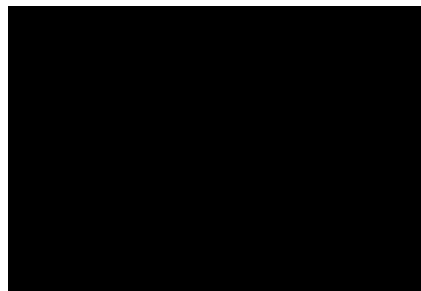


# Management of the Western Ringtail Possum and other Vertebrates during Clearing along the Vasse Diversion Drain, Busselton

October 2020 – January 2021



Images 1 – 4. Possums using relocated and artificial shelters (J & J Bamford)

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4<sup>th</sup> February 2021

## Executive Summary

The Water Corporation is widening the Vasse Diversion Drain in Busselton for flood mitigation, and preliminary environmental impact assessments found that the conservation significant Western Ringtail Possum occurs in remnant vegetation adjacent to the existing drain. Some of this vegetation was to be impacted by drain widening, so following assessment of the population in 2019, 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 Drive and the Busselton Bypass Road, and a southern area near the Golf Course. 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.

Of the 43ha project area surveyed in 2019, 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 64 artificial shelters (dreys and hollows) were installed, making a total of 87 new shelter locations.

Handling of possums 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.

In addition to displacement of possums, one Quenda, eighteen reptiles, five frogs and two birds (a nest of Silvereyes) were successfully relocated from the clearing area. Four reptiles were found killed in clearing operations, an inevitable consequence of any clearing activity using vehicles.

In a preliminary check of artificial shelters conducted in January 2021, six of 86 located shelters were occupied by possums, one contained a Black Rat and one had a Bronzewing Pigeon egg in it. A further 10 shelters appeared to have been used by possums since being installed but were not occupied when checked.

Eighteen possums were recorded in natural dreys or on branches in the vicinity of the artificial shelters during the January surveys, so including the six in artificial shelters, a total of 24 possums was recorded using the strip of vegetation immediately adjacent to the drain works, suggesting that the animals are tolerating the disturbance. It seems likely that many of these animals are those who were displaced from the impact area but have stayed within their remaining home ranges.

Ongoing monitoring will better assess the population adjoining the drain and help to detect any fluctuations in numbers.

Artificial shelters appear to be assisting in providing shelter for possums, although some appear to be building new natural dreys instead.

Relocated natural dreys performed an important function immediately following displacement of the possums but will need replacement as they deteriorate to maintain the numbers of additional dreys provided, as committed to as part of approvals for the project. While this is a requirement, the possums are now constructing their own dreys, so it will be interesting to see if increasing the numbers of artificial dreys increases usage of them.

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 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.

## INTRODUCTION

The Water Corporation manages a network of drains in the vicinity of Busselton and is widening the Vasse Diversion Drain for flood mitigation. This widening will affect 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*,’ 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 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 has 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.

Clearing works were carried out from October to December 2020 and construction is underway, with a notional completion time frame of 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. This interim report includes a summary of relocation activities, installation of artificial shelters and a preliminary assessment of their use by possums.



## **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.

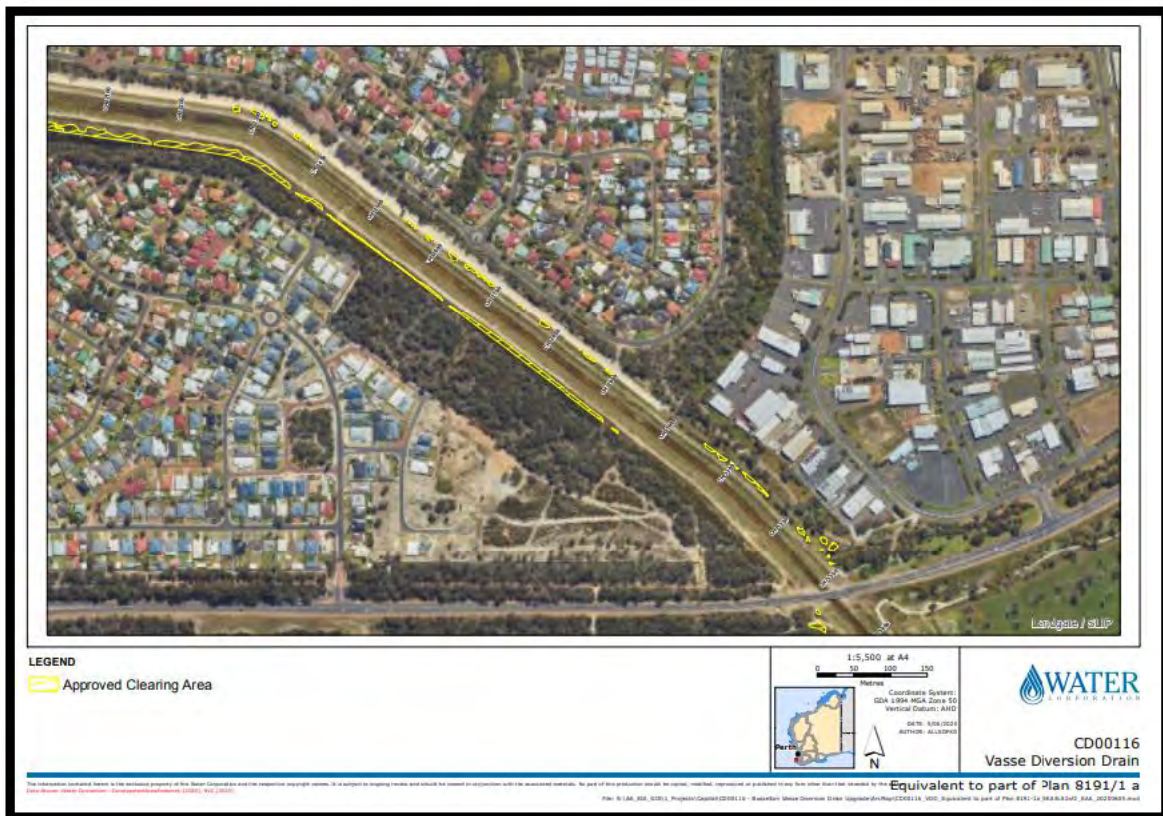
The southern area lies adjacent to the Busselton Golf Course, east of Chapman Hill Rd and includes land on the eastern side of the drain, as well as encompassing a section of the Vasse River. This will be the site of the Vasse River Overflow Structure (VROS). The vegetation is generally degraded and 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. (See Image 14 in Appendix 1).

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 into which artificial shelters and relocated dreys have been installed.

(a)



(b)





(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. Clearing areas are hatched yellow.

## Approach

All work was carried out in accordance with the Fauna Management Plan for the Vasse Diversion Drain Upgrade (Bamford et al., 2020). The aim was to displace animals as little as possible, ideally within their existing home ranges, while moving them from the impact area.

Since possums sleep during the day, they are often slow moving if roused, allowing a gentle approach to moving them with minimal handling and reduced stress to the animal. Since they only needed to move a short distance, this approach was particularly suitable.

Prior to animals being displaced, artificial shelters were installed in adjacent safe areas. Once animals had been moved, their natural drey was also relocated nearby, if it was salvageable.

All artificial shelters and relocated natural dreys were then surveyed in January 2021, to assess their status and check for possums. During this survey, natural dreys, and possums sighted out of dreys adjacent to the cleared area were also recorded opportunistically.

## Survey methods

In the week prior to clearing the project area was visited by Mike Bamford (B.Sc. Hons. Ph.D. Biol.), Mandy Bamford (B.Sc. Hons. Zool.) and Andrew McCreery (B.Sc. Cons. & Wildl. Biol.). Mike, Mandy and Andrew have many years of experience in management of the Western Ringtail Possum (hereafter referred to as possum). The work was carried out under DBCA Permit numbers TFA 2020-0149 and FR28000164, and undertaken with reference to the Fauna Management Plan for the Vasse Diversion Drain Upgrade (Bamford et al, 2020). Personnel considered information and locations identified in the previous survey (Bamford, 2019) while focussing on the reduced footprint of the project (Figure 1 a, b, & c). Field assistance was provided by Jake Bamford (B.C.I.) and Joshua Bamford (B. Sc. B.Mus. Hons. M.A.), and Data Management was undertaken by Joshua Bamford.

The entire project area (Figure 1) and some adjacent bushland was visited on foot, between 19<sup>th</sup> October and 27<sup>th</sup> November 2020, prior to clearing of each section, and trees were examined closely for possum dreys. These are clumps of twigs and leaves that are generally quite conspicuous and placed in the mid canopy of trees (See Images 7 & 8 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). By examining dreys through binoculars, it is sometimes possible to tell if a possum is present, and this was noted if observed. All dreys found in the impact area were recorded, whether they were occupied or not. In some cases, possums were found asleep but not in a drey and these were also noted. Possums will also shelter in tree hollows and thus dreys are not always a reliable indicator of possum presence. Attendance by BCE personnel at all clearing of trees ensured that possums in hollows would be detected and could be relocated.

Targetted spotlighting was carried out in areas where possums were thought to be sheltering in hollows, to inform likely locations to be targeted before and during clearing. The southern (VROS) area in particular had been found in previous surveys to support a possum that was sheltering in a hollow rather than a drey in the impact area. Spotlighting was carried out by two personnel each with a headlamp, and all trees were scoured thoroughly for possums. Possum eyeshine is very distinct.

All possum locations (dreys, trees containing possums and logs suspected of containing possums) were marked with flagging tape prior to clearing so that workers on site were aware of them (Appendix 1, Image 15). BCE personnel met with the clearing contractors at their pre-start meeting each day to clarify works to be carried out that day and develop a plan to undertake the safe displacement of possums and other fauna. The contractors understood the importance of protecting and safely relocating the possums and assisted in skilfully lowering vegetation slowly to avoid unnecessary stress to the animals and allowing BCE personnel to access possums and dreys efficiently, minimising risk to the animals.

If a possum went to ground and could not be accessed, work would stop at that location until the possum had emerged and could be located and moved safely. This sometimes required delaying clearing in an area until the following day when the animal could be located.

## **Handling of Fauna**

Fauna handling was kept to a minimum to minimise stress to the animals during displacement. The location and behaviour of each possum was assessed prior to displacement and a plan devised. Management was adapted in response to the animal's behaviour.

Cage traps were not used for displacement of the possums in this project as they were considered unnecessary and stressful. Many of the possums were females with dependent joeys, which might have become separated if either the mother or joey were trapped. Enclosing an animal in a cage trap is inherently stressful and a more prolonged procedure than gently displacing the animal. Where an animal is only to be moved a few metres within its existing home range, capturing the animal is often unnecessary, particularly if the animals can be moved during the day when they are sleepy and less active.

In many cases possums could be displaced by gently tapping the drey. When the animals emerged from the drey, they were then herded to a safe tree adjacent to the tree to be cleared. If a drey remained in the tree, the tree was lowered slowly by the machinery operator, so that the drey could be checked. In some cases an animal (often a joey) remained in the drey. If this occurred, the animal was either transported in its drey to the tree containing the mother and the drey attached to the tree, or if required the joey was gently captured and transferred to the tree containing the mother. The drey was then installed in the tree. The animals' behaviour was then observed to ensure that the pair stayed together and stayed in a safe area.

In cases where an animal was not in a drey or was otherwise difficult to move, an artificial drey was installed in the tree to encourage the animals to shelter within it overnight. If the possum was found inside the drey the following morning, the entrance to the drey could then be blocked to keep the animal inside while the drey was moved to a tree outside the impact area.

If possums needed to be captured, they were either captured by hand, or by using a large, soft rubber, landing net. Both these methods were safe and effective and on two occasions the net was mistaken for a branch by a sleepy possum, who climbed onto it and could then be carried across to a safe tree, without being captured.

## **Management of Fauna other than Possums**

As part of the project, species other than possums were searched for and relocated if possible.

Trapping and opportunistic searching were used to locate animals other than Possums. Following discovery of Quenda diggings, cage traps were installed. Elliott traps were deployed in areas likely to shelter King's Skinks and Bobtail Skinks. Hand-searching was undertaken for small reptiles.

Clearing debris was mulched and removed from site by the contractor immediately following clearing to minimise the attractiveness of the impact area for animals, in line with the Fauna Management Plan (Bamford et al., 2020).

## 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 to be 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.\*

Dome with Coconut Cup – a wire dome with the lower half lined with coconut fibre.\*

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 4 & 5 and Appendix 4. Examples of shelter designs are provided in Appendix 1, Image 9.

### **Monitoring of Artificial Shelters**

A check of all artificial shelters was carried out from the 20<sup>th</sup> - 25<sup>th</sup> January 2021. 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 been used since they were installed (see Appendix 1, Image 18).



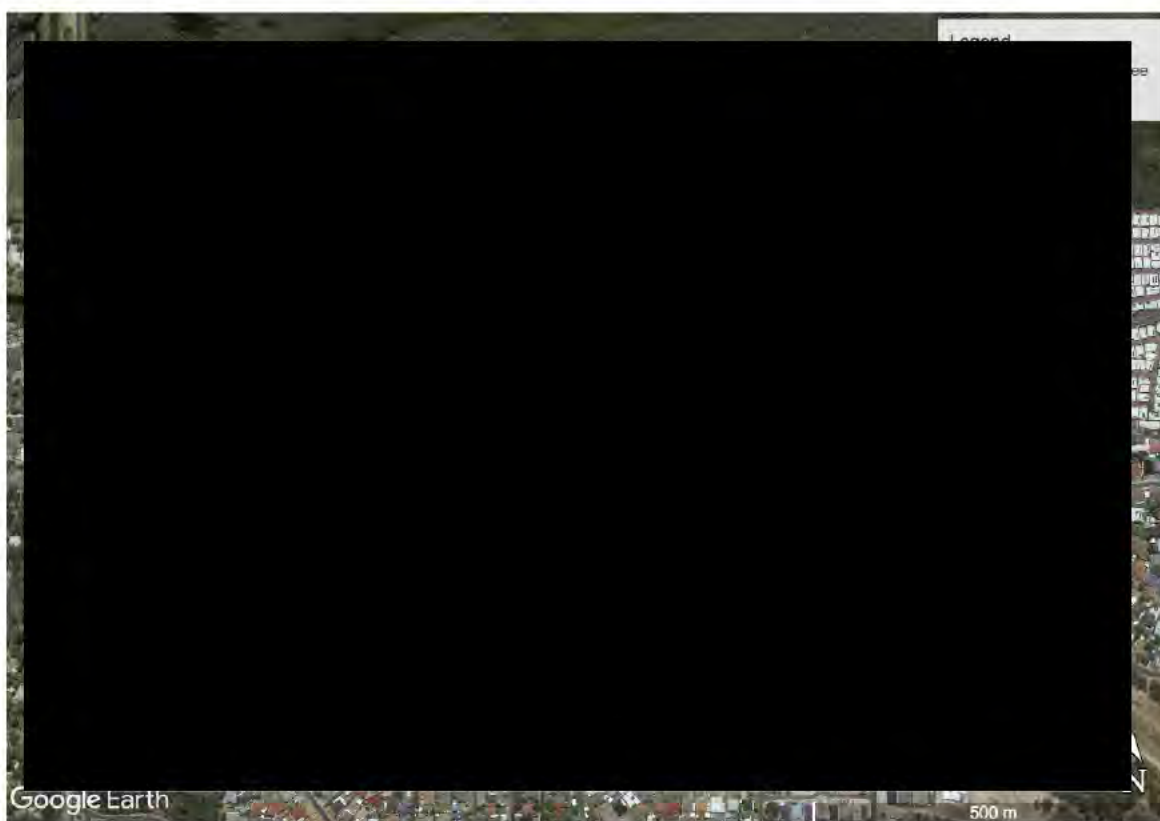
## RESULTS

### Possum Displacement

A detailed description of all possums moved prior to clearing is given in Appendix 3.

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. The longest distances moved were three possums in a hollow tree in Links Court who were relocated with their hollows approximately 650m west to the southern edge of the Broadwater as there was no connected, adjacent remnant vegetation into which they could be displaced.

Eleven possums had to be hand-captured and moved, four were moved without touching them, while contained within an artificial drey or holding onto the top of their 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.



*Figure 2. 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.*





*Figure 3. Locations of Western Ringtail Possums in the southern (VROS) site prior to displacement in November 2020.*

### **Relocation of Species other than Possums**

Records for species other than possums are presented in Appendix 2. Photographs are provided in Appendix 1.

Quenda: One Quenda was trapped and relocated to adjacent bushland immediately before clearing.

Reptiles: eighteen individuals of seven species were successfully captured and relocated, although four individuals of four species were crushed during clearing and were deceased when found, an inevitable consequence of any clearing activity involving vehicles.

Frogs: Five individuals of two species were captured and relocated.

Birds: two Silvereye chicks in their nest were successfully relocated. The parents returned to the relocated nest within a few minutes and fed the chicks. One nest of two Red-capped Parrot eggs was found abandoned in a hollow.

## January 2021 Shelter Check and Monitoring

Results of the January check are presented in Appendix 4.

Six relocated or artificial shelters out of the 87 that were installed were occupied when checked; a 7% occupancy rate. A further ten shelters contained green leaves of varying ages and appeared to have been used at some stage since they were installed.

**Table 1.** Numbers and designs of artificial shelters installed along the Vasse Diversion Drain and their use by possums in January 2021.

Shelter type	Number installed	Number Occupied	Evidence of past use	Total used
Relocated Natural Drey (NAT)	23***	1	1	2 ( 1%)
Dome with Coconut (DoCo)	17* 7 available	2	3	5 (29%) (70%)
Cup without Coconut (Cup)	14	0	1	1 ( 7%)
Cup with Coconut (CuCo)	11	0	4	4 (36%)
Installed or relocated Hollow (Hol)	10	3	1**	4 (40%)
Dome without Coconut (Dom)	5	0	0	0 ( 0%)
Plastic Filter Bucket (Buc)	6	0	0	0 ( 0%)
<b>Totals</b>	<b>86***</b>	<b>6</b>	<b>10</b>	<b>16 (18%)</b>

\*Note that in 10 of these dreys the coconut had collapsed and requires repair, so only 7 were available to the Possums.

\*\* This may be an underestimate since evidence of past use of hollows is more difficult to detect than past use of dreys.

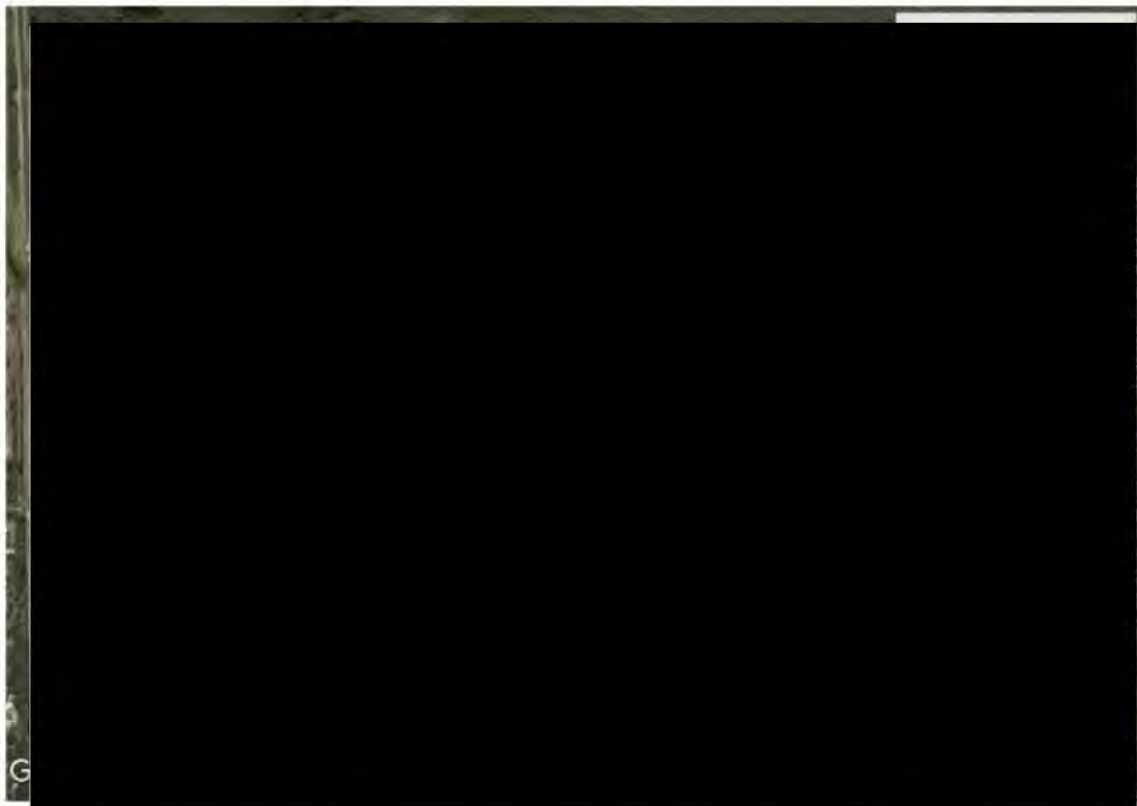
\*\*\* This number is one less than the number of shelters installed, as one relocated natural drey was not located in January.

Eighteen possums were observed opportunistically in natural dreys or on branches in the areas immediately adjacent to the clearing area in January while checking the artificial shelters. Eight of these animals were pairs of mothers and large joeys. One joey was out of the drey but in the same tree as the mother, suggesting that it was becoming independent. An additional six possums were in artificial shelters, making a total of 24 animals observed in January. These were opportunistic records along a narrow corridor and not an exhaustive survey.



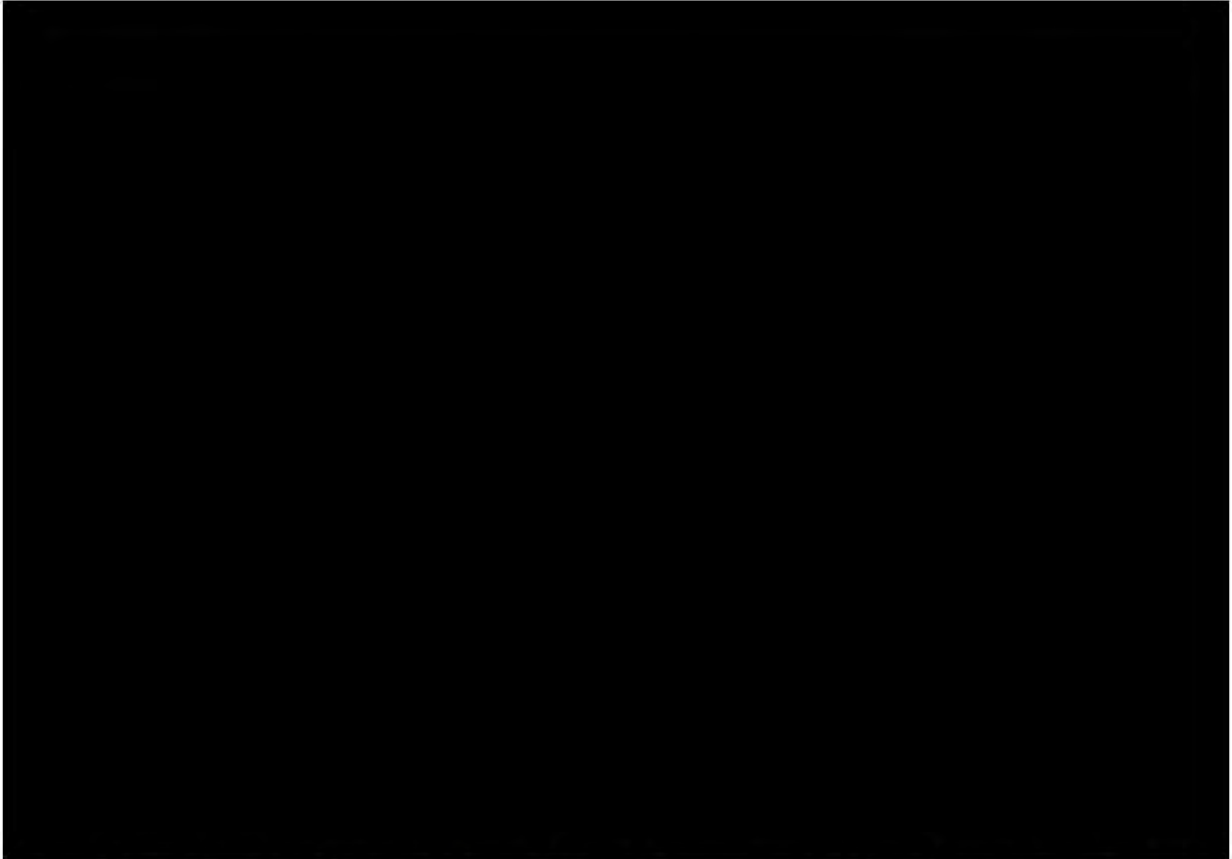


*Image 5. Retained Natural hollow on the edge of the southern VROS area which contained a possum in January despite the proximity to works. This may be the animal which sheltered in the hollow after being displaced from the Eucalyptus rudis at DEUCP1 in November (see Figure 5). A decision was made to retain this tree although it was on the edge of the clearing zone, Its continued use by a possum in January illustrates the importance of decisions to retain individual trees.*



*Figure 6. Opportunistic records of Western Ringtail Possums along the Vasse Drain in Busselton during January 2021. Three of the natural dreys (white points) contained two possums. Raw data is given in Appendices 4 and 5.*





*Figure 7. Use of artificial shelters by Western Ringtail Possums along the Vasse Drain in Busselton during January 2021. Red points indicate shelters which contained possums when surveyed, blue points indicate shelters which contained green Agonis leaves or where coconut fibre had been rearranged.*



*Image 6. A recently constructed natural drey containing a Western Ringtail Possum mother and large joey on January 22<sup>nd</sup>, 2021 – possibly a displaced pair from the clearing area who had constructed a new drey.*

## DISCUSSION

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 preliminary observations from the present study suggest that animals remained in the area following displacement. Ongoing surveys will better inform these preliminary observations.

Relocated natural dreys were used by several possums immediately following relocation but some had deteriorated and only two appeared to still be in use by January 2021. The relocated dreys probably perform an important function temporarily but ultimately may best be replaced with artificial shelters, 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). By January, it appeared that some displaced possums may have chosen a new location within their home range and built a new drey. New, natural dreys have been constructed in areas adjacent to the clearing area, suggesting that this might be the case. It will be interesting to see if increasing the numbers of artificial dreys increases usage of them in the long term, or if some animals prefer to build their own.

Artificial shelters are being used by the possums and once readjustments are made to the coconut fibre of some of the dome shelters to ensure that animals can enter the shelters, their use may increase further. At this stage, short hollows, wire domes with coconut fibre and cups with coconut fibre appear to be the most used by possums however more data is required, and repairs need to be made, before conclusions can be drawn.

Although the January data are preliminary and opportunistic, the recording of 24 possums alongside the clearing area in January is a good result and suggests that many of the relocated possums are likely still in the area. Eight of the animals recorded were mothers and large joeys which all appeared in good condition, suggesting that resources are not limiting. More systematic future surveys will better define the population alongside the drain and help to determine if the numbers of possums in the area are stable or fluctuating.

Observations from January emphasised the importance of retaining individual trees where possible. A strip of vegetation immediately adjacent to the impact area and including several trees with dreys or hollows on the border were marked to be cleared in November 2020. After consideration, a decision was made by the client and contractor to retain them. Three of these trees contained possums in January, and most of them will have been used as food resources. Three of the 24 animals recorded in January were in dreys or hollows directly overlooking the

construction site but the animals had persisted in them, tolerating the disturbance. Decisions made to reduce clearing, even by a single tree, can improve the outcome for fauna.

In order 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 selected for revegetation to be implemented by Tranen (Tranen Revegetation SouthWest, 2020), including Coojong *Acacia saligna*, *Kunzea asp.* and Marri *Corymbia calophylla*, as well as WA Peppermint *Agonis flexuosa*, will provide a varied diet which Mathieson et al. (2020) found Western Ringtail Possums prefer. Some plants are already beginning to resprout along the fence line adjacent to the impact area, which is good to see.

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).

Although the Vasse Diversion Drain Widening Project has 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, suitable structures for protection/nesting, and canopy continuity to escape predation and other threats, all issues identified as important by Department of Parks and Wildlife, (2017) and Bamford et al., (2019). Future monitoring as part of this project will help to show if this potential is realised.

## RECOMMENDATIONS

- Artificial shelters where coconut fibre is collapsing should be repaired.
- Relocated Natural Dreys should gradually be replaced with artificial shelters as they deteriorate. Additional short hollows and wire domes / cups with coconut seem the best choice, given preliminary results.
- Revegetation should commence as soon as practical to increase food resources and connectivity.
- The location of the Fox den identified south of the drain in the Council reserve should be forwarded to the City of Busselton Environmental Officers for their information.
- 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.

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## Appendix 1. Photographs



**Image 7 (left).** *A platform natural drey containing a Western Ringtail Possum mother and large joey taken in October 2020.*

**Image 8 (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 9.** 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); Dome with coconut cup. (DoCoCu). DoCo and DoCoCu were lumped for the preliminary analysis undertaken for this report. More detailed analysis will be possible once more data has been collected.





*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. Two Relocated Dreys were still in use in January 2021 but others were disused, or had deteriorated.*



*Image 11. Installation of a rope bridge by Tree Surgeons WA at Mary McKillop College, on College Avenue.*





**Image 12.** Rope Bridge along College Avenue 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 13.** Hollows were checked for possums and other wildlife such as geckoes, bats and birds, before and during clearing.





**Image 14.** *The VROS area was mostly parkland cleared but had some large *Eucalyptus rudis* trees with hollows, several of which were used by possums. These possums required careful management to ensure that they were displaced rather than going to ground under logs or in hollows as they had several ‘bolt holes’ where they would retreat. When this happened, work would stop (sometimes overnight) until BCE personnel could confirm that the animal was not at risk.*



**Image 15.** *Trees with dreys were marked with flagging tape and branches lowered slowly using a small machine to allow BCE personnel to check each drey and move possums if necessary. All material was either carried away, or mulched on site immediately and removed, to avoid creating shelter for animals such as *Quenda* and *Bobtails*.*





***Image 16.** A displaced Western Ringtail Possum making its way to cover. Animals often moved slowly through the vegetation and settled quickly once they reached the safe zone.*





**Image 17 (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 18 (right).** Artificial Shelters were checked using a pole camera if necessary. Pole camera images may be seen on the cover of this report (Images 1 – 4) and also in Appendix 4.





**Image 19.** Nest with two Silvereye chicks (*Zosterops australis*), almost ready to fledge. This nest was in a Paperbark tree on the west side of Queen Elizabeth Avenue and was relocated to the eastern side, in a similar Paperbark tree. The chicks began to call soon after the nest was installed and the parents returned to the nest in its new location and began to feed the chicks.



**Image 20.** Three Bobtail Skinks (*Tiliqua rugosa*) were relocated into the safe zone during clearing.





**Image 21.** Two Western Bearded Dragons (*Pogona minor*) were relocated into the safe zone.



**Image 22.** A Southern Blind Snake (*Anilos australis*) was hand-captured and released into the safe zone.





*Image 23. Four King's Skinks (Egernia kingii) were captured and relocated to the safe zone.*



*Image 24 Two Motorbike Frogs (Litoria moorei) were hand-captured and moved to the safe zone.*

**Appendix 2:** Notes on Fauna other than Possums. Details of other fauna displaced during clearing, and the location of Fox Den.

Date	Location	Species	Description	Approach
11/10/2020		<i>Pogona minor</i>	Western Bearded Dragon found on Northern boundary along College Ave	moved across bike path
11/ /2020		<i>Cryptoblepharus buchananni</i> x 4	Four Fence Skinks on fallen branch with loose bark	Moved branch to outside the clearing area. Lizards remained under bark while carried outside.
11/10/2020		<i>Lialis burtonis</i>	Burton’s Snake-Lizard Found on disturbed ground, moved from 34697e, 6273354N	Hand-captured and relocated south, of the clearing area, in the reserve.
11/12/2020		<i>Crinia glauerti</i> x 3	Three Clicking Frogs were exposed while clearing vegetation along the creekline.	captured by hand and relocated downstream along creek line.
11/12/2020		<i>Hemiergis peroni</i>	One Mulch Skink was found in the clearing area	crushed - deceased
11/12/2020		<i>Christinus marmoratus</i>	Marbled Gecko One found in the clearing area	crushed - deceased

Date	Location	Species	Description	Approach
11/12/2020		Possible bird hollow identified. Chew marks around entrance	Small - medium parrot, possibly Red-capped Parrot or Ringneck	No birds were observed attending the nest. Hollow checked as tree was felled on 13/11/2020. Hollow empty
11/13/2020		Red-capped Parrot eggs	Eggs were cold - presumed abandoned	Eggs were cold and one damaged. Dissection revealed dead, partially developed Red-capped Parrot embryo.
11/13/2020		<i>Christinus marmoratus</i> x 2	Two Marbled Geckoes Found under bark on felled trees	hand-captured and relocated downstream, to the east of the clearing area.
11/16/2020		<i>Litoria moorei</i> adult	Motorbike Frog Found in Melaleuca	hand-captured and relocated into the safe area.
11/17/2020		<i>Pogona minor</i> ; adult	Western Bearded Dragon Seen by Matt (excavator driver) on the ground ahead of the excavator. Ran up the stem of a small <i>Agonis</i> .	Dragon grabbed by hand, bagged and later released into adjacent safe area.
11/19/2020		<i>Anilius australis</i>	Southern Blind Snake Sub-adult exposed in loose soil and seen by Matt.	Hand caught and released in safe area

Date	Location	Species	Description	Approach
11/19/2020		<i>Egernia kingii</i> adult	King's Skink exposed by large excavator moving rocks along drain	crushed by rock - deceased
11/19/2020		<i>Tiliqua rugosa</i> adult female	Bobtail Skink Found in half-buried pipe	Hand-caught and released in safe area
11/19/2020		<i>Tiliqua rugosa</i> adult female	Bobtail Skink Emerged from loose soil as an Agonis pushed over	Hand-caught and released in safe area
11/19/2020		<i>Litoria moorei</i> adult	Motorbike Frog Found in fork of large branches of Agonis	Hand-caught and released in drain
11/19/2020		<i>Egernia kingii</i> adult	King's Skink Emerged from loose soil as an Agonis pushed over	Hand-caught and released in safe area



Date	Location	Species	Description	Approach
11/20/2020	[REDACTED]	<i>Tiliqua rugosa</i> adult female	Bobtail Skink Caught in Elliott E17	Released in safe area within 50m . NB 23 Elliotts set (E01 to E23). All animals moved into safe zone.
11/20/2020	[REDACTED]	<i>Egernia kingii</i> adult	King's Skink Caught in Elliott E23	Released in safe area within 50m
11/24/2020	[REDACTED]	<i>Egernia kingii</i> adult x 2	King's Skink in fallen log of E. rudis	captured by hand and relocated downstream along creek line.
11/24/2020	[REDACTED]	<i>Tiliqua rugosa</i> adult	Bobtail Skink in fallen log of E. rudis	crushed by log - deceased
11/26/2020	[REDACTED]	Silvereye nest with two chicks -	In Melaleuca - Chicks almost ready to fledge	Carefully cut twig with nest and relocated across QE2 Drive into similar Melaleuca. Watched at a distance. Chicks made begging call, parents returned to nest in new location to feed them.
01/25/2021	[REDACTED]	<i>Vulpes vulpes</i>	Active Fox Den. Fox seen leaving the area.	UTM: 50 H [REDACTED]

Appendix 3. Notes on Displacement of Possums from the Vasse Diversion Drain Upgrade, October – November 2020. WRtP = Western Ringtail Possum

Date	Location	Event Code	UTM	No. Possums	Description	Approach	Artificial Shelter
10/28/2021		DE		2	Mother & joey (subadult)	Tree gently leant over onto ground, mother flees up nearby tree and juvenile starts to follow but heads in wrong direction. I pick up juvenile gently and place on trunk of same tree as mother. It climbs up and is reunited with mother. Drey cut out and relocated onto tree in the wider corridor to the south, adjacent to the possums.	S25
10/29/2020						Possums checked and still within narrow corridor they were relocated to	
10/30/2020						possums were not visible in area of narrow strip	
11/03/2020						checked S25 and nothing inside	
11/05/2020						one possum in tree where possums were relocated to on 28/10	
10/28/2020		DO11		2	Mother & joey (subadult)	Tree leaned over onto nearby tree gently, possums moved from drey along branches onto nearby tree, no handling necessary. Possums remain in tree outside clearing area. Drey	

						cut out and installed in adjacent corridor. Drey WP: DO11R.	
10/29/2020					possums checked and still in narrow corridor, persisting on branches.		
10/30/2020					possums checked and still in narrow corridor. It appears a rudimentary drey has been assembled. Joey is in drey and mother nearby.	A decision was made to relocate the original drey to the location of where possums are now at. So DO11R was removed and relocated onto tree next to where possums are persisting. New drey S22	
11/3/2020						Checked S22 and found mother and joey in same tree as 30/10, on branches, not in drey	S22
10/29/2020	██████████ f	DE1	██████████ ██████████ ██████████	2	Mother & joey (subadult)	Tree leaned over onto nearby tree gently, possums hesitantly left drey and climbed on tree. Possums then climbed through the canopy back into the clearing areas. So had to be removed again using same method. Drey was	S18



						removed and relocated into larger corridor: S18	
10/30/2020					pair were not present along narrow corridor.		
10/29/2020	██████████	DE2 bound	██████████ ██████████ ██████████	1	Tree outside clearing area, retained. At least one possum in drey.		
11/3/2020					checked drey and no possums		
10/29/2020		DE3	██████████ ██████████ ██████████	2	mother and joey (about ½ grown).	Tree leant over gently, mother left drey freely and moved onto the next tree outside of the clearing area but young was reluctant to leave drey and had to be handled and placed on tree trunk. It climbed up to safety of canopy. The mother then moved across to the next tree canopy where it remained. Drey was cut out and relocated to same tree where the young was present. Drey S16	S16

10/30/2020					area checked for presence. No signs of possums along narrow corridor.		
11/3/2020					Checked S16 and at least one possum using drey		
10/30/2020	████████	DO out	████ ████ ████	1	Drey outside clearing area, retained. Appears to have at least one possum.		
11/3/2020					looks like possum(s) are still in there but can't be certain.	Not investigated closely to avoid disturbance.	
10/30/2020	████████	DO4 bound	████ ████ ████	1	tree on boundary and retained. At least one possum inside drey		
11/3/2020					at least one possum in drey.		

10/30/2020	[REDACTED]	DE4	[REDACTED]	0	Drey is small and flimsy and no possums were present. Drey was not salvageable.		
11/3/2020					drey falling apart after last rain.		
10/30/2020	[REDACTED]	DO5	[REDACTED]	2	mother and young (about 1/3 grown).	Tree leant over on side in direction of suitable tree. Possums were reluctant to move from the drey. Mother then bolted from drey into nearby thick sedges and could not be found after a thorough search of the sedges. Nearby trees were then searched in case the mother went up one but no presence was detected. The young remained in the drey. The drey was cut out gently with the young inside and attached to nearby tree. Upon installing the young got spooked and tried to escape, it was placed on the trunk of the tree but it didn't want to venture too far from the drey. Once the installation was complete and I moved down the ladder the joey felt safe	

						enough to climb back into the drey. Drey WP – DO5R	
11/2/2020					mother and joey reunited and located in a tree within the clearing area.	. It was decided to leave the tree for the time being. Possum WP: DO5poss	
11/3/2020			50 H		mother and young still in tree		
11/4/2020			50 H			artificial drey (2 hanging baskets assembled into a dome with a hole cut out, coconut husk left in) placed in tree.	
11/5/2020			50 H		Mother and young not sighted in tree, assumed in drey	Used a ladder to carefully reach drey without disturbance. Possums in artificial drey, a large bag was placed over the entire drey removed, lowered and reassembled in another tree, all the while being covered with the bag. The mother tried to push her way out but we gently coerced her back into the drey. Once attached, the bag was slowly removed and mother and young remained in the drey. WP of new drey – S54	S54



11/3/2020		DE17	50 H ██████ ██████	0	drey degraded and not salvageable.		
11/3/2020		DE18	50 H ██████ ██████	1	has possum but is outside of clearing area so retained.		
11/3/2020		DE5	██████ ██████ ██████	0	No possum	drey cut out, relocated. Drey S10	S10
11/4/2020		DE6out	50 H ██████ ██████	0	drey outside clearing area, retained.		
11/5/2020		DO7	50 H ██████ ██████	2	Mother and joey	shaking of the tree disturbed the mother, she exited drey and climbed through canopy. While Drey was lowered with the machine, a juvenile came out and remained within branches surrounding the drey. Excavator gently lowered the tree to the ground and the juvenile was hand-captured and bagged. Drey was relocated to nearby area and juvenile was gently placed inside where it stayed. Drey S46.	S46

						Mother still remained in canopy within clearing area. We selected a path we wanted the possum to go so we cleared all of the other trees within the vicinity. Excavator leant on the tree with possum and initially the animal went the wrong way (toward the machine) . With gentle herding, the animal was moved away from the machine and it went in the right direction, through the canopy into safety.	
11/6/2020		DO7	50 H		Checked S46, possums not visible from ground and not visible in surrounding vegetation.		
11/5/2020		DE8	50 H [REDACTED]	0	no possum.	Drey relocated to S47.	S47
11/5/2020		DO9	50H [REDACTED]	2	Mother and joey	possum fled drey when drey gently prodded but didn't go too far. It looked back and motioned the juvenile to follow, it did. It was quite small but furred. It climbed on	S45

						<p>mother's back and they went as high as possible in the canopy. Similar to previously, we decided on a path for them to go and excavator cleared the way. Excavator gently leaned the large tree toward a smaller tree outside the clearing area. As the tree lowered the mother was reluctant to move, then jumped to the ground with baby still on her back. She slowly moved toward the nearest tree and climbed up to safety outside of the clearing area. The drey was partly disassembled when we took it down but it was salvageable. We put it up in a nearby peppermint tree. S45</p>	
11/6/2020		DO9				<p>Checked DO9R and doesn't appear to have possum(s) inside but can't be certain. Possums not visible in surrounding vegetation.</p>	
11/6/2020	█	DO20	50 H █ █			<p>Drey found right on the edge, just inside of the clearing area, it looks occupied but was not disturbed. It may be able to be kept but a call by Client needs</p>	



						to be made. – Drey was relocated, unoccupied	
11/6/2020	S t	DE10	50 H [REDACTED] [REDACTED]		No possums, bit scraggly but can be salvaged.	Relocated to S42.	S42
11/6/2020	S t	DE11	50 H [REDACTED] [REDACTED]		No possums, very degraded and not worth salvaging.		
11/6/2020	S t	DE21	50 H [REDACTED] [REDACTED]		drey degraded, not worth salvaging.		
11/6/2020	S t	DO19	50 H [REDACTED] [REDACTED]	2	female with pouch young	gave the tree a shake and a possum came out. Has settled in canopy on the edge of the clearing area for at least 30 mins. Without witnessing, the possum must have moved on into safe areas. Drey relocated to S41	S41
11/6/2020	S t	DE12	50 H [REDACTED] [REDACTED]		no possum. Drey not salvageable.		



11/6/2020	[REDACTED]	DE13	50 H [REDACTED] [REDACTED]		No possum, drey salvageable.	relocated to S38.	S38
11/6/2020	[REDACTED]	DO14	50 H [REDACTED] [REDACTED]	1	Juvenile possum with no adult present.	Joey was furred but probably not independent. Tree bought down slowly and it stayed inside. Carefully cut out drey without disturbing the joey. In the process of relocating, it did escape the drey but remained within the branches above the drey. We then attached it, with joey inside, to another tree nearby. On the ladder the joey tried to escape the surrounding branches and it was hand-captured and placed on the tree trunk. Once the drey was secure the joey was placed in its drey. Its instant reaction was to climb inside, where it stayed. Drey WP: S39.	S39
11/10/2020		ARTSHEL1	50 H [REDACTED] [REDACTED]		Double basket with coconut fibre in base, drey material also.		S35

11/10/2020		ARTSHEL2	50 H ██████ ██████		Double basket with <i>A flexuosa</i> from a natural drey		S33
11/10/2020		MOVEDY	50 H ██████ ██████		A natural drey moved from <i>A saligna</i> to <i>A. flexuosa</i>		S37
11/10/2020		DYP02MOVE	50 H ██████ ██████	2	Adult female and large juvenile	moved into next tree to south. Natural drey cut out and installed in next tree.	Relocated Drey in next tree
11/12/2020	████████████████████	GPS271	50 H ██████ ██████		Old drey	old drey, not salvageable, 2 artificial dreys installed in trees to the east of the clearing zone	S1
		ARTDREYCOCO	50 H ██████ ██████				
		ARTDREYPEPONLY	50 H ██████ ██████				S2
				50 H		drey in <i>Acacia saligna</i> - previously identified	Checked previous location of drey - drey gone, possum not present.

11/13/2020	Chapman Hill VROS	ARTDREYCOCOCOVER	50 H ██████ ██████		artificial drey	installed outside the clearing area	S6
		ARTDREYPEPPONLY	50 H ██████ ██████		artificial drey	installed outside the clearing area	S5
11/13/2020		WGPO	50 H ██████ ██████		Dead <i>E. rudis</i> with hollows - possum previously observed	Decision made to leave dead <i>E. rudis</i> so hollows can be checked, cut and lowered to the ground rather than dropping the whole tree and risking injured animals. Clearing completed south of the creek pool. Limited vegetation adjacent to dead <i>E. rudis</i> – animal may choose to move over the weekend.	
11/15/2020		DEUCP1	50 H ██████ ██████	3	Mother and large joey next to drey in large <i>E. rudis</i> along creek line. Also a third animal - possibly the one previously seen in dead <i>E. rudis</i> previously	Spotlighting, found mother and large joey next to drey in large <i>E. rudis</i> . Also a third animal – possibly the animal from the dead <i>E. rudis</i> . No animal was spotted in the dead <i>E. rudis</i> . This animal is likely to be the third animal seen in the large <i>E. rudis</i> .	
11/16/2020		DEUCP1		1	Single WRTP flushed while	Started to work along the line of FGs on the north side of the	



					clearing <i>E. rudis</i> along creekline	creek crossing and flushed a WRtP which sheltered amongst twigs over the water. Waded in but was unable to catch it. The animal initially began to climb up, appearing to be heading for the foliage of the <i>E. rudis</i> but then saw the excavator and headed down into a bolt hole under the large, recumbent trunk of the <i>E. rudis</i> . Decision made to wait until the animal reappeared as clearing the tree now would create a high risk of injuring a possum.	
11/16/2020	██████ ██████	DEUCP1			Spotlighting: Three possums sighted in large <i>E. rudis</i> .	Spotlighting 16 11 20: Three possums sighted in large <i>E. rudis</i> , so the animal had emerged. Observed with night-vision binoculars to minimize disturbance.	
						Mother and joey finally able to be moved on 23/11/2020 (see description below). Third possum not present and presumably displaced and moved out of the impact area due to clearing in the vicinity.	
11/23/2020	██████ ██████ ████	DEUCP1		2 (Female & large joey)	One flooded gum contained a drey with a	Using a ladder, bag and net, two personnel attempted to catch the possums. Unfortunately, the mother	

					mother and joey.	was able to avoid capture and climbed down into the hollow log where it disappeared. The joey climbed out of the drey and higher into the canopy. At this point we could not take any further action due to the mother in the log. About 30 minutes later we witnessed what we assumed was the mother about 30 metres north climbing up a tree and into a hollow just outside of the clearing area. She had wet feet and tail and was clearly the same possum that escaped into the hollow but due to the joey still in the tree (and other concerns involving the operator) we did not remove the tree and logs that day. An artificial drey was installed into the tree below the joey, The original drey was removed to make it more appealing to use the artificial one. The trees around the joey tree were removed and we then left it alone.	
11/24/2020				1 -2 possums	In hollow where mother DEUCP1 had	Further inspection to see if 2 animals were in the hollow was not done to reduce the disturbance on the possums.	

					escaped to yesterday.		
					No possum observed in Flooded Gum	we carefully checked the artificial drey and nothing was inside. Presumably the joey felt exposed in the tree and abandoned the area. At least one possum was visible in the hollow that the mother had escaped into. Further inspection to see if 2 animals were in the hollow was not done to reduce the disturbance on the possums. The operators were given the go ahead to remove the tree and 2 logs. Upon removal of the logs, 2 King's Skinks were rescued and relocated and unfortunately one Bobtail was crushed in the process.	already installed artificial dreys and a third artificial drey installed
11/17/2020	e o o s	OLDDREY	50 H [REDACTED] [REDACTED]		Old drey - empty, degraded		
11/17/2020	e o o s	OLDDREY1	50 H [REDACTED] [REDACTED]		Old drey - empty, degraded		



11/17/2020			50 H			Noted that in the site on the east side of the drain, adjacent to Cook St one of the artificial dreys with coconut fibre had been raided for fibre which had been incorporated into a new drey in the next tree!	
11/17/2020		POSSDECEP	50 H [REDACTED] [REDACTED]	2 (female and large young)	Two WRtP in a drey in a large Agonis. A second old and shabby drey in same tree. No connection with safe areas.	Artificial drey (two hanging baskets) installed in tree; with coconut fibre lining. WRtP coerced from their drey by gently tapping it; they went to the top of the canopy. Branch and drey then cut out and the drey pushed into the artificial drey. The second natural drey was installed. This done after 5pm, leaving the two WRtP in the top of the tree. Hope is they will move into the artificial drey the following morning making for easy displacement.	
11/18/2020		POSSDECEP		2 (female and large young)	Two WRtP in large Agonis with artificial drey installed the previous afternoon. Despite rain, the two animals were	Trees around the Acacia were taken down but as this was done, the two WRtP moved into a small Agonis close to the fence. Plan was then to gently push this over which would put the canopy on the bike trail about 15m from safe trees. Personnel were spaced	S69

					<p>curled up together on bare branch of an Acacia saligna beside the large Agonis.</p>	<p>to encourage the WRtP to go in the direction of the safe trees. The female leapt from the tree before it was fully descended. She ran along the base of the fence for 20m, then climbed the fence. There she was hand-captured and carried to a large safe Agonis where she was released. She ran up this and into a large Tuart alongside. The young animal remained in the small Agonis until this was at waist height and tree still restrained in the grabbing arm of the excavator. This animal was also hand-captured and carried to the same tree for release. It ran to the dead topmost branches of this tree and went as close as it could to the female in the next tree. After about 40 minutes, the young animal had disappeared and was cuddled up with female on bare branch of Tuart. The artificial drey, containing the WRtP's original drey, was installed in the safe Agonis at a height of about 5m.</p>	

11/18/2020		POSSMOVE1	50 H ■■■■ ■■■■	1 adult	Drey in top of Acacia saligna at height of about 10m. Animal remained in drey as all other trees removed. Branch bearing drey angled away from fence so difficult to push canopy containing drey into safe trees across the bike path	All surrounding trees and most lower branches of tall Acacia removed. Excavator succeeded in pushing canopy containing drey in the direction of the path, and then held it at about chest height with WRtP still in drey. Branch below drey then cut with handsaw and drey, with possum, carried to a safe tree approx. 10 m away. WRtP ran up safe tree and disappeared into canopy. Drey intalled at about 4m in a fork in safe tree.	S72
11/19/2020		POSSMOV2	50 H ■■■■ ■■■■	2 Adult female and large joey	A large drey in the top of an Agonis. Drey looked fairly dense, so animals were suspected to be present, however animals did not appear until tree was felled.	All surrounding trees and lower branches removed. Tree then pushed over slowly on the basis that animals might be present, although none seen during the noisy clearing process and despite the tree swaying around; violently at times. The tree was felled through a gap created in the fence but the drey was well-buffered by the canopy. When examined	Drey installed in Kunzea S26



						<p>closely, two WRtP present. One left quickly and ran up a <i>Kunzea</i>. The other remained in the drey as we cut the drey out and tried to drag it into the safe area, but <i>Hardenbergia</i> tangled everything. Second WRtP then left drey and climbed a <i>Kunzea</i>. Drey installed in a <i>Kunzea</i>. Both animals stayed in the <i>Kunzeas</i>.</p>	
11/20/2020		TWOPOSS (probably the same animals as POSSMOV2)	50 H [REDACTED] [REDACTED]	2 Two adults - thought to be the same animals as POSSMOV2 from 19/11/2020	Two adults on bare branches of <i>Agonis</i> ; only about 30m from where two animals moved the previous day. One was greyish; the other very brown (identical to the animals recorded as POSSMOV2), so almost certainly the same two animals had moved back	<p>First animal came down in canopy as this was gently lowered, but refused to leave canopy and was 5m from a safe tree. The animal was netted, grasped through the net and carried to safe tree. Second animal remained in canopy when this was lowered, and climbed to the outmost dead twigs at head height. Net held out to it and it climbed onto the net and was carried to safe tree, where it climbed off slowly into the tree.</p>	

					into the clearing zone		
11/19/2020		POSSMOV3	50 H [REDACTED] [REDACTED]	1 Single adult; appeared female	A fairly small, low drey in an Agonis. Initially thought to be empty but the WRtP quickly left drey at the first disturbance. It clambered round the canopy of the Agonis.	Single male WRtP in drey in <i>A. flexuosa</i> . Moved into canopy and this brought down gently; WRtP walked into <i>Watsonia</i> in safe zone then climbed into a <i>Kunzea</i> . Drey moved into nearby <i>Kunzea</i> .	Drey moved S27
11/19/2020		TWODREYS	50 H [REDACTED] [REDACTED]	1 Single adult male	Two large dreys in an Agonis. Neither could be confirmed to contain a WRtP but an animal emerged from one of the dreys shortly after disturbance around the tree began. It	Usual procedure followed: surrounding trees and bushes and low branches removed, fence opened up and tree with WRtP in canopy pushed towards gap in fence and thus safe zone. When the canopy and WRtP were at about head height, the structure of the tree meant that the WRtP could not be brought any closer to the ground, and it was short of a safe tree by about 5m. With the WRtP at the end of a dead stem, the	Parts installed in <i>Kunzea</i> S29

					remained in the canopy and actually returned to the drey as the tree was coming down, although did not actually enter the drey.	net was held out to it and it climbed onto the net. It was then carried on the net into the safe zone and to a safe tree. The drey was not very solid but parts of it were installed into a <i>Kunzea</i> .	
11/23/2020				No Possums		Supervised clearing and checked trees	
11/23/2020		DAGPO4	50 H [REDACTED] [REDACTED]	2 (mother & subadult joey)	There was a large drey containing mother and	All trees surrounding were removed and an artificial drey was installed below the possums. I then disturbed the	



					joey (subadult). Unfortunately, there was no direct canopy connectivity to trees outside of the clearing area as was the case in previous weeks.	possums by rustling the drey so they would move out. It took some convincing but the 2 possums climbed out and settled high in the canopy. We then left them with the hope that they would use the artificial drey.	
11/24/2020		DAGPO4		1 (joey but not mother)		Artificial drey was checked and joey was inside but not mother. The fauna bag was placed over the drey and taken to the other side of College Ave and placed in a Peppermint tree. WP: DAG04R. When the bag was taken off, the joey came out and sat on the drey for a few minutes, then returned to the drey.	
11/24/2020		DAGPO1	50 H		Drey but no possum	The excavator driver was able to gently lower the drey down to the ground but no possums were inside. The drey was flimsy and was not salvaged.	



		AGPO	50 H [REDACTED] [REDACTED]	2 (mother & joey)	Mother and young in drey	The excavator driver used the machine to lean the tree with drey on to another tree outside of the clearing area. With some encouragement (a gentle poke with a pole) the mother and joey moved through the canopy onto the neighbouring tree into safety. The drey was salvaged and relocated 30 metres away – WP: S82	S82
11/24/2020						several peppermints and 2 eucalypts were removed by the arborists, none of which had signs of possums. There was a large flooded gum (E.rudis01) with several large hollows ideal for possums. The arborist was planning to climb the tree to look for hollows	

						until a beehive was spotted. A decision was made to deal with the hive in the morning when the bees are less active.	
11/25/2020	L L F C	.rudis01	50 H [REDACTED] [REDACTED]	3 possums	3 possums all in hollows in large Flooded Gum	The arborists poisoned the bees in the large Flooded Gum and waited until it took effect. Working with the arborists, each potential hollow in the tree was checked. In the end 3 WRt possums were found in hollows. The first was a small spout about 6 metres above the ground in which the possum was about 30cm in the hollow. the spout was blocked with cloth, the limb was cut well below where the possum was located and safely hoisted to the ground using a pulley system. The 2 <sup>nd</sup> possum was located in a shallow hollow in the fork of the tree 3 metres above the ground. The limbs were too big to cut out and lower, so the possum was captured and bagged, kept in a protected, shaded area. The 3 <sup>rd</sup> possum was in a hollow in one of the main trunks about 10 metres from the ground. This possum was similarly	S63, S64, S65



						<p>dealt as the 1<sup>st</sup> – stuffed hollow with bag, cut well below possum and slowly lowered down. All three possums were relocated a few hundred metres NW to fringing vegetation along Vasse-Wonnerup estuary where large Flooded Gum, peppermints and Melaleuca were present. The 2 hollows were hoisted up attached to the trunk of flooded gums about 5 metres above the ground, on the NE side of the tree to avoid the worst weather (WP: S64 and S65). The third possum was released onto the trunk of a flooded gum where it climbed up into a neighbouring peppermint tree. An artificial drey was placed in the peppermint (WP: S63).</p>	
11/25/2020		DMELPO4	50 H ■■■■ ■■■■	1 male WRTP	Male in Drey in <i>Melaleuca</i>	<p>One <i>Melaleuca</i> had a Male possum in a drey that we disturbed from its drey and tried to catch but no luck. From about 3 metres it jumped to the ground and scrambled into the thick scrub. About 10 minutes later we</p>	

						found it up a small tree, After making an attempt to catch it, it was decided that it was better to leave it alone and put up 2 artificial dreys.	
11/26/2020		DMELPO4			Artificial dreys empty	The surrounding vegetation was also clear of possums.	S62
						The excavator worked through the first 100 metres of bush quite quickly until we encountered 2 occupied dreys, both were in <i>Melaleuca</i> . First, the excavator cleared the bushland around the tree and flattened the grass to limit the hiding spots.	
11/26/2020		DMELPO1	50 H [REDACTED] [REDACTED]	1		The drey was quite low down and would have be able to reach it with a ladder if the possum remained undisturbed. Unfortunately, the possum woke up and climbed to the top of the shrub. The stems of the shrub were narrow so the digger was not needed. By hand, the excavator driver pulled the stem that the possum was on down towards the ground. I was waiting there with a net and a third person positioned himself in front of a log pile to	Poss Release Point: 50H [REDACTED] [REDACTED]  S59

						prevent the possum from going to ground. When the stem was at about a 45 degree angle, the possum jumped into the net, I hand-captured it and bagged it. It was then released in bushland in between the Water Corp depot and Vasse-Wonnerup estuary on the other side of Queen Elizabeth (WP: Poss release point). It was a male. That area contained several large peppermints with good canopy connectivity.	
11/26/2020		DMELCUT1	50 H 	2		This drey was higher up and tree was sturdier so the digger was needed. The excavator slowly leant the tree over, mid-lean a possum exited the drey and climbed to the end of the branch. With one person keeping an eye on the rouge possum, the excavator driver brought the tree down further to the point where the drey could be searched to find a Joey, which was quickly hand-captured and bagged. The mother was at chest height on the other side of the branch so I moved around and hand-	S55, S58





						<p>captured and bagged her as well. Both mother and joey were released into the same patch of bushland (WP: Poss release point). It was decided that no more clearing would be undertaken today so the mulcher could catch up and get rid of the remaining green waste.</p>	
11/27/2020		DAGPO13	50 H [REDACTED] [REDACTED]	1		<p>The excavator cleared trees around the drey which disturbed the possum. It moved a few trees along and went to the tallest part of the tallest tree. Once clearing around this tree was undertaken, The excavator gently grabbed the trunk and lowered it to the ground. 2 helpers were on hand to surround the possum if it went to ground. A risk of being so close to the road was the possum could track in that direction so the helpers did their best to block that pathway. At about 2 metres, the possum leapt to the ground and it was captured and put in the bag. The possum was a Female with no</p>	S60, S61



						pouch young, it had a scar on its back in-between the back and tail. It was released across the road, north of the Water Corp depot and its drey was relocated (S61).	
11/27/2020		DAGPO21	50 H		No possum	Drey relocated to S56	S56



**Appendix 4.** Table showing relocated and artificial dreys and logs installed in safe areas 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	Poss.	Used	Photos	Notes
S1	██████	██████	DoCo	██████	0	Unused		Collapsed coconut, very close to edge of works
S2	██████	██████	Dom	██████	0	Unused		Very close to edge of works








S3	██████	██████	Dom	██████	0	Unused		old leaves only
S4	██████	██████	DoCo	██████	0	Unused		Coconut collapsed – needs repair




S5	██████	██████	Dom	██████	0	Unused		Old Agonis, Dense
S6	██████	██████	DoCo	██████	0	Used		some newer Agonis leaves, likely recent use - Rattus burst out of drey when checked

								
S7	██████	██████	Dom	██████	0	Unused		Only old leaves in drey
S8	██████	██████	CuCo	██████	0	Unused		old leaves only








								
S9	██████	██████	Nat	██████	0	Unused		Blown down
S10	██████	██████	Nat	██████	0	Unused		Degraded




S11	██████	██████	Cup	██████	0	Unused		Old leaves only
S12	██████	██████	Buc	██████	0	Unused		empty

								
S13	██████	██████	CuCo	██████	0	Unused	 	dry Agonis leaves







S14	██████	██████	Cup	██████	0	Unused		Lots of dead leaves
S15	██████	██████	Buc	██████	0	Unused		Few leaves
S16	██████	██████	Nat	██████	0	Unused		degraded




S17	██████	██████	CuCo	██████	0	Unused		Lots of brown, old leaves
S18	██████	██████	Nat	██████	0	Unused		Brown old Agonis

S19	██████	██████	Cup	██████	0	Unused		Exposed location
S20	██████	██████	Buc	██████	0	Unused		Dead leaves, no evidence of use
S21	██████	██████	CuCo	██████	0	Unused		lots of dead Agonis leaves, pole camera photo taken





S22	██████	██████	Nat	██████	0	Unused		Platform still there but disused
S23	██████	██████	Cup	██████	0	Unused		Leaves mostly gone
S24	██████	██████	DoCo	██████	0	Unused		coconut collapsed




								
S25	██████	██████	Nat	██████	0	Unused		No fresh Agonis
S26	██████	██████	Nat	██████	0	Unused		in good condition

S27	██████	██████	Nat	██████	0	Unused		Collapsed
S28	██████	██████	Nat	██████	0	Used		light leaf cover but possibly used
S29	██████	██████	Nat	██████	0	Unused		Degraded








S30	██████	██████	CuCo	██████	0	Used		been used but empty. Coconut collapsed
S31	██████	██████	Cup	██████	0	Unused		few leaves



S32	██████	██████	CuCo	██████	0	Used		may have been used
S33	██████	██████	Dom	██████	0	Unused		Old leaves

								
S34	██████	██████	Buc	██████	0	Unused		Few leaves
S35	██████	██████	DoCo	██████	0	Unused		





								
S36	██████	██████	Cup	██████	0	Unused		Few leaves
S37	██████	██████	Nat	██████	0	Unused		Falling down




S38	██████	██████	Nat	██████	1	Used		Only old leaves seen from outside but drey in good condition, possum inside
S39	██████	██████	Nat	██████	0	Unused		Old leaves but still in good condition

S40	██████	██████	Cuco	██████	0	Unused		Old leaves
S41	██████	██████	Nat	██████	0	Unused		Degraded, still some Agonis leaves in it







S42	██████	██████	Nat	██████	0	Unused		Degraded
S43	██████	██████	Nat	██████	0	Unused		Large drey, good condition
S44	██████	██████	Buc	██████	0	Unused		Old leaves




S45	██████	██████	Nat	██████	0	Unused	No photo	Good condition, old leaves
S46	██████	██████	Nat	██████	0	Unused		Good condition
S47	██████	██████	Nat	██████	0	Unused		Degraded

S48	██████	██████	Cup	██████	0	Unused		Old leaves
S49	██████	██████	CuCo	██████	0	Used		Coconut Base pulled out
S50	██████	██████	Buc	██████	0	Unused		No evidence of use






S51	██████	██████	Cup	██████	0	Unused		Lots of old leaves
S52	██████	██████	CuCo	██████	0	Unused		Few leaves left



								
S53	■■■■■	■■■■■	Cup	■■■■■	0	Unused		few leaves
S54	■■■■■	■■■■■	DoCo	■■■■■	0	Unused		Artificial Drey originally installed at D05R but then relocated to D23H, material had been rearranged - possible possum use but empty on 25/01/21

								
S55	██████	██████	DoCo	██ ██████	0	Unused		Collapsed Difficult for possum to enter – needs repair
S56	██████	██████	Nat	██████	0	Unused		Large Agonis








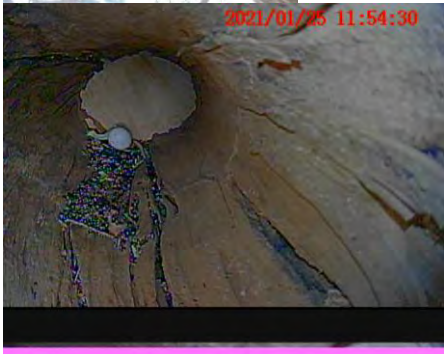
S57	██████	██████	CuCo	██████	0	Unused		Large Agonis, very full, old drey inserted into shelter
S58	██████	██████	Cup	██████	0	Used		Fresh leaves present, likely used, but empty when checked



S59	██████	██████	Nat	██████	0	Unused		Still some Agonis leaves
S60	██████	██████	Cup	██████		Unused		Still some Agonis leaves
S61	██████	██████	DoCo	██████	0	Unused		Coconut collapsed – needs repair

S62	██████	██████	DoCo	██████	0	Unused		Coconut collapsed – needs repair
S63	██████	██████	Hol	██████	0	Unused		Approx. 8m high, relocated from E. rudis in Links Ct







								
S64	██████	██████	Hol	██████	0	Unused	 	relocated from E. rudis in Links Ct



S65	██████	██████	DoCo	██████	0	Unused		Coconut dome collapsed
S66	██████	██████	Hol	██████	0	Unused	 	pigeon egg inside, another broken on ground below

S67	██████	██████	Cup	██████	0	Unused		few old leaves
S68	██████	██████	██████	██████	0	Used		coconut taken and placed further up tree, some blown down






S69	██████	██████	██████	██████	0	Unused		natural drey inserted into artificial drey, Coconut collapsed
S70	██████	██████	Hol	██████	1	Used		Possum in base of log

								
S71	██████	██████	CuCo	██████	0	Used		coconut rearranged, removed from base
S72	██████	██████	Nat				No photo	RELOCATED DREY NOT FOUND

S73	██████	██████	Hol	██████	0	Unused		A few old leaves only
S74	██████	██████	DoCo	██████	0	Used		coconut still in good condition, looks like it has been used, although not very recently








								
S75	██████	██████	Hol	██████	0	Used		Slightly green leaves in bottom, probably used but not recently




S76	██████	██████	DoCo	██████	1	Used		coconut rearranged – visible from the outside, possum inside
S77	██████	██████	Hol	██████	1	Used		Possum inside

								
S78	██████	██████	CuCo	██████	0	Unused	 	coconut collapsed. Needs repair






S79	██████	██████	Hol	██████	1	Used		Possum in back of log
S80	██████	██████	DoCo	██████	1	Used		Klara's Lodge. Paperbark had been rearranged – visible from outside, possum inside.

								
S81	██████	██████	Hol	██████	0	Unused		
S82	██████	██████	█	██████	0	Unused		Dry, collapsed

S83	██████	██████	Hol	██████	0	Unused		
S84	██████	██████	Nat	██████	0	Unused		On ground, blown out of tree
S85	██████	██████	DoCo	██████	0	Unused		Coconut collapsed – needs repair



S86	██████	██████	DoCo	██████	0	Unused		
S87	██████	██████	Cup	██████	0	Unused		In Large Agonis

								
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## Appendix 5. Possum notes from Vasse Diversion Drain Monitoring, January 2021 (not in artificial shelters). See also Figure 6.

ID	Date			Possums	Notes
WP1	22/01/2021			1	Same hollow as possum from DEUCP1 used when displaced - good that it was retained
WP2	22/01/2021			1	Mother still in drey immediately adjacent to clearing area, great that this was left
WP3	22/01/2021			1	Joey drey next to 49
WP4	20/01/2021			1	Possum near drey 57
WP5	21/01/2021			1	Adult animal on top / next to drey overlooking clearing area. Good to have kept this tree and drey.
WP7	17/11/2020			0	Old drey, retained
WP8	17/11/2020			0	Old drey, retained
WP9	25/01/2021			0	Natural drey, no possum
WP10	25/01/2021			2	Two possums in natural drey in <i>Banksia attenuata</i>
WP11	25/01/2021			0	Natural drey, no possum
WP12	25/01/2021			0	Natural drey, no possum
WP13	25/01/2021			1	Possum, not in drey
WP15	25/01/2021			0	Natural drey
WP16	25/01/2021			1	Possum, not in drey
WP17	25/01/2021			1	Possum in drey
WP18	25/01/2021			0	Natural drey, no possum
WP19	25/01/2021			0	Natural drey, no possum
WP20	22/01/2021			1	Likely occupied
WP21	22/01/2021			1	One possum in natural drey
WP22	25/01/2021			1	Natural drey with possum
WP23	22/01/2021			2	Two possums in natural drey
WP24	22/01/2021			2	Very low down - approx. 1.5 m
WP25	22/01/2021			0	NOT MOVED - but has deteriorated
WP26	25/01/2021			1	Possum, not in drey



WP27	21/01/2021	██████	██████	0	Three old, collapsed dreys on boundary formerly D04Bound
WP28	21/01/2021	██████	██████	0	Two old dreys high in the tree, one Bronzewing Pigeon nest low down - note 63 (not 636) in notes, and DO Out in original study
WP29	21/01/2021	██████	██████	1	Single possum, not in drey
WP30	24/01/2021	██████	██████	1	Possum, spotlighted
WP31	24/01/2021	██████	██████	1	Possum, spotlighted
WP33	24/01/2021	██████	██████	2	Possum, spotlighted
WP34	24/01/2021	██████	██████	1	Brushtail possum, spotlighted
WP35	25/01/2021	██████	██████	0	Natural drey, no possum
WP36	21/01/2021	██████	██████	1	Adult possum, near joey
WP37	21/01/2021	██████	██████	1	Possum joey, near mother
WP38	21/01/2021	██████	██████	1	Possum, not in drey
WP39	21/01/2021	██████	██████	2	Two possums in natural drey
WP40	21/01/2021	██████	██████	1	Possum
WP41	25/01/2021	██████	██████	1	Natural drey with possum