drawing: Spring 2022 Vegetation Condition
Drawing Number: P875C-09
Revision: 0

Date: 25/01/23
Drawn By: AJ

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Appendix 3 Declared Weed Mapping

Appendix 4 Monitoring Quadrat Data Summary

Water Corporation - Vasse Diversion Drain Upgrade Revegetation

Quantitative Data Summary - Autumn 2023

Assessed Completion Criteria								
Quadrat and Vegetation Composition		Native Cover (%)	Weed Cover (%)	Bare Ground Cover (%)	Native Species Richness (No. of species) - QD	Native Species Richness (No. of species) - GCWS	Native Species Richness (No. of species) - PEC	Vegetation Condition
Completion Criteria		**70**	**15**	**16.3**	**12 (QD)**	**13 (GCWS)**	**34 (PEC)**	**>50% Good Condition or Above**
Q1	QD Open	70	0	0	6			
Q2	QD Rest	30	0	0	8			
Q3	QD Open	40	0	0	5			
Q4	QD Rest	100	0	0	8			
Q5	VDD ER	100	0	5	9			
Q6	VDD ER	60	5	10	9			
Q7	VDD ER	70	10	5	9			
Q8	VDD ER	100	0	0	11			
Q9	QEA SR	50	10	30		11		
Q10	QEA SR	30	5	60		7		
Q11	QEA SR	20	10	70		11		
Q12	W PEC Rest	40	5	0			12	
Q13	W PEC Rest	0	10	50			0	
Q14	W PEC Open	0	40	0			2	
Q15	PC Open	65	30	0			12	
Q16	PC Open	20	60	0			4	
Q17	PC Open	60	30	0			9	
Q18	C PEC Rest	15	5	20			10	
Q19	C PEC Rest	20	1	70			11	
Q20	C PEC Rest	40	2	50			13	
Q21	E PEC LF	0	5	0			2	
Q22	E PEC Open	0	5	10			0	
Q23	E PEC Open	5	2	0			11	
Q24	E PEC Open	10	5	0			12	
Q25	E PEC Open	5	0	0			9	
Q26	E PEC Open	10	0	0			10	
Q27	E PEC Rest	1	10	0			3	
Q28	E PEC Rest	40	5	0			17	
Q29	E PEC Rest	40	2	0			17	
Q30	E PEC Rest	20	0	0			18	
Q31	E PEC Rest	30	0	0			17	
Q32	WB PEC Drain	10	40	10			5	
Q33	SS PEC Drain	10	50	40			2	
Q34	SS PEC Drain	20	50	30			4	
Avg/Overall		**33.3**	**11.7**	**13.5**	**14**	**16**	**58**	**97%**

Appendix 5 Individual Quadrat Record Sheets

Quadrat Information	
Site / Quadrat Name:	VDD Q1
Quadrat GPS Location:	GDA94 (MGA Z50) 344552E; 6274562S
Current Site Conditions (Vegetation Composition Class):	Old depot site - gravel area (Quindalup Dune Open)

Native Species		Comments:
Agonis flexuosa		
Ficinia nodosa		
Hibbertia cuneiformis		
Lepidosperma gladiatum		
Rhagodia baccata		
Scaevola crassifolia		

Weed Species		Comments:
Vicia sativa		

Cover (%)		Comments:
Native Cover	70	
Native Canopy cover	0	
Weed Cover	0	
Bare Ground	0	

Other		Comments:
Prescence of Fauna	N	
Presence of Disease / Pests	N	

Additional Comments:

Quadrat Information	
Site / Quadrat Name:	VDD Q2
Quadrat GPS Location:	GDA94 (MGA Z50) 344554E; 6274501S
Current Site Conditions (Vegetation Composition Class):	Old depot site - gravel area (Quindalup Dune Restoration)

Native Species		Comments:
Acacia cochlearis		
Acacia littorea		
Agonis flexuosa		
Ficinia nodosa		
Hibbertia cuneiformis		
Lepidosperma gladiatum		
Rhagodia baccata		
Spyridium globulosum		

Weed Species		Comments:
Hypochaeris sp.		

Cover (%)		Comments:
Native Cover	30	
Native Canopy cover	0	
Weed Cover	0	
Bare Ground	0	

Other		Comments:
Prescence of Fauna	N	
Presence of Disease / Pests	N	

Additional Comments:

Quadrat Information	
Site / Quadrat Name:	VDD Q3
Quadrat GPS Location:	GDA94 (MGA Z50) 344551E; 6274444S
Current Site Conditions (Vegetation Composition Class):	Parkland cleared (Quindalup Dune Open)

Native Species		Comments:
Agonis flexuosa		
Ficinia nodosa		
Lepidosperma gladiatum		
Rhagodia baccata		
Scaevola crassifolia		

Weed Species		Comments:
Fumaria capreolata		
Sonchus sp.		

Cover (%)		Comments:
Native Cover	40	
Native Canopy cover	40	
Weed Cover	0	
Bare Ground	0	

Other		Comments:
Prescence of Fauna	N	
Presence of Disease / Pests	N	

Additional Comments:

Quadrat Information	
Site / Quadrat Name:	VDD Q4
Quadrat GPS Location:	GDA94 (MGA Z50) 344556E; 6274372S
Current Site Conditions (Vegetation Composition Class):	Parkland cleared (Quindalup Dune Restoration)

Native Species		Comments:
Acacia cochlearis		
Acacia littorea		
Agonis flexuosa		
Ficinia nodosa		
Hardenbergia comptoniana		
Hibbertia cuneiformis		
Lepidosperma gladiatum		
Rhagodia baccata		

Weed Species		Comments:
Erigeron sp.		
Raphanus raphanistrum		

Cover (%)		Comments:
Native Cover	100	
Native Canopy cover	0	
Weed Cover	0	
Bare Ground	0	

Other		Comments:
Prescence of Fauna	N	
Presence of Disease / Pests	N	

Additional Comments:

Quadrat Information	
Site / Quadrat Name:	VDD Q5
Quadrat GPS Location:	GDA94 (MGA Z50) 344564E; 6274600S
Current Site Conditions (Vegetation Composition Class):	Man-made internal levee embankment (VDD Embankment - Western)

Native Species		Comments:
Acacia cochlearis		
Acacia littorea		
Agonis flexuosa		
Ficinia nodosa		
Hibbertia cuneiformis		
Lepidosperma gladiatum		
Olearia axillaris		
Rhagodia baccata		
Scaevola crassifolia		

Weed Species		Comments:
Erigeron sp.		

Cover (%)		Comments:
Native Cover	100	
Native Canopy cover	0	
Weed Cover	0	
Bare Ground	5	

Other		Comments:
Prescence of Fauna	N	
Presence of Disease / Pests	N	

Additional Comments:

Quadrat Information	
Site / Quadrat Name:	VDD Q6
Quadrat GPS Location:	GDA94 (MGA Z50) 344570E; 6274442S
Current Site Conditions (Vegetation Composition Class):	Man-made internal levee embankment (VDD Embankment - Western)

Native Species		Comments:
Acacia cochlearis		
Agonis flexuosa		
Ficinia nodosa		
Hibbertia cuneiformis		
Lepidosperma gladiatum		
Olearia axillaris		
Rhagodia baccata		
Scaevola crassifolia		
Spyridium globulosum		

Weed Species		Comments:
Avena barbata		
Erigeron sp.		
Raphanus raphanistrum		

Cover (%)		Comments:
Native Cover	60	
Native Canopy cover	60	
Weed Cover	5	
Bare Ground	10	

Other		Comments:
Prescence of Fauna	N	
Presence of Disease / Pests	N	

Additional Comments:

Quadrat Information	
Site / Quadrat Name:	VDD Q7
Quadrat GPS Location:	GDA94 (MGA Z50) 344597E; 6274681S
Current Site Conditions (Vegetation Composition Class):	Man-made internal levee embankment (VDD Embankment - Eastern)

Native Species		Comments:
Acacia cochlearis		
Acacia littorea		
Ficinia nodosa		
Hibbertia cuneiformis		
Juncus kraussii		
Lepidosperma gladiatum		
Olearia axillaris		
Rhagodia baccata		
Scaevola crassifolia		

Weed Species		Comments:
Avena barbata		
Chenopodium alba		
Oxalis sp.		

Cover (%)		Comments:
Native Cover	70	
Native Canopy cover	0	
Weed Cover	10	
Bare Ground	5	

Other		Comments:
Prescence of Fauna	N	
Presence of Disease / Pests	N	

Additional Comments:

Quadrat Information	
Site / Quadrat Name:	VDD Q8
Quadrat GPS Location:	GDA94 (MGA Z50) 344602E; 6274405S
Current Site Conditions (Vegetation Composition Class):	Man-made internal levee embankment (VDD Embankment - Eastern)

Native Species		Comments:
Acacia cochlearis		
Acacia littorea		
Enchylaena tomentosa		
Ficinia nodosa		
Hibbertia cuneiformis		
Juncus kraussii		
Lepidosperma gladiatum		
Olearia axillaris		
Rhagodia baccata		
Sarcocornia quinquefolia		
Scaevola crassifolia		

Weed Species		Comments:
Cynodon dactylon		

Cover (%)		Comments:
Native Cover	100	
Native Canopy cover	0	
Weed Cover	0	
Bare Ground	0	

Other		Comments:
Prescence of Fauna	N	
Presence of Disease / Pests	N	

Additional Comments:

Quadrat Information	
Site / Quadrat Name:	VDD Q9
Quadrat GPS Location:	GDA94 (MGA Z50) 344610E; 6274320S
Current Site Conditions (Vegetation Composition Class):	Man-made drainage swale (Queen Elizabeth Ave Swale Restoration)

Native Species		Comments:
Acacia littorea		
Acacia saligna		
Banksia littoralis		
Baumea juncea		
Bolboschoenus caldwellii		
Eucalyptus rudis		
Hakea varia		
Lepidosperma gladiatum		
Lepidosperma longitudinale		
Melaleuca viminea		
Rhagodia baccata		

Weed Species		Comments:
Cynodon dactylon		
Malva parviflora		
Raphanus raphanistrum		

Cover (%)		Comments:
Native Cover	50	
Native Canopy cover	0	
Weed Cover	10	
Bare Ground	30	

Other		Comments:
Prescence of Fauna	Y	Kangaroo scats noted
Presence of Disease / Pests	N	

Additional Comments:

Quadrat Information	
Site / Quadrat Name:	VDD Q10
Quadrat GPS Location:	GDA94 (MGA Z50) 344612E; 6274183S
Current Site Conditions (Vegetation Composition Class):	Man-made drainage swale (Queen Elizabeth Ave Swale Restoration)

Native Species		Comments:
Banksia littoralis		
Baumea juncea		
Eucalyptus rudis		
Juncus kraussii		
Lepidosperma longitudinale		
Melaleuca rhaphiophylla		
Melaleuca thymoides		

Weed Species		Comments:
Cynodon dactylon		
Juncus microcephalus		
Medicago polymorpha		
Raphanus raphanistrum		

Cover (%)		Comments:
Native Cover	30	
Native Canopy cover	0	
Weed Cover	5	
Bare Ground	60	

Other		Comments:
Prescence of Fauna	N	
Presence of Disease / Pests	N	

Additional Comments:

Quadrat Information	
Site / Quadrat Name:	VDD Q11
Quadrat GPS Location:	GDA94 (MGA Z50) 344618E; 6274056S
Current Site Conditions (Vegetation Composition Class):	Man-made drainage swale (Queen Elizabeth Ave Swale Restoration)

Native Species		Comments:
Acacia littorea		
Acacia saligna		
Baumea juncea		
Ficinia nodosa		
Juncus kraussii		
Lepidosperma gladiatum		
Lepidosperma longitudinale		
Melaleuca preissiana		
Melaleuca rhaphiophylla		
Melaleuca viminea		
Rhagodia baccata		

Weed Species		Comments:
Cynodon dactylon		
Euphorbia terracina		

Cover (%)		Comments:
Native Cover	20	
Native Canopy cover	0	
Weed Cover	10	
Bare Ground	70	

Other		Comments:
Prescence of Fauna	Y	Evidence of herbivory
Presence of Disease / Pests	N	

Additional Comments:

Quadrat Information	
Site / Quadrat Name:	VDD Q12
Quadrat GPS Location:	GDA94 (MGA Z50) 344680E; 6273940S
Current Site Conditions (Vegetation Composition Class):	Depression between roadway - gravel turnaround (Western PEC Restoration)

Native Species		Comments:
Acacia pulchella		
Acacia saligna		
Adenanthos meisneri		
Agonis flexuosa		
Banksia grandis		
Corymbia calophylla		
Dampiera linearis		
Hakea prostrata		
Hakea varia		
Hardenbergia comptoniana		
Jacksonia furcellata		
Kennedia prostrata		

Weed Species		Comments:
Ferraria crispa		
Oxalis sp.		

Cover (%)		Comments:
Native Cover	40	
Native Canopy cover	0	
Weed Cover	5	
Bare Ground	0	

Other		Comments:
Prescence of Fauna	N	
Presence of Disease / Pests	N	

Additional Comments:

Quadrat Information	
Site / Quadrat Name:	VDD Q13
Quadrat GPS Location:	GDA94 (MGA Z50) 344592E; 6273934S
Current Site Conditions (Vegetation Composition Class):	Between private property and W levee (Western PEC Restoration)

Native Species		Comments:

Weed Species		Comments:
Oxalis sp.		
Pennisetum clandestinum		
Plantago lanceolata		
Watsonia sp.		

Cover (%)		Comments:
Native Cover	0	
Native Canopy cover	40	
Weed Cover	10	
Bare Ground	50	

Other		Comments:
Prescence of Fauna	N	
Presence of Disease / Pests	N	

Additional Comments:

Quadrat Information	
Site / Quadrat Name:	VDD Q14
Quadrat GPS Location:	GDA94 (MGA Z50) 344728E; 6273804S
Current Site Conditions (Vegetation Composition Class):	Degraded bushland (Western PEC Open)

Native Species		Comments:
Dianella revoluta		
Hardenbergia comptoniana		

Weed Species		Comments:
Avena barbata		
Cynodon dactylon		
Ehrharta longiflora		

Cover (%)		Comments:
Native Cover	0	
Native Canopy cover	75	
Weed Cover	40	
Bare Ground	0	

Other		Comments:
Prescence of Fauna	N	
Presence of Disease / Pests	N	

Additional Comments:

Quadrat Information	
Site / Quadrat Name:	VDD Q15
Quadrat GPS Location:	GDA94 (MGA Z50) 344813E; 6273905S
Current Site Conditions (Vegetation Composition Class):	Degraded bushland - between informal bike paths (Possum Corridor Open)

Native Species		Comments:
Agonis flexuosa		
Conospermum caeruleum var. Busselton		
Conostylis aculeata		
Hardenbergia comptoniana		
Jacksonia furcellata		
Lepidosperma squamatum? effusum?		
Lomandra sp.		
Phyllanthus calycinus		
Sowerbaea laxiflora		
Spyridium globulosum		

Weed Species		Comments:
Avena barbata		
Briza minor		
Zantedeschia aethiopica		

Cover (%)		Comments:
Native Cover	65	
Native Canopy cover	60	
Weed Cover	30	
Bare Ground	0	

Other		Comments:
Prescence of Fauna	N	
Presence of Disease / Pests	N	

Additional Comments:

Quadrat Information	
Site / Quadrat Name:	VDD Q16
Quadrat GPS Location:	GDA94 (MGA Z50) 345135E; 6273853S
Current Site Conditions (Vegetation Composition Class):	Degraded bushland - previous infill revegetation area (Possum Corridor Open)

Native Species		Comments:
Agonis flexuosa		
Conostylis candicans		
Lepidosperma gladiatum		
Spyridium globulosum		

Weed Species		Comments:
Avena barbata		
Erigeron sp.		
Oxalis sp.		
Solanum americanum		
Solanum nigrum		

Cover (%)		Comments:
Native Cover	20	
Native Canopy cover	50	
Weed Cover	60	
Bare Ground	0	

Other		Comments:
Prescence of Fauna	N	
Presence of Disease / Pests	N	

Additional Comments:

Quadrat Information	
Site / Quadrat Name:	VDD Q17
Quadrat GPS Location:	GDA94 (MGA Z50) 345822E; 6273647S
Current Site Conditions (Vegetation Composition Class):	Degraded bushland - adjacent strip adjacent to College Ave (Possum Corridor Open)

Native Species		Comments:
Agonis flexuosa		
Austrostipa sp.		
Corymbia calophylla		
Gompholobium tomentosum		
Hardenbergia comptoniana		
Hibbertia cuneiformis		
Lomandra sp. 1		
Lomandra sp. 2		
Spyridium globulosum		

Weed Species		Comments:
Briza maxima		
Freesia sp.		

Cover (%)		Comments:
Native Cover	60	
Native Canopy cover	70	
Weed Cover	30	
Bare Ground	0	

Other		Comments:
Prescence of Fauna	N	
Presence of Disease / Pests	N	

Additional Comments:

Quadrat Information	
Site / Quadrat Name:	VDD Q18
Quadrat GPS Location:	GDA94 (MGA Z50) 345388E; 6273794S
Current Site Conditions (Vegetation Composition Class):	Drainage swale adjacent to DUP - N bank (Central PEC Restoration)

Native Species		Comments:
Acacia pulchella		
Acacia saligna		
Agonis flexuosa		
Anigozanthos manglesii		
Baumea juncea		
Conostylis aculeata		
Corymbia calophylla		
Hakea prostrata		
Kunzea glabrescens		
Spyridium globulosum		

Weed Species		Comments:
Avena barbata		
Ehrharta longiflora		
Oxalis sp.		

Cover (%)		Comments:
Native Cover	15	
Native Canopy cover	5	
Weed Cover	5	
Bare Ground	20	

Other		Comments:
Prescence of Fauna	N	
Presence of Disease / Pests	N	

Additional Comments:

Quadrat Information	
Site / Quadrat Name:	VDD Q19
Quadrat GPS Location:	GDA94 (MGA Z50) 345646E; 6273757S
Current Site Conditions (Vegetation Composition Class):	Drainage swale adjacent to DUP - N bank (Central PEC Restoration)

Native Species		Comments:
Adenanthos meisneri		
Agonis flexuosa		
Banksia littoralis		
Baumea juncea		
Conostylis aculeata		
Eucalyptus rudis		
Hakea prostrata		
Hibbertia racemosa		
Kunzea glabrescens		
Spyridium globulosum		
Xanthorrhoea preissii		

Weed Species		Comments:
Ehrharta longiflora		
Romulea rosea		

Cover (%)		Comments:
Native Cover	20	
Native Canopy cover	10	
Weed Cover	1	
Bare Ground	70	

Other		Comments:
Prescence of Fauna	N	
Presence of Disease / Pests	N	

Additional Comments:

Quadrat Information	
Site / Quadrat Name:	VDD Q20
Quadrat GPS Location:	GDA94 (MGA Z50) 346013E; 6273493S
Current Site Conditions (Vegetation Composition Class):	Drainage swale adjacent to DUP - N bank (Central PEC Restoration)

Native Species		Comments:
Acacia saligna		
Agonis flexuosa		
Banksia littoralis		
Baumea juncea		
Conostylis aculeata		
Gahnia trifida		
Hakea prostrata		
Hakea varia		
Hardenbergia comptoniana		
hibbertia cuneiformis		
Kennedia prostrata		
Patersonia occidentalis		
Spyridium globulosum		

Weed Species		Comments:
Ehrharta longiflora		
Oxalis sp.		
Sonchus sp.		

Cover (%)		Comments:
Native Cover	40	
Native Canopy cover	20	
Weed Cover	2	
Bare Ground	50	

Other		Comments:
Prescence of Fauna	N	
Presence of Disease / Pests	N	

Additional Comments:

Quadrat Information	
Site / Quadrat Name:	VDD Q21
Quadrat GPS Location:	GDA94 (MGA Z50) 346352E; 6273273S
Current Site Conditions (Vegetation Composition Class):	Parkland cleared (Eastern PEC Low Fuel)

Native Species		Comments:
Baumea juncea		
Conostylis aculeata		

Weed Species		Comments:
Oxalis sp.		
Raphanus raphanistrum		

Cover (%)		Comments:
Native Cover	0	
Native Canopy cover	0	
Weed Cover	5	
Bare Ground	0	

Other		Comments:
Prescence of Fauna	N	
Presence of Disease / Pests	N	

Additional Comments:

Quadrat Information	
Site / Quadrat Name:	VDD Q22
Quadrat GPS Location:	GDA94 (MGA Z50) 346312E; 6273517S
Current Site Conditions (Vegetation Composition Class):	Parkland cleared (Eastern PEC Open)

Native Species		Comments:

Weed Species		Comments:
Avena barbata		
Cynodon dactylon		
Oxalis sp.		

Cover (%)		Comments:
Native Cover	0	
Native Canopy cover	50	
Weed Cover	5	
Bare Ground	10	

Other		Comments:
Prescence of Fauna	N	
Presence of Disease / Pests	N	

Additional Comments:

Quadrat Information	
Site / Quadrat Name:	VDD Q23
Quadrat GPS Location:	GDA94 (MGA Z50) 346222E; 6273402S
Current Site Conditions (Vegetation Composition Class):	Parkland cleared (Eastern PEC Open)

Native Species		Comments:
Agonis flexuosa		
Anigozanthos manglesii		
Conostylis aculeata		
Corymbia calophylla		
Eucalyptus decipiens		
Eucalyptus rudis		
Hibbertia cuneiformis		
Kunzea glabrescens		
Patersonia occidentalis		
Spyridium globulosum		
Xanthorrhoea preissii		

Weed Species		Comments:
Avena barbata		
Cynodon dactylon		
Erigeron sp.		
Sonchus sp.		

Cover (%)		Comments:
Native Cover	5	
Native Canopy cover	70	
Weed Cover	2	
Bare Ground	0	

Other		Comments:
Prescence of Fauna	N	
Presence of Disease / Pests	N	

Additional Comments:

Quadrat Information	
Site / Quadrat Name:	VDD Q24
Quadrat GPS Location:	GDA94 (MGA Z50) 346351E; 6273239S
Current Site Conditions (Vegetation Composition Class):	Parkland cleared (Eastern PEC Open)

Native Species		Comments:
Anigozanthos manglesii		
Banksia grandis		
Baumea juncea		
Conostylis aculeata		
Corymbia calophylla		
Eucalyptus decipiens		
Gompholobium tomentosum		
Kunzea glabrescens		
Melaleuca preissiana		
Melaleuca rhaphiophylla		
Patersonia occidentalis		
Xanthorrhoea preissii		

Weed Species		Comments:
Hypochaeris sp.		
Oxalis sp.		
Raphanus raphanistrum		
Sonchus sp.		

Cover (%)		Comments:
Native Cover	10	
Native Canopy cover	0	
Weed Cover	5	
Bare Ground	0	

Other		Comments:
Prescence of Fauna	N	
Presence of Disease / Pests	N	

Additional Comments:

Quadrat Information	
Site / Quadrat Name:	VDD Q25
Quadrat GPS Location:	GDA94 (MGA Z50) 346548E; 6273150S
Current Site Conditions (Vegetation Composition Class):	Parkland cleared (Eastern PEC Open)

Native Species		Comments:
Conostylis aculeata		
Corymbia calophylla		
Eucalyptus decipiens		
Gompholobium tomentosum		
Hibbertia racemosa		
Jacksonia furcellata		
Kunzea glabrescens		
Patersonia occidentalis		
Xanthorrhoea brunonis		
Weed Species		**Comments:**
Cover (%)		**Comments:**
Native Cover	5	
Native Canopy cover	20	
Weed Cover	0	
Bare Ground	0	

Other		Comments:
Prescence of Fauna	N	
Presence of Disease / Pests	N	

Additional Comments:

Quadrat Information	
Site / Quadrat Name:	VDD Q26
Quadrat GPS Location:	GDA94 (MGA Z50) 346678E; 6273193S
Current Site Conditions (Vegetation Composition Class):	Parkland cleared (Eastern PEC Open)

Native Species		Comments:
Anigozanthos manglesii		
Banksia grandis		
Conostylis aculeata		
Corymbia calophylla		
Gastrolobium capitatum		
Gompholobium tomentosum		
Hakea prostrata		
Hibbertia cuneiformis		
Patersonia occidentalis		
Xanthorrhoea preissii		

Weed Species		Comments:
Avena barbata		
Raphanus raphanistrum		
Sonchus sp.		

Cover (%)		Comments:
Native Cover	10	
Native Canopy cover	20	
Weed Cover	0	
Bare Ground	0	

Other		Comments:
Prescence of Fauna	N	
Presence of Disease / Pests	N	

Additional Comments:

Quadrat Information	
Site / Quadrat Name:	VDD Q27
Quadrat GPS Location:	GDA94 (MGA Z50) 346179E; 6273390S
Current Site Conditions (Vegetation Composition Class):	Parkland cleared (Eastern PEC Restoration)

Native Species		Comments:
Acacia saligna		
Hakea prostrata		
Spyridium globulosum		

Weed Species		Comments:
Avena barbata		
Cynodon dactylon		
Oxalis sp.		

Cover (%)		Comments:
Native Cover	1	
Native Canopy cover	35	
Weed Cover	10	
Bare Ground	0	

Other		Comments:
Prescence of Fauna	N	
Presence of Disease / Pests	N	

Additional Comments:

Quadrat Information	
Site / Quadrat Name:	VDD Q28
Quadrat GPS Location:	GDA94 (MGA Z50) 346292E; 6273439S
Current Site Conditions (Vegetation Composition Class):	Parkland cleared (Eastern PEC Restoration)

Native Species		Comments:
Adenanthos meisneri		
Agonis flexuosa		
Banksia grandis		
Banksia litoralis		
Conostylis aculeata		
Corymbia calophylla		
Dampiera linearis		
Eucalyptus rudis		
Gastrolobium capitatum		
Gompholobium tomentosum		
Hakea prostrata		
Hakea varia		
Hardenbergia comptoniana		
Hibbertia cuneiformis		
Lepidosperma longitudinale		
Patersonia occidentalis		
Spyridium globulosum		
Xanthorrhoea preissii		

Weed Species		Comments:
Avena barbata		
Hypochaeris sp.		
Oxalis sp.		
Rapanus raphanistrum		
Sonchus sp.		

Cover (%)		Comments:
Native Cover	40	
Native Canopy cover	30	
Weed Cover	5	
Bare Ground	0	

Other		Comments:
Prescence of Fauna	N	
Presence of Disease / Pests	N	

Additional Comments:

Quadrat Information	
Site / Quadrat Name:	VDD Q29
Quadrat GPS Location:	GDA94 (MGA Z50) 346245E; 6273332S
Current Site Conditions (Vegetation Composition Class):	Parkland cleared (Eastern PEC Restoration)

Native Species		Comments:
Acacia saligna		
Agonis flexuosa		
Banksia grandis		
Banksia littoralis		
Conostylis aculeata		
Corymbia calophylla		
Eucalyptus decipiens		
Eucalyptus rudis		
Gompholobium tomentosum		
Hakea prostrata		
Hibbertia cuneiformis		
Hibbertia racemosa		
Jacksonia furcellata		
Kunzea glabrescens		
Lepidosperma longitudinale		
Patersonia occidentalis		
Spyridium globulosum		

Weed Species		Comments:
Hypochaeris sp.		
Oxalis sp.		
Raphanus raphanistrum		

Cover (%)		Comments:
Native Cover	40	
Native Canopy cover	0	
Weed Cover	2	
Bare Ground	0	

Other		Comments:
Prescence of Fauna	N	
Presence of Disease / Pests	N	

Additional Comments:

Quadrat Information	
Site / Quadrat Name:	VDD Q30
Quadrat GPS Location:	GDA94 (MGA Z50) 346398E; 6273211S
Current Site Conditions (Vegetation Composition Class):	Parkland cleared (Eastern PEC Restoration)

Native Species		Comments:
Acacia saligna		
Adenanthos meisneri		
Agonis flexuosa		
Anigozanthos manglesii		
Banksia littoralis		
Conostylis aculeata		
Corymbia calophylla		
Eucalyptus decipiens		
Gastrolobium capitatum		
Gompholobium tomentosum		
Hakea varia		
Hardenbergia comptoniana		
Jacksonia furcellata		
Kunzea glabrescens		
Lepidosperma longitudinale		
Melaleuca preissiana		
Spyridium globulosum		
Xanthorrhoea preissii		

Weed Species		Comments:
Sonchus sp.		

Cover (%)		Comments:
Native Cover	20	
Native Canopy cover	80	
Weed Cover	0	
Bare Ground	0	

Other		Comments:
Prescence of Fauna	N	
Presence of Disease / Pests	N	

Additional Comments:

Quadrat Information	
Site / Quadrat Name:	VDD Q31
Quadrat GPS Location:	GDA94 (MGA Z50) 346438E; 6273152S
Current Site Conditions (Vegetation Composition Class):	Parkland cleared (Eastern PEC Restoration)

Native Species		Comments:
Adenanthos meisneri		
Anigozanthos manglesii		
Banksia grandis		
Conostylis aculeata		
Corymbia calophylla		
Daviesia physodes		
Eucalyptus decipiens		
Eucalyptus rudis		
Gastrolobium capitatum		
Hakea prostrata		
Hakea varia		
Hardenbergia comptoniana		
Kunzea glabrescens		
Melaleuca rhaphiophylla		
Patersonia occidentalis		
Spyridium globulosum		
Xanthorrhoea preissii		

Weed Species		Comments:
Hypochaeris sp.		

Cover (%)		Comments:
Native Cover	30	
Native Canopy cover	10	
Weed Cover	0	
Bare Ground	0	

Other		Comments:
Prescence of Fauna	N	
Presence of Disease / Pests	N	

Additional Comments:

Quadrat Information	
Site / Quadrat Name:	VDD Q32
Quadrat GPS Location:	GDA94 (MGA Z50) 346675E; 6273818S
Current Site Conditions (Vegetation Composition Class):	Stormwater compensating basin (Western Basin PEC Drainage)

Native Species		Comments:
Agonis flexuosa		
Baumea juncea		
Centella asiatica		
Juncus kraussii		
Samolus Junceus		

Weed Species		Comments:
Juncus microcephalus		
Symphyotrichum squamatum		

Cover (%)		Comments:
Native Cover	10	
Native Canopy cover	20	
Weed Cover	40	
Bare Ground	10	

Other		Comments:
Prescence of Fauna	N	
Presence of Disease / Pests	N	

Additional Comments:

Quadrat Information	
Site / Quadrat Name:	VDD Q33
Quadrat GPS Location:	GDA94 (MGA Z50) 345807E; 6273552S
Current Site Conditions (Vegetation Composition Class):	Vegetated drainage swale (Southern Swale PEC Drainage)

Native Species		Comments:
Acacia saligna		
Agonis flexuosa		

Weed Species		Comments:
Cynodon dactylon		
Eragrostis curvula		
Gladiolus sp.		
Symphyotrichum squamatum		

Cover (%)		Comments:
Native Cover	10	
Native Canopy cover	0	
Weed Cover	50	
Bare Ground	40	

Other		Comments:
Prescence of Fauna	N	
Presence of Disease / Pests	N	

Additional Comments:

Quadrat Information	
Site / Quadrat Name:	VDD Q34
Quadrat GPS Location:	GDA94 (MGA Z50) 345998E; 6273411S
Current Site Conditions (Vegetation Composition Class):	Vegetated drainage swale (Southern Swale PEC Drainage)

Native Species		Comments:
Acacia saligna		
Agonis flexuosa		
Sowerbaea laxiflora		
Thysanotus maglesianus		

Weed Species		Comments:
Ehrharta longifolia		
Hypochaeris sp.		
Lolium rigidum		
Symphiotrychum subulatum		

Cover (%)		Comments:
Native Cover	20	
Native Canopy cover	0	
Weed Cover	50	
Bare Ground	30	

Other		Comments:
Prescence of Fauna	N	
Presence of Disease / Pests	N	

Additional Comments:

Appendix 6 Monitoring Quadrat Images



Q1 – spring 2020



Q1 – Autumn 2023



Q2 – spring 2020



Q2 – Autumn 2023



Q3 – spring 2021 (Position Change from 2020)



Q3 – Autumn 2023



Q4 – spring 2020



Q4 – Autumn 2023



Q5 – spring 2020



Q5 – Autumn 2023



Q6 – spring 2020



Q6 – Autumn 2023



Q7 – spring 2020



Q7 – Autumn 2023



Q8 – spring 2021 (Position Change from 2020)



Q8 –Autumn 2023



Q9 – spring 2020



Q9 – Autumn 2023



Q10 – spring 2020



Q10 – Autumn 2023



Q11 – spring 2020



Q11 – Autumn 2023



Q12 – spring 2020



Q12 – Autumn 2023



Q13 – spring 2020



Q13 – Autumn 2023



Q14 – spring 2020



Q14 – Autumn 2023



Q15 – spring 2020



Q15 – Autumn 2023



Q16 – spring 2020



Q16 – Autumn 2023



Q17 – spring 2020



Q17 – Autumn 2023



Q18 – spring 2020



Q18 – Autumn 2023



Q19 – spring 2020



Q19 – Autumn 2023



Q20 – spring 2020



Q20 – Autumn 2023



Q21 – spring 2020



Q21 – Autumn 2023



Q22 – spring 2020



Q22 – Autumn 2023



Q23 – spring 2020



Q23 – Autumn 2023



Q24 – spring 2020



Q24 – Autumn 2023



Q25 – spring 2020



Q25 – Autumn 2023



Q26 – spring 2020



Q26 – Autumn 2023



Q27 – spring 2020



Q27 – Autumn 2023



Q28 – spring 2020



Q28 – Autumn 2023



Q29 – spring 2020



Q29 – Autumn 2023



Q30 – spring 2020



Q30 – Autumn 2023



Q31 – spring 2021 (Position Changed from 2020)



Q31 – Autumn 2023



Q32 – spring 2020



Q32 – Autumn 2023



Q33 – spring 2020



Q33 – Autumn 2023



Q34 – spring 2020



Q34 – Autumn 2023

Appendix 7 General Site Images



VDD Embankment Previous Condition – September 2020



VDD Embankment Current Condition – July 2022



Quindalup Dune Previous Condition – September 2020



Quindalup Dune Current Condition – July 2022



Western PEC Previous Condition – September 2020



Western PEC Current Condition –December 2022



Central PEC – February 2021



Central PEC – December 2022

tranen
revegetation southwest



Vasse Diversion Drain Upgrade
Revegetation Plan

Water Corporation

P875B-01-Rev5

September 2020

PERTH

11 Vincent Street
Bayswater WA 6053
p 9284 1399

SOUTHWEST

20 Possum Place
Vasse WA 6280
p 9754 2643

Disclaimer

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4	01.09.20	Revision 4	AJ	MB
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1 EXECUTIVE SUMMARY

The Vasse Diversion Drain is a 100-year-old strategic infrastructure corridor, constructed in the 1920s to create more arable land in the catchment, its primary function now, is to prevent flooding of the Busselton Township. Water Corporation plan to upgrade the drain and associated infrastructure to better accommodate future flood events.

The upgrade works require the clearing of 2.16 ha of existing vegetation, much of which is in a degraded state, although some of which is locally and nationally significant habitat.

Tranen Revegetation Southwest (Tranen) were commissioned by Water Corporation to prepare a Revegetation Plan for environmental offset works related to the planned Vasse Diversion Drain (VDD) Upgrade Project CPS8191/1.

The Revegetation works have the following objectives:

1. Mitigate the effects of vegetation clearing within the local area and maximise local environmental benefits;
2. Build on existing and previous successful environmental enhancement projects undertaken locally;
3. Enhance habitat for the WRP and provide connectivity between areas of local distribution; and
4. Facilitate better connection and engagement between the local environment and community.

The overarching strategy for the revegetation works is to re-create naturally occurring and connected vegetation communities that are appropriate for their geographic location, support long-term ecological function and provide suitable habitat for critical species.

The Revegetation Plan is also designed to consider key management requirements for native vegetation in an urban context. Due to a number of factors requiring consideration within the plan, additional layers of complexity are inherent in the development of an appropriate revegetation strategy.

This Plan seeks to progressively establish focal areas of high biodiversity, with native vegetation forming a discontinuous mosaic-like corridor of variable structural composition and biological complexity, to reflect natural vegetation community structure.

A summary of the proposed revegetation works is provided in the following table.

Table 1 VDD Upgrade Summary of Revegetation Activities

			Site Preparation			Revegetation						
Item	Zone	Total Area (m2)	Mulching (m2)	Ripping (m2)	Matting (m2)	Planting density (plants / m2)	Total Plants	Total Tree guards	Mature trees	Vegetation Composition Classification(s)	Fencing (lm)	Zone Specific Management Tasks
1.0	Zone 1 - Quindalup Dune	7,908	6,000	3,000	0	1.6	11,023	0	0	Low Fuel; Open; Restoration	850	Possum nesting boxes
2.0	Zone 2 - VDD Embankments	6,848	0	0	3,500	4	16,436	0	0	Restoration (Functional)	150	Embankment re-grading; Toe protection (brushwalling); pathway construction
3.0	Zone 3 - QE Ave Swale	4,572	0	0	2,500	3	13,716	0	0	Restoration	960	
4.0	Zone 4 - PEC Upland											
4.1	Zone 4.1 - Possum Corridor PEC	24,747	0	0	0	1	7,425	7,425	0	Open	0	Possum bridges and nesting boxes
4.2	Zone 4.2 - Western PEC	9,267	6,000	6,000	0	2	11,121	5,000	0	Open; Restoration;	500	
4.3	Zone 4.3 - Central PEC	9,128	5,000	5,000	0	2	14,605	10,000	214	Restoration	0	Matural trees installed along path edge at 5m centres
4.4	Zone 4.4 - Eastern PEC	42,829	20,000	30,000	0	2	42,829	20,000	0	Low Fuel; Open; Restoration: Biodiverse Nodes	1,500	
4.5	Zone 4.5 - Southern PEC	36,643	0	0	0	1	3,665	0	0	Restoration; Biodiverse Nodes	2,210	C. procera habitat enhancement
5.0	Zone 5 - Drainage PEC											
5.1	Zone 5.1 - Western Basin PEC	1,490	0	0	0	2	1,490	0	0	Drainage	0	
5.2	Zone 5.2 - Southern Swale PEC	3,559	0	0	0	3	10,677	3,000	0	Drainage	0	
	TOTAL / Avg	146,991	37,000	44,000	6,000	0.90	132,987	45,425	214		6,170	

2 INTRODUCTION AND BACKGROUND

In April 2020, Tranen Revegetation Southwest (Tranen) were commissioned by Water Corporation to prepare a Revegetation Plan for environmental offset works related to the planned Vasse Diversion Drain (VDD) Upgrade Project CPS8191/1. The revegetation works are required to mitigate the impacts of vegetation clearing associated with the upgrade project, with the intention to maximise the retention and enhancement of ecological values in the local area and in the immediate vicinity of the disturbance.

2.1 Background

The Vasse Diversion Drain is a 100-year-old strategic infrastructure corridor, originally constructed in the 1920s to create more arable land in the catchment, its primary function now, is to prevent flooding of the Busselton Township (Water Corporation 2020). Water Corporation plan to upgrade the drain and associated infrastructure to better accommodate future flood events.

2.2 Project Specific Conditions of Approval

This project has been assessed Bilaterally by the DWER Native Vegetation branch under Part V of the EP Act [WA] and by AWE under the EPBC Act 1999 [cth].

2.2.1 Environmental Protection and Biodiversity Conservation Act 1999 (Cth)

The project was referred under the EPBC Act (Cth). The project is a 'Controlled Action,' all activities must be undertaken in compliance with conditions set in the EPBC 2017/7932 Approval Conditions.

Table 2: EPBC 2017/7932 environmental approval conditions

Ref	Requirement	Comments
1	To minimise impacts to EPBC Act listed species, the approval holder must: a) clear no more than 2.16 hectares (ha) of Western Ringtail Possum habitat within the project area (hatched yellow in Attachment A and Attachment B); b) comply with and implement the conditions of the clearing permit CPS 8191/1 or as varied from time to time; and c) c. notify the Department in writing of any variations of the conditions of clearing permit CPS 8191/1 within 10 business days of such a change being approved by the State Government.	Refer to *CD00116 – Vasse Diversion Drain Upgrade, Construction Environmental Management Framework* (Water Corporation 2020).
2, 3, 4	To avoid and mitigate impacts to the Western Ringtail Possum	Refer to Bamford Consulting Ecologists (2020).
5, 6	Minimise impacts to the Carbunup King Spider Orchid	Refer to project CEMF (Water Corporation 2020)

Ref	Requirement	Comments
7	Implement the weed management and soil hygiene management measures	Refer to project CEMF (Water Corporation 2020)
8	provide a fauna management plan for approval	Refer to Bamford Consulting Ecologists (2020).
9	implement a flora management plan as required by condition 10	Refer to project CEMF (Water Corporation 2020)
10	To compensate for the residual significant impacts on the Western Ringtail Possum, the approval holder must implement condition 17 of the clearing permit CPS 8191/1.	This document
12	The approval holder must maintain accurate and complete compliance records.	Management and process for compliance reporting for the Revegetation and Offsets ONLY are relevant to this document.
14	14. The approval holder must: a) submit plans electronically to the Department for approval by the Minister; b) publish each plan on the website within 20 business days of the date the plan is approved by the Minister or of the date a revised action management plan is submitted to the Minister or the Department, unless otherwise agreed to in writing by the Minister; c) exclude or redact sensitive ecology d) keep plans published on the website until the end date of this approval.	The Corporation will ensure all plans are published as required on the Project website. Including this document.
16	Annual Compliance reporting	Management and process for compliance reporting for the Revegetation and Offsets ONLY are relevant to this document.

2.2.2 Part V, Environmental Protection Act 1986 (WA)

The Water Corporation has been granted a Purpose Permit under Part V of the EP Act (WA) for project activities. All activities must be undertaken in compliance with conditions set in the DWER Purpose Permit CPS 8191/1.

Table 3: Environmental conditions specific to DWER Purpose Permit CPS8191/1

Ref	Requirement	Responsibility
11	Fauna Management – Other approvals	Refer to Bamford (2020) and IndoPacific (2020)
12	Fauna management – Carter's freshwater mussel	Refer to (IndoPacific 2020)
13	Fauna management – western ringtail possum	Refer to Bamford (2020)
14	Fauna management – western ringtail possum rope bridges	The Corporation has engaged BCE to identify suitable locations. Tranen Revegetation Southwest will facilitate the installation of the rope bridges. This will be reported in a separate Memorandum.
15	Fauna management – western ringtail possum nest boxes	The Corporation has engaged BCE to identify suitable locations. Tranen Revegetation Southwest will facilitate the installation of the rope bridges. This will be reported in a separate Memorandum.
16	Within 12 months of the commencement of clearing, the Permit Holder must undertake revegetation within 0.55 hectares of the area hatched red on attached Plan 8191/1d in accordance with condition 17 of this permit.	This document

Ref	Requirement	Responsibility
17	Offset – revegetation and rehabilitation a) Within 3 months of clearing commencing, the Permit Holder must submit a Project Revegetation Plan to the CEO for approval for the revegetation of 10.34 hectares of land within the areas cross-hatched red on Plan 8191/1e, which shall be developed in accordance with A Guide to Preparing Revegetation Plans for Clearing Permits (Department of Water and Environmental Regulation (DWER) 2018). b) The Project Revegetation Plan must be prepared by an environmental specialist. c) The Project Revegetation Plan must include the following: (i) site preparation; (ii) deliberate planting of native vegetation that will provide suitable habitat(b) for western ringtail possum; (iii) deliberate planting of species associated with the *Eucalyptus rudis* (flooded gum*), Corymbia calophylla*, *Agonis flexuosa* Closed Low Forest (near Busselton)' priority ecological community (PEC) in areas as outlined in the Project Revegetation Plan; (iv) deliberate planting of up to 300 seedlings of *Conospermum caeruleum* var. Busselton; (v) planting of local provenance native understorey species at an optimal time so as to achieve the completion criteria specified in condition 17(a)(xii) below; (vi) a biannual weed control program within the area hatched red on Plan 8191/1e to achieve the completion criteria outline under condition 17(a)(xii), criterion 2; (vii) establishment of a total of 34, 5 x 5 metre monitoring quadrats within the area hatched red on Plan 8191/1e; (viii) maintenance of sufficient fencing to protect revegetation areas adjacent to areas most impacted by public access as outlined in the Project Revegetation Plan; (ix) implementation of hygiene protocols by cleaning earth-moving machinery of soil and vegetation prior to entering and leaving the site; (x) installation of signage to educate reserve users of the revegetation activities being undertaken; (xi) (xi) achieve the below completion criteria within the ten year monitoring period for the area hatched red on Plan 8191/1e; (xii) remedial actions to be undertaken if completion criteria are not met; and (xiii) management commitments that will be achieved. d) The Permit Holder shall implement the Project Revegetation Plan as approved by the CEO.	This document

Ref	Requirement	Responsibility
18 (b)	Record keeping The Permit Holder must maintain the following records: a) In relation to revegetation activities undertaken pursuant to conditions 16 and 17 of this Permit: (i) the date(s) each area was revegetated; (ii) the location of each area revegetated recorded using a GPS unit set to GDA94, expressing the geographical coordinates in Eastings and Northings or decimal degrees; (iii) at least two photographs of each area revegetated taken on an annual basis at the same location each year; (iv) a description of the revegetation activities undertaken each year for each area revegetated; and (v) a description of the tree density and native understorey vegetation cover for each area revegetated recorded on an annual basis.	Management and Processed relating to recording keeping and reporting of the Revegetation and Offset ONLY are provided in this document.

2.2.3 Completion Criteria

The development of this plan has been guided by the approved clearing permit issued by the Department of Water and Environmental Regulation (DWER). The permit includes the provision of the Completion Criteria required to be achieved at the end of the project period. The following is an excerpt from Section 17 of the permit:

Table 4 Completion Criteria - DWER Clearing Permit CPS 8191/1

Criterion	Aspect	Scale	Completion criteria description	Monitoring frequency
1	Per cent *weed* cover	Average of *quadrat* data and site traverse	<15 per cent weed cover across all sites	Bi-annually in the first 2 years, and annually for the next 8 years
2	Declared *weeds*	Site traverse	Absence of declared weeds	Bi-annually in the first 2 years, and annually for the next 8 years
3	Per cent bare ground	Average of *quadrat* data and site traverse	Per cent of bare ground to be no greater than that recorded in the *pre clearing surveys*.	Bi-annually in the first 2 years, and annually for the next 8 years
4	Vegetation condition	Site traverse	The condition of the vegetation to be in a good to very good condition on average across the revegetation area (Keighery 1994).	Bi-annually in the first 2 years, and annually for the next 8 years
5	Native vegetation cover/density	Average of *quadrat* data	>70 per cent native cover	Bi-annually in the first 2 years, and

				annually for the next 8 years
6	Species richness	Average of *quadrat* data	>70 per cent of species planted represented across all sites respectively (PEC, GCWS & QD) as outlined in the species list provided in the Project Revegetation Plan	Bi-annually in the first 2 years, and annually for the next 8 years
7	*Conospermum caeruleum var.* Busselton	Site traverse / direct survival observation	>50 per cent survival rate to be achieved	Bi-annually in the first 2 years, and annually for the next 8 years

2.3 Documentation

This report is based on the following information provided by the Client:

- Water Corporation 2020. CD00116, 2017/7932, CPS 8191/1 Vasse Diversion Drain Upgrade Var 2. Mitigation Package Summary. March 2020; and
- Various email correspondence with Water Corporation personnel inc. various attachments;
- Clearing Permit issued by DWER: CPS 8191/1.

2.4 Objectives

The Revegetation works have the following objectives:

1. Mitigate the effects of vegetation clearing within the local area and maximise local environmental benefits;
2. Build on existing and previous successful environmental enhancement projects undertaken locally;
3. Enhance habitat for the WRP and provide connectivity between areas of local distribution; and
4. Facilitate better connection and engagement between the local environment and community.

3 SITE DESCRIPTION

3.1 Site Location

The VDD revegetation project area is located within the City of Busselton, approximately 2 km south west of the Busselton CBD. A general location map showing the extent of site is provided in Appendix 1.

3.2 Existing Vegetation and Fauna

The upgrade works will require approximately 2.16 hectares of vegetation clearing as part of construction works. The condition of this vegetation is variable, approximately 75% of which is degraded or completely degraded (Water Corporation 2020). Despite this, the vegetation is considered locally and nationally significant, with the area considered habitat for the Critically Endangered Western Ringtail Possum (WRP). A section of vegetation to be cleared is also a WA state government Priority Ecological Community (PEC) - *Eucalyptus rudis*, *Corymbia calophylla*, *Agonis flexuosa* Closed Low Forest (near Busselton), which forms critical habitat for the State and Federally Protection Declared rare flora *Caladenia procera* (Cabunup Spider Orchid)

The existing condition of native vegetation within the revegetation zones is highly variable. However, in general, the majority is considered completely degraded due to the high level of disturbance from close urban proximity and previous land-use, minimal native vegetation strata representation and high weed abundance. Much of the revegetation area is considered “parkland cleared” with sparse trees and exotic grass understorey.

4 REVEGETATION STRATEGY

The overarching strategy for the revegetation works is to re-create naturally occurring and connected vegetation communities that:

- Are appropriate for their geographic location,
- Support long-term ecological function, and
- Provide suitable habitat for critical species.

The Revegetation Plan is also designed to consider key management requirements for native vegetation in an urban context.

Due to the numerous factors requiring consideration within the plan, additional layers of complexity are inherent in the development of an appropriate revegetation strategy. This Plan seeks to progressively establish focal areas of high biodiversity, with native vegetation forming a discontinuous mosaic-like corridor of variable structural composition and biological complexity, to reflect natural vegetation community structure.

4.1 Revegetation Zones

The project area (the "site") is separated into 5 key management zones based on existing and targeted vegetation communities. These are broken down into targeted management strategies and actions for specified sub-zones.

Initial revegetation quantities and planting densities for these zones have been produced based on the current existing native vegetation cover and the percentage of each zone available for intensive revegetation works. These are summarised as follows:

- Zone 1 – Quindalup Dune;
- Zone 2 – VDD Embankments;
- Zone 3 – Queen Elizabeth Avenue Swale (QE Ave Swale);
- Zone 4 – PEC Upland:
    - Zone 4.1 – Possum Corridor PEC;
    - Zone 4.2 – Western PEC;
    - Zone 4.3 – Central PEC;
    - Zone 4.4 – Eastern PEC;
    - Zone 4.5 – Southern PEC.
- Zone 5 – Drainage PEC:
    - Zone 5.1 – Western Basin PEC;
    - Zone 5.2 – Southern Swale PEC.

Detailed descriptions of each zone are provided in Section 5.

4.2 Vegetation Composition Classification

Vegetation composition has been classified within each revegetation zone to account for factors such as fire risk management, drainage asset management and the scale of species richness to be implemented. This is an additional consideration utilised to determine planting requirements and the composition of vegetation in each zone. The following classes have been utilised to define the types of vegetation to be established:

- **Low Fuel (3.6% of site):** Buffer of low-growing native vegetation adjacent to residential / commercial properties to reduce fire risk;
- **Open (34.3%):** Revegetation with minimal use of mid-storey species to maintain canopy separation and reduced fire risk / fuel loads, while minimising potential higher fuel loads where possible;
- **Restoration (58.9%):** Full strata representation and high biodiversity values;
- **High Diversity Nodes (Progressive):** Focal points of increased diversity within Restoration areas, extending outwards across the Restoration areas progressively. The extent of which will be determined by the site's trajectory towards meeting the Completion Criteria and availability of resources;
- **Drainage (3.2%):** Full strata representation and high biodiversity values where practical. Consideration is also provided for maintenance of management access and hydrological function.

4.3 Revegetation Species Prioritisation and Listing

The species utilised for the revegetation will focus on replicating suitable vegetation communities relevant to the local area. The original comprehensive species list was provided by DBCA to guide the revegetation species list. The species have been categorised and prioritised based on the following factors:

- **Propagation capacity:** The feasibility of propagating sufficient material for use in revegetation in the allocated project period;
- **Local availability:** Relative abundance of material that can be locally acquired, assuming that access to suitable collection areas is provided and seasonal / annual productivity variation is accounted for;
- **Provenance requirement**: Species with a proven distinct genetic provenance that is deemed important to preserve or, in some cases, a perceived provenance requirement;
- **Management requirement:** Likelihood of successful and eventual self-sufficient establishment considering the likely on-going pressures experienced at the project site.

Utilising the above factors, three species lists have been developed and are summarised as follows:

1. **Priority Species List:** Composed of mostly locally abundant and/or common species that can be propagated with relative ease. Plants will be sourced through a combination of nursery stock and locally collected provenance material. The quantities provided in this list are for planting in the first two years of project commencement. Species in this list are to be measured against the species richness Completion Criteria as outlined in the Clearing Permit;

2. **Progressive Target Species List**: Includes more difficult to source and/or propagate species. These are feasible for inclusion in the initial stages, and progressively expanded-on depending on project success trajectory, available resources and if sufficient material can be sourced and successfully propagated. There is potential to consider some targeted direct seeding. Due to the anticipated risks in sourcing and propagating material, this list is not to be considered as part of project Completion Criteria.

3. **Opportunistic Species List:** This list covers the remaining species provided in the initial list and is comprised of species that are uncommon, difficult to propagate and/or highly vulnerable. These species will be considered if sufficient material is sourced and resources are available. Any species used from this list will be focussed in the High Diversity Nodes and will likely only be attempted later in the project timeline where resources are available and surrounding, potentially buffering vegetation, is sufficiently established. These species will not be considered as part of project Completion Criteria.

4.3.1 Revegetation Species Mixes

A combination of revegetation zone and vegetation composition has been used to develop the following table, which categorises the site into specific species mixes relevant to each distinct area of site.

Table 4 Revegetation Composition

Reveg Zone	Revegetation Species Mix	Area (m²)	Species List	Vegetation Structure
1	Quindalup Dune Low Fuel	1,254	1,2	Lower storey only
1	Quindalup Dune Open	3,299	1,2	Minimal mid-storey
1	Quindalup Dune Restoration	3,355	1,2	All strata
2	VDD Embankment Restoration	6,848	1,2	Lower and mid-storey
3	QE Ave Swale Restoration	4,572	1,2	All strata
4.1	Possum Corridor Open	24,747	1,2	Minimal mid-storey
4.2	Western PEC Open	3,670	1,2	Minimal mid-storey
4.2	Western PEC Restoration	5,597	1,2,3	All strata + high diversity node
4.3	Central PEC Restoration	9,128	1,2	All strata
4.4	Eastern PEC Low Fuel	4,317	1,2	Lower storey only
4.4	Eastern PEC Open	20,347	1,2	Minimal mid-storey
4.4	Eastern PEC Restoration	18,165	1,2,3	All strata + high diversity node
4.5	Southern PEC Restoration	36,643	1,2,3	All strata + high diversity node
5.1	Western Basin PEC Drainage	1,490	1,2	All strata
5.2	Southern Swale PEC Drainage	3,559	1,2	All strata
		146,991		

The full species lists are provided in Appendix 3 of this document. Quantities are provided for *List 1: Priority Species* only and are intended for installation in the first two years of project commencement. Further infill planting utilising species from all lists will occur progressively to increase diversity and/or ensure the key Completion Criteria are met within the project timeframe and subject to available resources.

5 REVEGETATION APPROACH

Maps of the revegetation zones are provided in Appendix 2. The following provides a description of each revegetation zone, specific revegetation strategies required to achieve the overall aim of the revegetation works and a summary of key tasks in sequential order.

Further detailed methodology of each management action is provided in Section 6 of this document.

5.1 Zone 1 – Quindalup Dune

This zone encompasses a section of land at the north of the site directly adjacent to the previously completed first stage of the Vasse Diversion Drain Enhancement Project on the western bank of the VDD. The Quindalup Dune covers the upland areas, extending approximately 400 m along the western side of the VDD. A large proportion of the land was previously a Water Corporation depot site, which is now currently a gravel area used for informal parking and material lay-down. The remaining upland area is cleared parkland type vegetation, with weed / grass dominant understorey and peppermint tree overstorey.

The overall management within this zone is focussed on extending the works undertaken in the previous stage of enhancement works, which includes improvements to public access and revegetation.

Revegetation within the upland sections is to be undertaken through a combination of ground preparation and revegetation works to increase the diversity and ecological value of the area. The weeds will be treated via herbicide, followed by slashing and removal of biomass where weed cover is dense. The ground surface will then be mulched, followed by deep ripping across the revegetation area. Planting of tubestock will be undertaken following mulch application. Tree guards have not been allocated to this area due to the lower level of rabbit activity that was observed. Several possum nesting boxes will also be installed in amongst the existing peppermint trees.

Carpark / Gravel Area: The gravel carpark / laydown area of approx. 2,500 m² is to have the top 200mm removed and replaced with topsoil / clean-fill. The base of the excavation will also be deep ripped to reduce compaction.

Pathway Extension: As part of the extension of the previous enhancement project, a 2 m wide crushed limestone pathway will be constructed to join the existing pathway on the western side to the pedestrian bridge to the south of the site, a length of approximately 300 m. This will provide connection between the previous project and the wider enhancement / revegetation works. The path will likely need to meander through existing trees in some sections of site.



Figure 1 Zone 1 – Quindalup Dune

Zone 1 – Summary of Approach and Key Tasks

- Vegetation composition will be a combination of Restoration, Low Fuel and Open revegetation classes;
- 3m wide Low Fuel vegetation will be established adjacent to the residential property boundary;
- Soil remediation through removal of surface gravel, decompaction and replacement with topsoil in existing carpark / laydown area;
- Installation of crushed limestone pedestrian path through the western side of site adjacent to the VDD Embankment;
- Installation of WRP nest boxes;
- Soil surface preparation including ripping and mulching;
- Vegetation to reflect Quindalup Dune reference vegetation community;
- Low-impact fencing to manage access and protect establishing vegetation.

5.2 Zone 2 - VDD Embankments

The VDD embankments at the north of the site are highly degraded, with high weed cover and significant erosion occurring in many areas. The works in this area are intended to continue the enhancement and stabilisation works previously undertaken and contribute to the complete implementation of the wider vision for the area (Calibre 2018a).

Both the western and eastern embankments are to be revegetated to reflect the work previously undertaken on the adjacent embankments. This will include the removal of weeds, re-profiling of the embankment, erosion control matting and dense revegetation. Additional stabilisation is to be performed in selected sections of the lower embankment using bioengineering techniques, specifically brushwalling, due to the success of similar works in the area. Additional access management will be installed in the form of vegetated palisades in a number of locations along the embankment. More mature plants are to be installed along the lower embankment to provide more immediate erosion mitigation and improved survival. As with the original design of the Geocatch project, the works are intended to create a stable drain embankment with high ecological and aesthetic values.



Figure 2 Zone 2 – VDD Embankments

Zone 2 – Summary of Approach and Key Tasks

- Vegetation composition will be Restoration class revegetation, with a focus on functional species for embankment stabilisation;
- Embankment regrading, bioengineering (matting and brushwalling) and vegetated palisade areas to better control access;
- Use of advance stock on lower embankment to facilitate establishment of toe protection;
- Continuation of fencing along the top of the embankment.

5.3 Zone 3 - Queen Elizabeth Avenue (QE Ave) Swale

The swale runs along the western side of Queen Elizabeth Avenue, totalling a length of approximately 350 m. The swale contains some significant existing remnant wetland vegetation, which is to be completely cleared and modified as part of the upgrade works. It is intended to be revegetated across the entire area, with the embankments and base of the swale reinstated. The newly re-constructed embankments of the swale are to be covered with biodegradable coir mesh matting to prevent erosion during vegetation establishment in the first 2-3 years. The revegetation will focus on a wetland vegetation community to reflect the surrounding landscape and the likely hydrological conditions of the swale.

Weed control will be conducted prior to matting installation, although weed cover should be low due to the removal of surface soils, which should not be reintroduced. No other ground preparation will be required due to the reconstructed surface and the works will focus on stabilising the embankments and the rapid establishment of vegetation while maintaining swale function.



Figure 3 Zone 3 - QE Ave Swale

Zone 3 – Summary of Approach and Key Tasks

- Vegetation composition will be Restoration class revegetation;
- Protecting swale batters with matting to reduce erosion;
- Species planted to reflect a modified assemblage based on the Geographe Coastal Wetland System while maintaining function of asset;
- Fencing perimeter of swale with low-impact public management fencing.

5.4 Zone 4 – PEC Upland

The PEC Upland is comprised of several discrete revegetation areas with variable management strategies. Zone 4 covers all revegetation zones within the PEC suitable geographic range, including the north and south side of the VDD.

5.4.1 Zone 4.1 – Possum Corridor PEC

The Possum Corridor PEC zone covers a large area of existing vegetation in variable condition across the northern side of the VDD. The key focus of this zone is to enhance the WRP habitat and provide additional connectivity between the other revegetation zones. The primary tasks will be the installation of numerous rope bridges connecting pockets of vegetation and canopy continuity, with strategic infill planting across the entire area to improve habitat and ecological value. Additional opportunities for community engagement are also presented in this zone due to the proximity of a school and prior revegetation works that they have been undertaken in the area.

Rope bridges will be installed at each road cross-over running west-to-east and additional bridges installed across more major roads to provide connectivity to the greater area. Planting and tree guard installation will be conducted opportunistically around the zone, focussing on more degraded areas and where previous planting has had limited success. No ground preparation, mulching or other surface preparation is to be performed due to the sporadic nature of the infill planting. Comprehensive weed control will be undertaken as per other revegetation zones and will contribute to the ecological enhancement of this area.



Figure 4 Zone 4.1 - Possum Corridor PEC

Zone 4.1 – Summary of Approach and Key Tasks

- Vegetation composition will be Open revegetation, with a focus on increasing diversity of existing vegetation and possum habitat;
- Installation of rope bridges across gaps in canopy / roads and nest boxes for WRP;
- Management actions will focus on long-term weed management as a priority;
- Tree guards will be used in this area to reduce damage from rabbits;
- Vegetation to reflect PEC reference vegetation community.

5.4.2 Zone 4.2 – Western PEC

These pockets of revegetation will focus on the enhancement of existing vegetation, which is currently in a degraded state and has minimal native understorey representation. The primary site preparation for this sub-zone will involve significant ground preparation due to heavy compaction, particularly along informal vehicle tracks. These sites will be deep ripped following weed control and slashing. Mulching will also be undertaken in the revegetation areas to assist water retention and supress the weeds.

Herbivore protection fencing will be installed around the larger revegetation area, with the composition of revegetation being Restoration class and include a High Diversity Node in the centre.

The area to the south will focus on Open class revegetation and additional fuel load management through weed control and slashing. The small pocket to the west of QE Ave and the above southern area will have tree guards installed, with no mulching occurring in either of these areas.



Figure 5 Zone 4.2 – Western PEC

Zone 4.2 – Summary of Approach and Key Tasks

- Vegetation composition will be a combination of Open, Restoration and High Diversity Node revegetation;
- Deep ripping will be required in some areas of high soil compaction;
- Mulching will be undertaken in selected areas of this zone;
- A High Diversity Node will be established within the fenced section of the Zone;
- Herbivore exclusion fencing installed in selected areas;
- Vegetation to reflect PEC reference vegetation community.

5.4.3 Zone 4.3 – Central PEC

The Central PEC zone extends along a narrow area directly adjacent to and between the Possum Corridor PEC zone and the dual-use path (DUP) for approximately 1 km along the north side of the VDD. The current vegetation condition is mostly degraded or completely cleared, with minimal vegetation and highly modified and weedy understorey. The revegetation will be undertaken primarily to re-instate cleared vegetation and enhance ecological connectivity between the northern areas and the large areas of remnant vegetation further south. A shallow drainage swale has been constructed through this section to manage stormwater runoff from the new DUP and College Avenue.

Revegetation will exclude the base of the drainage swale (approx. 3 m width) to maintain asset management access and avoid existing underground services. This area will be left weed and vegetation free as part of on-going maintenance.

Additional mature tree stock (*Agonis flexuosa*) will be installed approx. 1.5 m offset from the north side of the DUP, with spacing at approx. 5m with the aim to provide a continuous canopy corridor for the WRP. Additional tubestock of low-lying species will be installed along this strip to enhance the ecological and aesthetic value adjacent to the path. The trees will also provide a “tree avenue” along the newly constructed DUP, which will have both ecological and aesthetic benefits. Tree guards will be used on all tubestock due to the high abundance of rabbits in this area.

A low-impact fence will be installed along the edge of the DUP to protect revegetation from pedestrian encroachment.



Figure 6 Zone 4.3 – Central PEC

Zone 4.3 – Summary of Approach and Key Tasks

- Vegetation composition will be Restoration revegetation;
- Revegetation works will be excluded from a 3m strip through the base of the drainage swale to maintain access and function and avoid underground services;
- Some ripping will be required in selected areas of high soil compaction;
- Mulching will be undertaken in selected areas;
- A single row of mature *Agonis flexuosa* will be installed along the path side of the zone to create a tree "avenue" at 5 m spacing, with some additional low-lying vegetation established underneath;
- Low-impact fencing to be installed along the DUP for protection of establishing vegetation;
- Vegetation to reflect PEC reference vegetation community.

5.4.4 Zone 4.4 – Eastern PEC

The Eastern PEC covers land adjacent to a section of industrial area at the eastern end of the site on the northern side of the VDD. It is characterised by open cleared parkland with large mature trees and minimal native understorey, dominated by introduced grasses. This zone is to be enhanced through the introduction of more representative native vegetation strata to increase WRP habitat and local ecological values. This section will also provide ecological connection to another previously completed restoration project by Geocatch: College Avenue Living Wetland Project.

Following weed control and slashing activities, this zone will be selectively ripped in open areas, followed by mulching, prior to planting. A combination of tree guards and herbivore protection fencing will also be installed to protect from herbivory.



Figure 7 Zone 4.4 – Eastern PEC

Zone 4.4 – Summary of Approach and Key Tasks

- Vegetation composition will be a combination of Low Fuel, Open, Restoration and High Diversity Node revegetation;
- A 10m wide Low Fuel zone including a 3m wide mineral earth firebreak / access track and turn-around will be established adjacent to the existing commercial property boundary;
- Some ripping will be required in open areas of high soil compaction;
- Mulching will be undertaken in selected areas;
- Multiple High Diversity Nodes will be established within the Restoration areas;
- The base of existing drainage channels will be excluded from revegetation works to maintain access and function;
- Existing vegetation within drainage areas will be managed through weed control and vegetation management;
- Herbivore exclusion fencing will be installed where practical across this zone, tree guards used in other areas;
- Vegetation to reflect PEC reference vegetation community.

5.4.5 Zone 4.5 – Southern PEC

The Southern PEC zone currently has significant native vegetation cover, although some sections have high weed cover and multiple signs of disturbance such as informal access tracks and high volumes of litter. The area has known populations of *C. procera* and other notable native species; therefore, is a high value area for local ecology.

Works in this zone will focus on ecological enhancement and improvements to known orchid habitat utilising a Restoration class revegetation approach and include a number of High Diversity Nodes. Works will also focus on reducing the fire fuel load through weed control and removal of weed biomass. Ground disturbance will be avoided to ensure that existing orchids are not disturbed. Revegetation planting will be limited to selected areas to increase diversity, targeted in the High Diversity Nodes. Fencing is proposed for as much of the zone as practical to reduce uncontrolled access and protect orchid populations from people and herbivores.



Figure 8 Zone 4.5 – Southern PEC

Zone 4.5 – Summary of Approach and Key Tasks

- Vegetation composition will be Restoration and High Diversity Node revegetation;
- No significant soil disturbance or other preparation will occur due to the potential for orchids to be present;
- Multiple High Diversity Nodes will be established within the Restoration areas;
- Revegetation will be minor and focus only on High Diversity Nodes;
- Key focus on careful weed management across this zone;
- Herbivore exclusion fencing will be installed where practical across this zone;
- Vegetation to reflect PEC reference vegetation community.

5.5 Zone 5 – Drainage PEC

Drainage PEC zones are differentiated from other PEC zones due to their unique species assemblages and the differing management requirements. The two sub-zones within this zone are also separated due to the requirements for differing approaches.

5.5.1 Zone 5.1 – Western Basin PEC

This sub-zone is primarily focussed on the revegetation of a compensating basin with minimal native vegetation cover. Species will comprise mostly native rushes and sedges and be concentrated around the edges of the basin as to ensure function of the drainage asset. No additional ground preparation works will be required within the basin. Due to the predominance of hardy rushes / sedges to be used in the revegetation, no tree guards are required for this sub-zone.



Figure 9 Zone 5.1 – Western Basin PEC

Zone 5.1 – Summary of Approach and Key Tasks

- Vegetation composition will be Drainage PEC revegetation class,
- Revegetation works will focus on the outer edges of the basin to maintain drainage access and function;
- Vegetation to reflect relevant PEC reference vegetation community.

5.5.2 Zone 5.2 – Southern Swale PEC

The Southern Swale PEC zone is a narrow section of vegetation to be cleared along the southern side of the VDD, located within the PEC. This area has a varied vegetation community structure and ecological condition, with evidence of several disturbances and past rehabilitation efforts. The upgrade works will require the clearing of the vegetation of this zone and reinstatement of ground conditions post-construction.

Revegetation works will focus on the establishment of species specific to the PEC and is intended to cover the entire zone due to the current vegetation cover and the proximity to other nearby dense vegetation. No specific ground preparation works are proposed for this area, although tree guards will be installed to protect all the tubestock planted.



Figure 10 Zone 5.2 - Southern Swale PEC

Zone 5.2 – Summary of Approach and Key Tasks

- Vegetation composition will be Restoration PEC revegetation class;
- Vegetation to reflect relevant PEC reference vegetation community.

6 IMPLEMENTATION METHODOLOGY

The following section outlines the specific methodology for each management action to be implemented as part of the project. The methodology for the key tasks is to be consistent across all of the zones in the project area, with some slight variations depending on site specific conditions. Further refinement of these will be required as part of implementation management, ensuring the need to remain flexible to provide the most effective outcomes.

6.1 Site Hygiene and Dieback Management

Site hygiene management is of the highest priority when working on this site. Several hygiene management measures are required to minimise the spread of weeds and diseases.

All vehicles and plant are to be cleaned down with all dirt and vegetative material removed offsite before being mobilised to site. Inspections will be undertaken by the superintendent or equivalent before the machine can be unloaded from the float. Ongoing inspections will be conducted periodically for the duration of the works.

6.2 Site Preparation

Several key site preparation tasks are critical to successful vegetation establishment. These tasks are itemised in order of implementation for the majority of the revegetation zones, although some variation in sequence may be required at the time of implementation.

6.2.1 Site Set-out

- Each revegetation zone and composition class area is to be visually delineated along the boundaries.
- Marking pegs / stakes or similar is to be used as a guide for revegetation areas where practical.
- It is expected that a high degree of accuracy is not required for these works and that the mark-out will not be required to be undertaken by a licenced surveyor.

6.2.2 Preliminary Weed Control

- Herbicide (predominantly Glyphosate Biactive or Fluazifop) is to be applied to control weeds within the revegetation areas via either boom spray or spot spray application. The exact application method will be determined by distribution of existing native vegetation.
- A minimum of 2x herbicide applications are to be undertaken prior to any revegetation works. These are to be at least 3 weeks apart.
- Additional weed control events may be required prior to planting in areas of high weed abundance.
- Manual and mechanical weed control will be conducted where possible within areas of existing native vegetation during follow-up events.
- Woody weeds are to be treated via cut-stump herbicide application using high concentration Glyphosate or Triclopyr. These are predominantly located in the Geocatch Extension Zone.

- Slashing is to be undertaken in areas of dense weed cover following initial herbicide treatment to reduce weed biomass / seed bank and facilitate installation of mulch and plants.
- All greenwaste generated from weed control activities is to be removed and disposed of offsite.

6.2.3 Soil Surface Preparation

- Deep ripping is to be undertaken to a minimum depth of 300 mm using a single tine.
- Riplines are to be approximately 1 m spacing and cross ripped where possible to ensure a more natural distribution of planting.
- Ripping is to occur after any mulching to avoid compacting the riplines;
- Riplines will require some rainfall post-installation and prior to planting to allow for settlement of the soil.

6.2.4 Mulching

- Mulch material is to be weed and disease free and be a coarse nature mulch or similar equivalent product.
- Mulch is to be installed to a nominal depth of 75 mm in all specified areas via a combination of machinery and manual methods. Compaction from repeated tracking over areas is to be avoided when using machinery.
- All mulching is to be undertaken prior to planting.

6.3 Possum Infrastructure

6.3.1 Possum Bridges

- Simple rope bridges are to be installed across roadways and other large gaps in the tree canopy.
- Installation is to be undertaken by a qualified arborist to ensure connections to trees are appropriate and installation is undertaken safely.
- Oversight of exact locations and specifications of rope bridges is to be provided by the appropriate specialist consultants.

6.3.2 Fauna Shelters (Nesting Boxes)

- Specification for fauna shelters are to be determined in consultation with Geocatch and specialist consultants.
- The fauna shelters are to be fabricated by the Busselton Men's Shed, who have experience in building these structures.
- The fauna shelters are to be installed strategically under direction from specialist consultants and secured minimising damage to trees.

6.4 Embankment Stabilisation

6.4.1 Embankment Re-grading

- Following initial weed treatment, the embankments are to be re-profiled through a combination of manual and mechanical techniques to create more bank stability and improved conditions for revegetation.
- Works are to focus on large areas of exposed banks and where there is minimal native vegetation.

6.4.2 Erosion Control Matting

- 700 gsm coir mesh matting and/or 800gsm jute matting is to be installed across exposed and re-profiled areas of embankment. The lower-most section of the embankment will not be matted due to fluctuating water levels potentially damaging the matting.
- The matting should be secured using 280mm biodegradable starch pins.
- The top edges of the matting is to be trenched-in and sheets laid perpendicular to the flow of the drain.
- Focus of matting is to be on large open areas, and work around existing vegetation where possible.

6.4.3 Foreshore Toe Stabilisation

- Toe stabilisation is to utilise a similar approach to the Calibre design (Calibre 2018b), as amended by Tranen, implemented for the first stage of the Geocatch VDD enhancement project.
- Brushwalls are to be installed along exposed areas of the lower embankment, particularly in areas with minimal existing native vegetation.
- Sufficient space is to be allowed for behind brushwalls to provide an area for planting
- All plants installed at the toe of the embankment should be larger, more advanced stock (minimum 130 mm pots) and ideally salt-hardened prior to installation.
- The key design parameter for the brushwall is to ensure to top of the structure is above the typical high-water mark of the drain. More than one brushwall may be required in some areas to provide adequate toe protection across multiple water horizons.

6.5 Revegetation

6.5.1 Species Selection and Plant Propagation

- Plant stock is to be species native to the local area and local provenance where possible. Limitations exist for provenance in this area due to the restricted extent of remnant vegetation this should not restrict the ability to source a diverse selection of species;
- Local provenance material is to be sourced from the Swan Coastal Plain - Perth (SWA02) Interim Biogeographical Region of Australia (IBRA) sub-region, within 100km of the site where possible.
- Species have been selected based on balancing likely availability, function, local ecology and specific regulatory requirements specific to Endangered and Priority species.

- Stock is to be sourced from accredited nurseries, with a proportion to be sourced from local nurseries where possible.
- Tubestock is to be provided in deep cells and / or forestry tubes or similar. Advanced *Juncus kraussii* is to be minimum 130 mm pots and mature trees in min. 11 litre pots.

6.5.2 Tubestock Installation

- Tubestock is to be planted via planting tubes / augers for efficiency and safety purposes.
- Watering of all stock is to occur on the day of planting prior to installation.
- 10 g fertiliser tablets or 5 g of TerraCottem™ is to be installed with each tubestock, except for wetter areas. Terracottem is to be installed on the embankments and tablets will be used in upland areas.
- Corflute tree guards are to be installed around each tubestock as specified. The guards are to be secured with a single hardwood stake.

6.5.3 Mature Trees

- Stock is to be min. 11 L in size and at least 1 m in height.
- Holes for the mature trees are to be over-excavated by an additional 50% for the size of the pot and back-filled with a soil conditioner medium.
- Each tree is to be secured with 2 x 50 mm x 50 mm x 1800 mm hardwood stakes and attached with rubber tree-tie.
- 1 m wide mulch rings at a depth of 75 mm to be installed around each tree when not located in mulched areas.
- Watering is to be conducted immediately post-install and additional follow-up watering depending on weather conditions at time of install.

6.6 Fencing

6.6.1 Post and Rail Barrier Fencing

This fence type is to be installed along the top of the VDD Embankment in Zone 2. This will be a continuation of the existing fencing located in the adjacent section. The fence is to be Treated pine post and rail, using 125mm diameter timber and constructed to 1.2 m in height. A single sighter wire to be included as per existing fence design.

6.6.2 Public Management Fencing

This fencing is aimed to be visibly low-impact, with treated pine posts and three white sighter wires with a height of 1.2 m. It is designed to discourage public access to revegetation areas without creating a significant physical barrier or visually disrupting the visual amenity of the revegetation areas.

6.6.3 Herbivore Protection Fencing

This fencing will be utilised to protect larger areas of revegetation from herbivory as a more effective alternative to tree guards and limit public access. It is to be constructed from ring-lock material to a min. height of 1.2 m and include a 600 mm high rabbit skirt, which also extends 300mm over the ground to prevent digging underneath.

6.6.4 Temporary Orchid Protection

Orchid protection fencing is to be installed for the duration of construction works around areas of known and potential *C. procera* habitat. This is to be a hard barrier at least 1.8 m in height and shade cloth installed on the construction side to reduce impacts of dust.

7 POST-INSTALLATION MONITORING AND MAINTENANCE

Following completion of the installation phase, the site will enter a ten-year maintenance period. Regular monitoring will be undertaken to track progress against the established completion criteria. Where the success targets are not being met, remedial action will be determined and undertaken to ensure the project goals are met by the end of the maintenance period.

7.1 Vegetation Monitoring

7.1.1 Monitoring Events

- A ten-year comprehensive monitoring program is to be established to monitor the success of the revegetation efforts against the established criteria, provide recommendations to improve success and document the progress of the works more generally.
- Monitoring will be undertaken each spring and autumn for the first two years with annual monitoring conducted in spring for the remaining eight years.
- Monitoring quadrats are to be established across all revegetation areas, with a total of 34 monitoring quadrats established across all revegetation zones.
- Quadrats are to be 5 m x 5 m in size and randomly established, ensuring representation of all vegetation types and revegetation zones.
- Photo monitoring points are also to be established across the site to provide qualitative data and a direct visual capture of progress.
- Visual assessment of the entire site through site traverses is to be undertaken as part of each monitoring event to provide a broader picture of success, and identify the progress of areas that are not captured buy the quadrat data;
- Additional informal monitoring of site progress is to be undertaken regularly in addition to formal monitoring events where possible.

7.1.2 Monitoring Reporting

- A report is to be provided for each monitoring event to document the findings and provide recommendations for any additional actions required to achieve the project targets.

7.2 Site Maintenance

7.2.1 Weed Management

- Weed management will be undertaken over the maintenance period to ensure <15% weed cover, as per Criteria 1 and 2 of Condition 17.(c)(xi) of the Clearing Permit.
- Herbicide spraying and manual removal of weeds is to be undertaken quarterly across the revegetation areas to align with seasonal changes: spring, summer, autumn, winter.
- Spot spraying will be the maintenance method of herbicide application to minimise off-target damage to revegetation plantings.

7.2.2 Infill Planting

- Infill planting is to occur as required over the monitoring and maintenance period to ensure Completion Criteria are met for vegetation cover and richness targets, as per Condition 17.(c)(xi).
- The requirements for infill planting will be determined based on the outcomes of the monitoring and will utilise all species from the proposed species lists where appropriate.
- Increasing species richness, particularly in High Diversity Nodes and Restoration areas will be a focus of the infill planting. However, key indicators of revegetation success will need to show a positive trajectory towards meeting the Completion Criteria before significant efforts are made to increase diversity further.

7.2.3 Tree Guard Maintenance and Removal

- All tree guards are to be monitored and maintained, including adjustment, replacement and removal once no longer required. Guards will remain in place until the plant has matured and is resilient enough to survive without it or has died. All guards will be removed by the end of the maintenance period.

7.2.4 Watering

- Watering of tubestock is to be undertaken fortnightly (if required) for the first summer post-installation to assist establishment.
- This is to focus on larger revegetation areas where planting is dense, and mature trees. More sporadic planting is to be watered only if practical to do so.

8 REFERENCES

Calibre 2018b. Vasse Diversion Drain Enhancement Project Stage 1 – Detailed Design. Calibre Consulting, March 2018.

Calibre 2018a. Vasse Diversion Drain Restoration and Landscape Concept Plan. Calibre Consulting, January 2018.

Water Corporation 2020. CD00116, 2017/7932, CPS 8191/1 Vasse Diversion Drain Upgrade Var 2. Mitigation Package Summary. March 2020

Appendix 1 Site Location

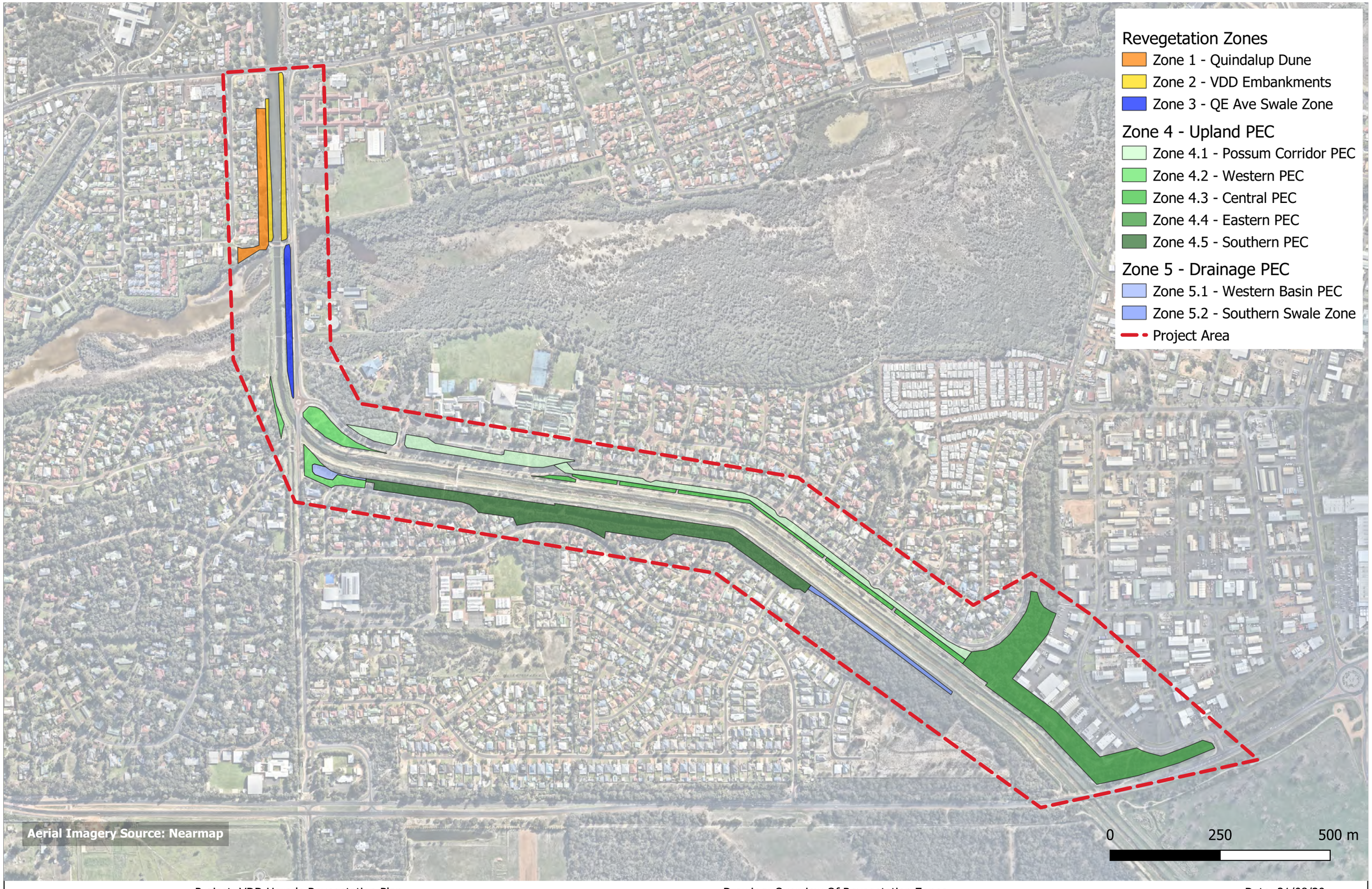


Project: VDD Upgrade Revegetation Plan
Project Number: P875B
Client: Water Corporation

Drawing: Site Location
Drawing Number: P875B-00
Revision: 1

Date: 09/09/20
Drawn By: AJ

Appendix 2 Revegetation Zones



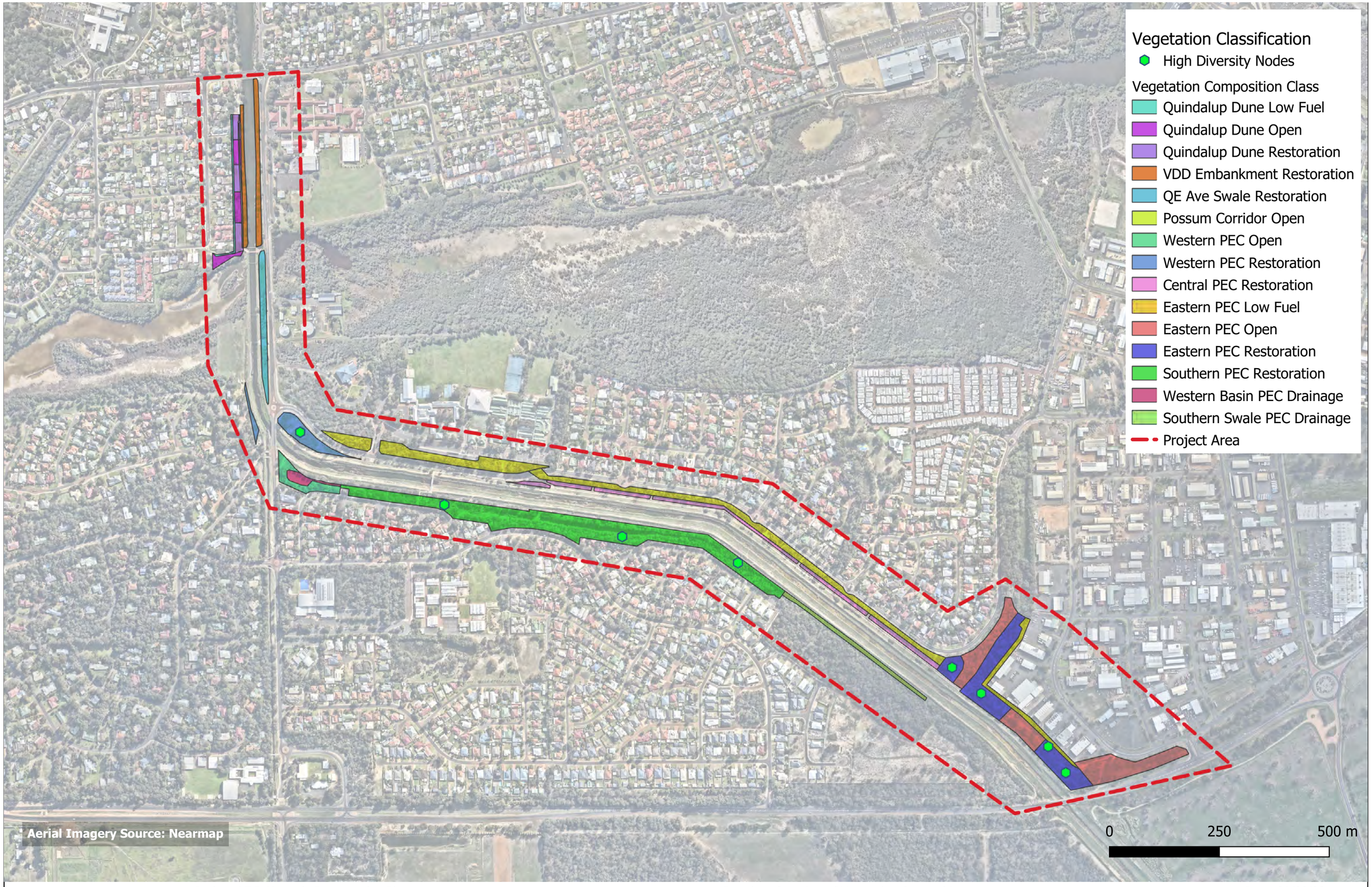
tranen revegetation southwest

Project: VDD Ugrade Revegetation Plan
Project Number: P875B
Client: Water Corporation

Drawing: Overview Of Revegetation Zones
Drawing Number: P875-01
Revision: 3

Date: 21/08/20
Drawn By: AJ

N



tranen revegetation southwest

Project: VDD Upgrade Revegetation Plan
Project Number: P875B
Client: Water Corporation

Drawing: Overview of Vegetation Composition
Drawing Number: P875B-02
Revision: 1

Date: 21/08/20
Drawn By: AJ

N

Appendix 3 Indicative Species Lists

tranen
revegetation southwest

Vasse Diversion Drain Upgrade
Primary Species List and Quantities
For planting 1st and 2nd Year

Revegetation Zones	Area (m2)	Seedling Density (plants / m2)	Total Seedlings
Quindalup Dune Low Fuel	1,254	1.3	1,599
Quindalup Dune Open	3,299	1.0	3,332
Quindalup Dune Restoration	3,355	1.8	6,092
VDD Embankment Restoration	6,848	2.4	16,637
QE Ave Swale Restoration	4,572	3.0	13,716
Possum Corridor Open	24,747	0.3	7,742
Western PEC Open	3,670	1.0	3,778
Western PEC Restoration	5,597	1.4	7,868
Central PEC Restoration	9,128	1.4	13,016
Eastern PEC Low Fuel	4,317	1.0	4,252
Eastern PEC Open	20,347	0.9	17,463
Eastern PEC Restoration	18,165	1.0	18,132
Southern PEC Restoration	36,643	0.1	3,772
Western Basin PEC Drainage	1,490	1.0	1,548
Southern Swale PEC Drainage	3,559	2.6	9,093
TOTAL	**146,991**	0.87	**128,040**

	Quindalup Dune				Geographe Coastal Wetland	Priority Ecological Community										
Species	**Quindalup Dune Low Fuel**	**Quindalup Dune Open**	**Quindalup Dune Restoration**	**VDD Embankment Restoration**	**QE Ave Swale Restoration**	**Possum Corridor Open**	**Western PEC Open**	**Western PEC Restoration**	**Central PEC Restoration**	**Eastern PEC Low Fuel**	**Eastern PEC Open**	**Eastern PEC Restoration**	**Southern PEC Restoration**	**Western Basin PEC Drainage**	**Southern Swale PEC Drainage**	**Total**
Tree Species																
Agonis flexuosa	0	300	800	0	250	0	50	150	500	0	500	500	50	0	50	**3,150**
Banksia grandis	0	0	0	0	0	0	50	100	300	0	500	500	50	0	50	**1,550**
Banksia littoralis	0	0	0	0	150	0	0	0	250	0	300	300	50	50	150	**1,250**
Corymbia calophylla	0	0	0	0	0	0	50	100	200	0	500	500	50	0	50	**1,450**
Eucalyptus decipiens	0	0	0	0	0	0	0	100	100	0	300	300	50	0	50	**900**
Eucalyptus rudis	0	0	0	0	150	0	25	0	100	0	300	300	50	50	100	**1,075**
Melaleuca preissiana	0	0	0	0	0	0	0	0	0	0	100	100	50	50	200	**500**
Melaleuca rhaphiophylla	0	0	0	0	500	0	0	0	0	0	100	100	50	50	200	**1,000**
Sub-Total	**0**	**300**	**800**	**0**	**1,050**	**0**	**175**	**450**	**1,450**	**0**	**2,600**	**2,600**	**400**	**200**	**850**	**10,875**
Shrub Species																
Acacia cochlearis	0	0	500	800	0	0	0	0	0	0	0	0	0	0	0	**1,300**
Acacia littorea	0	0	500	800	300	0	0	0	0	0	0	0	0	0	0	**1,600**
Acacia pulchella	0	0	0	0	0	200	100	250	500	0	150	500	25	0	100	**1,825**
Acacia saligna	0	0	0	0	50	100	0	50	200	0	50	200	25	0	50	**725**
Acacia stenoptera	0	0	0	0	0	200	100	250	200	0	100	400	25	0	100	**1,375**
Adenanthos meisneri	0	0	0	0	0	250	100	300	400	0	500	500	100	0	250	**2,400**
Alyxia buxifolia	0	100	200	250	0	0	0	0	0	0	0	0	0	0	0	**550**
Daviesia physodes	0	0	0	0	0	150	0	200	250	0	200	300	50	0	100	**1,250**
Diplolaena dampieri	0	0	100	0	0	0	0	0	0	0	0	0	0	0	0	**100**
Gompholobium capitatum	0	0	0	0	0	100	50	150	300	0	300	500	50	0	150	**1,600**
Gompholobium tomentosum	0	0	0	0	0	150	100	250	400	0	350	500	50	0	150	**1,950**
Hakea prostrata	0	0	0	0	0	150	0	200	400	0	100	500	50	0	100	**1,500**
Hakea varia	0	0	0	0	300	0	0	200	300	0	100	500	50	25	100	**1,575**
Hibbertia cuneiformis	0	150	500	800	0	300	50	250	350	0	300	400	50	0	150	**3,300**
Hibbertia racemosa	0	0	0	0	0	200	100	200	350	0	350	400	50	0	150	**1,800**
Hovea trisperma	0	0	0	0	0	150	200	200	350	0	300	300	50	0	100	**1,650**
Jacksonia furcellata	0	0	0	0	0	150	0	250	400	0	50	300	50	0	150	**1,350**
Kunzea glabrescens	0	0	0	0	0	150	0	150	250	0	50	400	50	25	150	**1,225**
Melaleuca cuticularis	0	0	0	600	300	0	0	0	0	0	0	0	0	0	0	**900**
Melaleuca incana	0	0	0	0	250	0	0	0	0	0	0	0	0	0	0	**250**
Melaleuca viminea	0	0	0	0	250	0	0	0	0	0	0	0	0	0	0	**250**
Olearia axilaris	0	100	100	600	0	0	0	0	0	0	0	0	0	0	0	**800**
Phyllanthus calycinus	0	100	150	250	0	250	0	150	300	0	350	300	50	0	150	**2,050**
Rhagodia baccata	500	200	300	600	200	0	0	0	0	0	0	0	0	0	0	**1,800**
Spyridium globulosum	0	0	500	500	0	250	0	250	500	0	150	500	50	0	200	**2,900**
Xanthorrhoea brunonis	0	0	0	0	0	250	50	150	300	0	100	300	50	0	150	**1,350**
Xanthorrhoea preissii	0	0	0	0	0	250	50	150	300	0	100	300	50	0	150	**1,350**
Sub-Total	**500**	**650**	**2,850**	**5,200**	**1,650**	**3,250**	**900**	**3,600**	**6,050**	**0**	**3,600**	**7,100**	**875**	**50**	**2,450**	**38,725**
Herbs and Groundcover Species																
Anigozanthos manglesii	0	0	0	0	0	350	300	500	600	0	1000	800	50	0	150	**3,750**
Austrostipa compressa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**Seed only**
Austrostipa flavescens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**Seed only**
Chamaescilla corymbosa	0	0	0	0	0	150	200	200	300	350	500	300	50	0	150	**2,200**
Conospermum caeruleum var.Busselton	0	0	0	0	0	300	150	100	200	250	300	350	50	25	150	**1,875**
Conostylis aculeata	0	0	0	0	0	500	200	400	500	500	1200	700	50	0	150	**4,200**
Dampiera alata	0	0	0	0	0	250	100	200	250	200	500	400	50	0	150	**2,100**
Dampiera linearis	0	0	0	0	0	250	200	200	300	300	500	400	100	0	150	**2,400**
Hardenbergia comptoniana	0	50	50	0	0	150	100	100	150	150	300	200	50	0	150	**1,450**
Kennedia prostrata	0	0	0	0	0	500	200	400	500	500	900	500	50	0	150	**3,700**
Lomandra micrantha	0	0	0	0	0	500	200	250	400	0	800	450	50	0	150	**2,800**
Muehlenbeckia adpressa	0	0	0	0	150	150	100	100	150	200	300	300	50	0	150	**1,650**
Patersonia occidentalis	0	0	0	0	0	500	200	400	500	600	1200	700	50	0	150	**4,300**
Rytidosperma caespitosum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**Seed only**
Rytidosperma occidentale	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**Seed only**
Samolus junceus	0	0	0	0	500	0	0	0	0	0	0	0	0	0	0	**500**
Samolus repens	0	0	0	0	500	0	0	0	0	0	0	0	0	0	0	**500**
Scaevola calliptera	0	0	0	0	0	292	100	250	300	500	500	400	50	0	150	**2,542**
Scaevola crassifolia	0	150	100	600	0	0	0	0	0	0	0	0	0	0	0	**850**
Stackhousia monogyna	0	0	0	0	0	200	100	150	250	200	500	300	50	0	150	**1,900**
Stylidium brunonianum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**Seed only**
Trachymene coerulea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**Seed only**
Sub-Total	**0**	**200**	**150**	**600**	**1,150**	**4,092**	**2,150**	**3,250**	**4,400**	**3,750**	**8,500**	**5,800**	**700**	**25**	**1,950**	**36,717**
Rushes and Sedges																
Baumea juncea	0	0	0	0	2066	400	553	568	516	502	1163	1032	597	273	1243	**8,913**
Carex preissii	0	0	0	0	0	0	0	0	300	0	500	500	300	200	800	**2,600**
Ficinia nodosa	1099	500	500	5037	0	0	0	0	0	0	0	0	0	0	0	**7,136**
Gahnia trifida	0	0	0	0	2500	0	0	0	300	0	500	500	300	200	800	**5,100**
Juncus kraussii	0	0	0	1300	1800	0	0	0	0	0	0	0	0	0	0	**3,100**
Juncus kraussii - advanced	0	0	0	2000	0	0	0	0	0	0	0	0	0	0	0	**2,000**
Lepidosperma gladiatum	0	1682	1792	2500	0	0	0	0	0	0	0	0	0	0	0	**5,974**
Lepidosperma longitudinale	0	0	0	0	3500	0	0	0	0	0	300	300	300	300	500	**5,200**
Lepidosperma squamatum	0	0	0	0	0	0	0	0	0	0	300	300	300	300	500	**1,700**
Sub-Total	**1,099**	**2,182**	**2,292**	**10,837**	**9,866**	**400**	**553**	**568**	**1,116**	**502**	**2,763**	**2,632**	**1,797**	**1,273**	**3,843**	**41,723**
TOTAL	**1,599**	**3,332**	**6,092**	**16,637**	**13,716**	**7,742**	**3,778**	**7,868**	**13,016**	**4,252**	**17,463**	**18,132**	**3,772**	**1,548**	**9,093**	**128,040**

tranen
revegetation southwest

Vasse Diversion Drain Upgrade
Additional Species Lists

For infill Planting Year 3 - 10

Progressive Target Species List

SPECIES NAME	PEC	GCWS	QD
Adriana quadripartita		*	
Agrostocrinum scabrum	*		
Austrostipa campylachne	*		
Burchardia congesta	*		
Chorizema diversifolium	*		
Cryptandra arbutiflora	*		
Dianella brevicaulis	*		
Dichondra repens			*
Dichopogon capillipes	*		
Hibbertia hypericoides	*		
Hyalosperma cotula	*		
Hypolaena pubescens	*		
Leucopogon parviflorus			*
Leucopogon propinquus	*		
Lobelia tenuior	*		
Logania serpyllifolia	*		
Logania vaginalis	*		
Lomandra caespitosa	*		
Lomandra nigricans	*		
Lomandra preissii	*		
Lomandra sericea	*		
Lomandra suaveolens	*		
Microlaena stipoides	*		
Microtis media	*		
Myoporum caprarioides		*	
Opercularia apiciflora	*		
Opercularia hispidula	*		
Opercularia vaginata	*		
Philotheca spicata	*		
Pimelea angustifolia	*		
Pimelea argentea			*
Pimelea rosea	*		
Pimelea sylvestris	*		
Platytheca galioides	*		
Sowerbaea laxiflora	*		
Tetraria capillaris	*		
Tetraria octandra	*		
Thysanotus multiflorus	*		
Thysanotus patersonii/manglesianus	*		

Opportunistic Species List

SPECIES NAME	PEC
Astroloma ciliatum	*
Astroloma pallidum	*
Caesia micrantha	*
Caladenia attingens	*
Caladenia flava	*
Caladenia paludosa	*
Caladenia reptans	*
Caladenia speciosa	*
Cassytha glabella	*
Cassytha racemosa	*
Centrolepis aristata	*
Centrolepis drummondiana	*
Comesperma confertum	*
Craspedia variabilis	*
Cyrtostylis huegelii	*
Daucus glochidiatus	*
Desmocladus fasciculatus	*
Drosera erythrorhiza	*
Drosera glanduligera	*
Drosera menziesii	*
Drosera pallida	*
Eriochilus dilatatus	*
Geranium solanderi	*
Hibbertia cunninghamii	*
Hibbertia diamesogenos	*
Homalosciadium homalocarpum	*
Hydrocotyle callicarpa	*
Hypoxis occidentalis	*
Lagenophora huegelii	*
Leptoceras menziesii	*
Levenhookia pusilla	*
Lomandra hermaphrodita	*
Lomandra pauciflora	*
Lyginia barbata	*
Lyperanthus nigricans	*
Millotia tenuifolia	*
Olax benthamiana	*
Oxalis exilis	*
Poranthera microphylla	*
Pterostylis nana	*
Pterostylis vittata	*
Pyrorchis nigricans	*
Rhodanthe citrina	*
Stylidium calcaratum	*
Stylidium crassifolium	*
Stypandra glauca	*
Thysanotus arenarius	*
Thysanotus sparteus	*
Thysanotus thyrsoideus	*
Trachymene pilosa	*
Tricoryne elatior	*
Tripterococcus brunonis	*
Xanthosia candida	*
Xanthosia huegelii	*

Appendix F
Regulator liaison

From:	Sean Nicholson
To:	epbcmonitoring@awe.gov.au; Post Approval; compliance@environment.gov.au; Info
Cc:	Louis Tang; Aaron Thorburn; Alex Gower; Alyce Nehme; Margaret McCormack; Steve Rolls
Subject:	2017/7932, CPS 8191/1, CD00116 - Vasse Diversion Drain Upgrade - Annual Environmental Compliance Report
Date:	Friday, 30 June 2023 12:36:51 PM

CAUTION: This email originated from outside of RPS.

Good Afternoon,

In accordance with the permit Conditions below, the Corporation has prepared the Annual Environmental Compliance Report for environmental approvals at the WA State and Federal Level for the CD00116 - Vasse Diversion Drain Upgrade. Practical completion of the construction works was 18 June 2021. Revegetation planting and weed management work is ongoing, in addition to minor completions work (e.g. installation of railings and stairs).

2017/7932	16. **The approval holder must prepare a compliance report for each 12 month period following the date of commencement of the action, or otherwise in accordance with an annual date that has been agreed to in writing by the Minister**. The approval holder must: a. publish each compliance report on the website within 60 business days following the relevant 12 month period; b. notify the Department by email that a compliance report has been published on the website and provide the weblink for the compliance report within five business days of the date of publication; c. keep all compliance reports publicly available on the website until this approval expires; d. exclude or redact sensitive ecological data from compliance reports published on the website; and e. where any sensitive ecological data has been excluded from the version published, submit the full compliance report to the Department within 5 business days of publication.
CPS 8191/1	19. Reporting (a) The Permit Holder must provide to the CEO on or before 30 June of each year, a written report: (i) of records required under condition 18 of this Permit; and (ii) concerning activities done by the Permit Holder under this Permit between 1 January to 31 December of the preceding calendar year.

2017/7932, CPS 8191/1 , CD00116 Vasse Diversion Drain Annual Environmental Compliance Report.

https://filetransfer.rpsgroup.com.au/link/fIuBNXvHshziZKe1KObfKi

Please note this link will expire by 31 July 2023. Please contact me if you need to access the document after this date.

If you have any queries about the Compliance report or have any difficulties downloading the documentation, please do not hesitate to contact me. As per 2017/7932 Condition 16(a), the Corporation will make this compliance report available (with sensitive ecological information

redacted) on the project website (see below) within 60 days.

https://www.watercorporation.com.au/Outages-and-works/Ongoing-Works/Vasse-diversion-drain-upgrade

Kind regards,

Sean Nicholson
Senior Environment Advisor
Assets Planning and Delivery
Water Corporation

E sean.nicholson@watercorporation.com.au
T (08) 9420 2125
Working remotely on Wednesdays and Fridays

watercorporation.com.au

Water Corporation acknowledges the Traditional Owners throughout Western Australia and their continuing connection to the land, water and community. We pay our respects to all members of the Aboriginal communities and their cultures and to Elders past, present and emerging.

The Water Corporation respects individuals' privacy. Please see our privacy notice at What about my privacy

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From:	Sean Nicholson
To:	epbcmonitoring@awe.gov.au; Post Approval; compliance@environment.gov.au; Info
Cc:	Louis Tang; Alyce Nehme; Margaret McCormack; Steve Rolls
Subject:	RE: 2017/7932, CPS 8191/1, CD00116 - Vasse Diversion Drain Upgrade - Annual Environmental Compliance Report - Published on Water Corporation Website
Date:	Tuesday, 22 August 2023 8:38:18 AM

CAUTION: This email originated from outside of RPS.

Good morning,

In accordance with the permit Conditions below, the Corporation has published the Annual Environmental Compliance Report for environmental approvals at the WA State and Federal Level for the CD00116 - Vasse Diversion Drain Upgrade, on the Corporations project website (with sensitive ecological information redacted).

2017/7932	16. **The approval holder must prepare a compliance report for each 12 month period following the date of commencement of the action, or otherwise in accordance with an annual date that has been agreed to in writing by the Minister**. The approval holder must: a. publish each compliance report on the website within 60 business days following the relevant 12 month period; b. notify the Department by email that a compliance report has been published on the website and provide the weblink for the compliance report within five business days of the date of publication; c. keep all compliance reports publicly available on the website until this approval expires; d. exclude or redact sensitive ecological data from compliance reports published on the website; and e. where any sensitive ecological data has been excluded from the version published, submit the full compliance report to the Department within 5 business days of publication.
CPS 8191/1	19. Reporting (a) The Permit Holder must provide to the CEO on or before 30 June of each year, a written report: (i) of records required under condition 18 of this Permit; and (ii) concerning activities done by the Permit Holder under this Permit between 1 January to 31 December of the preceding calendar year.

The report can be publicly accessed via Vasse diversion drain upgrade and navigating to Documents > Annual Compliance Reports. Or you can access it directly via the link below.

Direct link: https://pw-cdn.watercorporation.com.au/-/media/WaterCorp/Documents/Outages-and-Works/Ongoing-works/Vasse/Vasse-Diversion-Drain-Annual-Compliance-Report-2022.pdf

Kind regards,

Sean Nicholson
Senior Environment Advisor
Water Corporation

E: sean.nicholson@watercorporation.com.au
T: (08) 9420 2125
Working remotely on Wednesdays and Fridays

From: Sean Nicholson
Sent: Friday, 30 June 2023 12:36 PM
To: epbcmonitoring@awe.gov.au; Post Approval <PostApproval@awe.gov.au>; compliance@environment.gov.au; Info <info@dwer.wa.gov.au>
Cc: Louis Tang <Louis.Tang@watercorporation.com.au>; Aaron Thorburn <Aaron.Thorburn@watercorporation.com.au>; Alex Gower <Alex.Gower@watercorporation.com.au>; Alyce Nehme <Alyce.Nehme@watercorporation.com.au>; Margaret McCormack <Margaret.McCormack@rpsgroup.com.au>; Steve Rolls <Steve.Rolls@rpsgroup.com.au>
Subject: 2017/7932, CPS 8191/1, CD00116 - Vasse Diversion Drain Upgrade - Annual Environmental Compliance Report

Good Afternoon,

In accordance with the permit Conditions below, the Corporation has prepared the Annual Environmental Compliance Report for environmental approvals at the WA State and Federal Level for the CD00116 - Vasse Diversion Drain Upgrade. Practical completion of the construction works was 18 June 2021. Revegetation planting and weed management work is ongoing, in addition to minor completions work (e.g. installation of railings and stairs).

2017/7932	16. **The approval holder must prepare a compliance report for each 12 month period following the date of commencement of the action, or otherwise in accordance with an annual date that has been agreed to in writing by the Minister**. The approval holder must: a. publish each compliance report on the website within 60 business days following the relevant 12 month period; b. notify the Department by email that a compliance report has been published on the website and provide the weblink for the compliance report within five business days of the date of publication; c. keep all compliance reports publicly available on the website until this approval expires; d. exclude or redact sensitive ecological data from compliance reports published on the website; and e. where any sensitive ecological data has been excluded from the version published, submit the full compliance report to the Department within 5 business days of publication.
CPS 8191/1	19. Reporting (a) The Permit Holder must provide to the CEO on or before 30 June of each year, a written report: (i) of records required under condition 18 of this Permit; and (ii) concerning activities done by the Permit Holder under this Permit between 1 January to 31 December of the preceding calendar year.

Report.

https://filetransfer.rpsgroup.com.au/link/fIuBNXvHshziZKe1KObfKi

Please note this link will expire by 31 July 2023. Please contact me if you need to access the document after this date.

If you have any queries about the Compliance report or have any difficulties downloading the documentation, please do not hesitate to contact me. As per 2017/7932 Condition 16(a), the Corporation will make this compliance report available (with sensitive ecological information redacted) on the project website (see below) within 60 days.

https://www.watercorporation.com.au/Outages-and-works/Ongoing-Works/Vasse-diversion-drain-upgrade

Kind regards,

Sean Nicholson
Senior Environment Advisor
Assets Planning and Delivery
Water Corporation

E sean.nicholson@watercorporation.com.au
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Working remotely on Wednesdays and Fridays

watercorporation.com.au

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