

Assessment of the Western Ringtail Possum along the Vasse Main Drain, Busselton



Vasse Main Drain (Mandy Bamford)

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Executive Summary

The Water Corporation is proposing to widen the Vasse Main 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 will be impacted by drain widening, and therefore Bamford Consulting Ecologists was commissioned to undertake a detailed possum survey along the drain in two areas; a northern area between Queen Elizabeth Drive and the Busselton Bypass Road (ca. 30ha), and a southern area near the Golf Course (ca. 13ha).

The entire 43ha project area was searched in daylight for dreys, and spotlighting (head-torching) was carried out in five locations across three nights. During the daylight survey, 206 dreys and at least 66 possums were recorded. Four of these possums were not in dreys. Dreys were found across the project area and in almost all species of trees and tall shrubs present. They were in the very abundant Peppermint trees but were over-represented in Marri and Coojong. There were even dreys in Saltwater Paperbarks where the drain crosses The Broadwater. Dreys were found close to high levels of human activity. The greatest density of dreys was in the most continuous vegetation along the drain between Queen Elizabeth Avenue and the Busselton Bypass Road. Dreys tended to be in vegetation where connectivity of canopy was continuous, and especially where the vegetation was low, dense and mixed in species. Dreys were not found in tall, rather open Peppermint forest and were scarce or absent where eucalypts provided hollows as an alternative shelter site. This was particularly notable in the southern of the project area, near the golf course. Spotlighting confirmed the presence of possums in areas containing hollows, despite the lack or scarcity of dreys.

Spotlighting located 25 possums at an average density of 5.83/ha in the northern area, but only 9 animals in the southern area. This was a total count in the southern area. If the density of 5.8/ha is assumed for the northern area, it suggests a population of around 170 animals; the actual value may be slightly lower as spotlighting was biased towards 'better' areas for possums. The possums were seen mostly in Marri and Coojong, and rarely in Peppermint, reinforcing the importance of these less-common plants for the species.

The proposed drain widening will result in some habitat loss, with population decline potentially proportional to the proportion of connected vegetation lost. This may account for 10-20 possums but this figure needs to be treated with caution. A number of actions could be taken to ameliorate impacts include:

- Displace (rather than relocate) animals immediately prior to clearing. This could be complimented with a nest-box installation prior to clearing to provide increased shelter availability where possum density is increased due to displacement.
- Replant sections along the drain where vegetation is currently sparse; this would improve connectivity and offset some habitat loss. This includes around the southern area.

- While Peppermint is an important tree for the species, planting Marri, Spearwood and Coojong in addition would be very helpful.
- Alternative habitat could also be created elsewhere through a planting programme.
- Planting of possum food and shelter trees could be encouraged in new suburbs in the vicinity of the drain.

INTRODUCTION

The Water Corporation manages a network of drains in the vicinity of Busselton and is proposing to widen the Vasse Main 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 to provide more information on the distribution and abundance of this species along the drain. Bamford Consulting Ecologists was commissioned to undertake this work.

METHODS

Description of Project Area

The project area consists of land along two parts of the Vasse Main drain (Figure 1). The northern area lies between the Busselton Bypass Road in the south and Bussell Highway in the north, but includes some extra land in small reserves to the south of the drain. It crosses The Broadwater and the total area surveyed was approximately 30ha. 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 and includes land on the eastern side of the drain, as well as encompassing a section of the Vasse River. This has an area of approximately 13ha. 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.

Survey methods

The project area was visited by Mike Bamford (B.Sc. Hons. Ph.D. Biol.) and Mandy Bamford (B.Sc. Hons. Zool.) from 10-13 March 2019 (northern area), and 27-28 March (southern area) by Mike Bamford and Tim Gamblin (B. Sc. Cert. Env. Man.). Both Mike and

Mandy have many years of experience in surveying for the Western Ringtail Possum (hereafter referred to as possum), and the work was undertaken with reference to Federal survey guidelines (SEWPaC 2011). Tim has informally searched for the species previously. Two approaches were used for this survey.

The entire project area (Figure 1) and some adjacent bushland was visited on foot, initially accompanied by Water Corporation personnel on 11th March, 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 (Figures 2, 3 and 4). 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. However, all dreys were recorded, even simple platforms and dreys that were falling apart, as the presence of dreys is a good indicator of possum usage. The tree species in which dreys were found were also recorded. In some cases, possums were found asleep but not in a drey (Figure 5), and these were also noted. Possums will also shelter in tree hollows and thus dreys are not always a reliable indicator of possum presence, but in the northern area there were few trees of sufficient size to provide suitable hollows. There were more large trees in the southern area.

Spotlighting was carried out in four locations in the northern area across the nights of 10th and 12th March (areas indicated on Figure 6 by yellow stars which were night sightings of possums), and across all of the southern area on the night of 27th March. Spotlighting was carried out by two personnel each with a headlamp, and all trees were scoured thoroughly for possums. Possum eyeshine is very distinct. About half an hour was spent in each location in the northern area, and about two hours across the southern area. Locations of possums were recorded and the tree species where they were seen was noted.

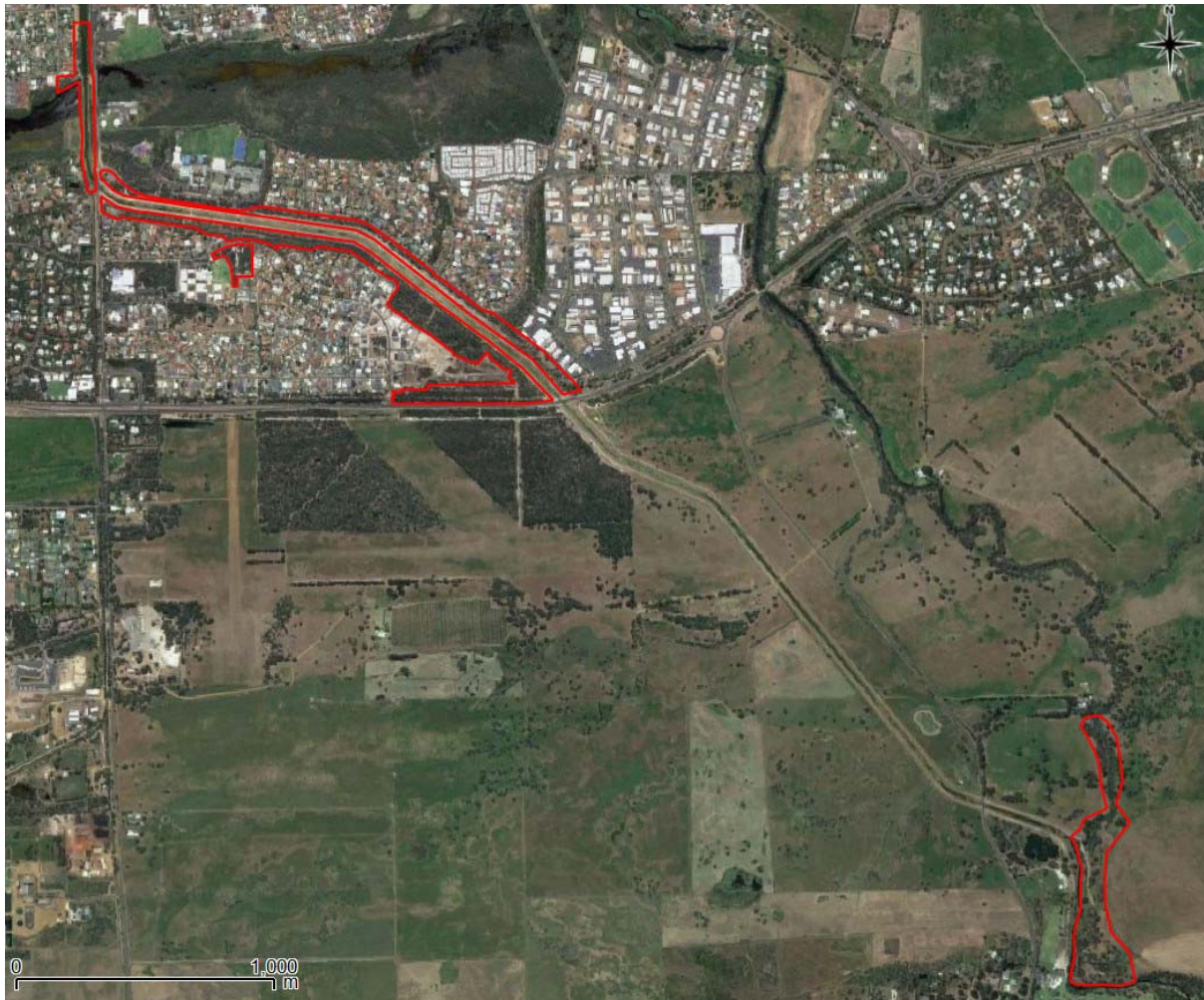


Figure 1. The Vasse Main Drain project area; survey areas visited in March 2019 are indicated in red. The northern area was inspected 10-13 March, and the southern area 27-28 March.



Figure 2. Drey in a Marri. Note that leaves in the drey are mostly from a Peppermint. This drey is in regular recent use and contained a possum.



Figure 3. An old and disused drey in a Peppermint. Even dreys in this condition occasionally contained a possum.



Figure 4. Two dreys in a Peppermint. They are probably used by the same animal and there was a possum in the drey on the left.



Figure 5. A possum asleep on a Peppermint branch with no attempt at drey construction.

RESULTS

Drey surveys

Raw data from the drey survey are presented in Appendix 1 and dreys are mapped on Figures 6 and 7. There were 206 dreys found, plus four possums asleep on branches where there was no drey. Including these four possums, and possums seen in dreys, 66 possums were recorded during the drey survey. This figure of 66 includes 14 records where the presence of a possum in a drey was considered likely but was not confirmed, but assumes that only one possum was present unless two could actually be seen. The majority (204) of the dreys were found in the northern area, with just two dreys in the southern area.

Dreys were found in a wide variety of plants (Table 1). While the majority were in Peppermints, they were also found in much less abundant trees and bushes. The representation of dreys in Marri and Spearwood, for example, was much higher than would be expected by the small number of these plants present. This suggests that plants with denser foliage than Peppermint are actually favoured for drey construction. The four possums found without dreys were in Peppermints. Dreys were typically in areas of interconnected trees and bushes rather than in isolated plants, and were particularly abundant along the southern side of the drain between Queen Elizabeth Avenue and the Busselton Bypass Road. They were in trees across the breadth of the project area, but were most abundant where trees were densest which was typically in the second line of trees back from the drain. Despite this, on the northern side of the drain there were a few dreys in clumps of just four or five Peppermints that were close to the drain and otherwise isolated. There were very few dreys in the southern area which many large trees bearing hollows (Figure 8), and possums will generally shelter in such hollows when available.

Dreys were found right around the project area and were even in small Saltwater Paperbarks where the drain crosses The Broadwater (Figure 6). This indicates that The Broadwater is not a barrier for possums. There were more dreys on the south side of the drain where vegetation was more extensive. Dreys were absent from some areas of native vegetation in the south-east of the southern area; these were areas of tall Peppermint forest and woodland, with few other tree species present (Figure 9), whereas possums favoured areas where the Peppermints were low and dense, and particularly where other tree species were amongst the Peppermints (Figure 10). Dreys were found very close to major roads and even in foliage overhanging roads, and one of the possums asleep and not in a drey was about 10m from traffic moving along the Busselton Bypass Road.

Details of drey distribution along part of the project area (in the north) are illustrated in Figure 11. On the north side of the drain, there are almost no trees close to the bund wall and a patch of trees close to this bund on the bend in the drain did not contain dreys. However, a single drey with a possum was found in a tree on the base of the bund further east. On the south side of the drain, there were two distinct lines of trees separated by a swale. The outer (further from the drain) area of trees was broader but the two lines had similar numbers of dreys, although possibly with more occupied dreys in the outer trees.

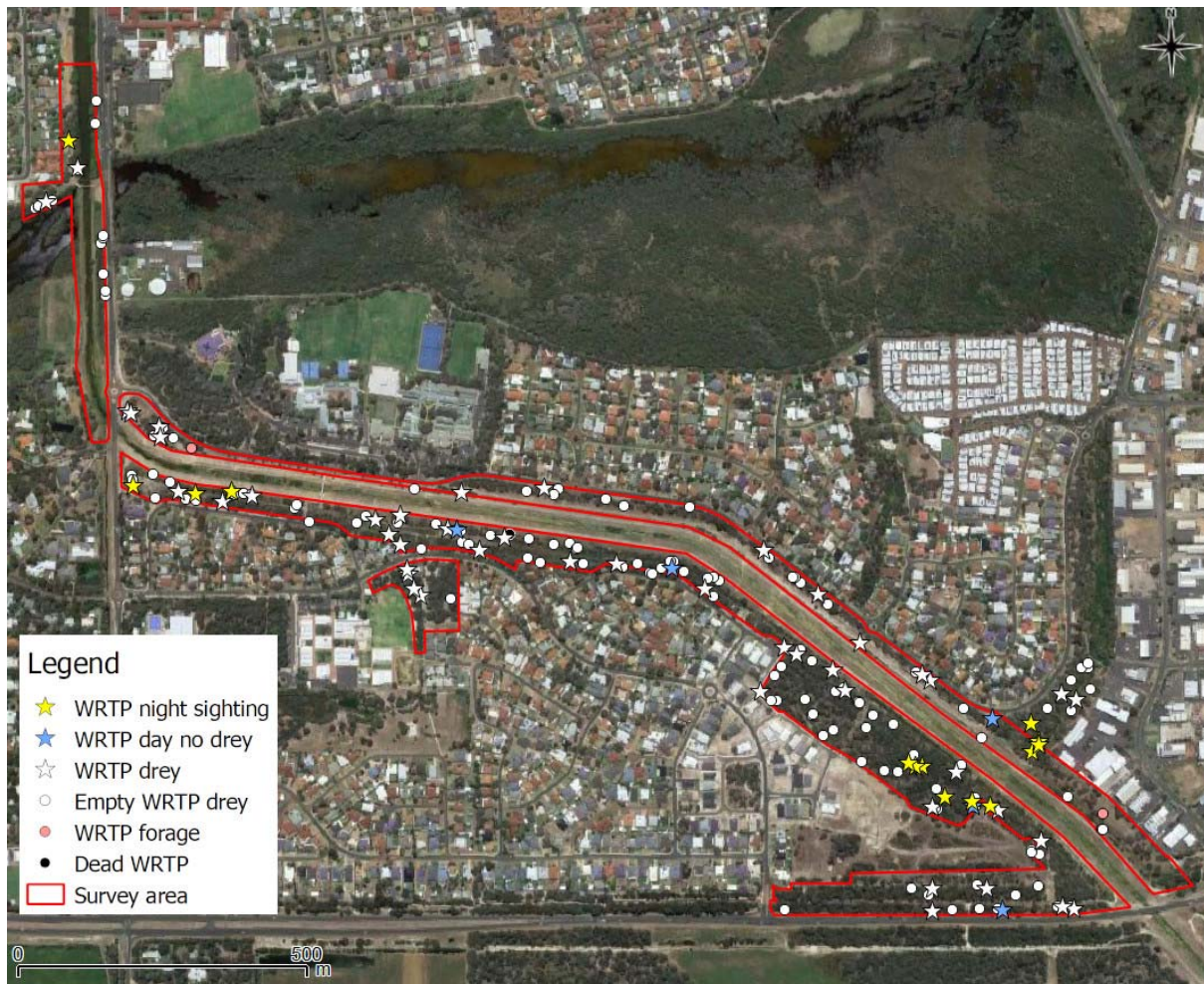


Figure 6. The northern project area (enclosed by red line) along the Vasse Main Drain. A small area of bushland to the north was outside the project area but was checked for possums at the request of the Water Corporation; it is the area outside the red line where possums were found. Western Ringtail Possum (WRTP) records are indicated: yellow star for a possum or possums at one location at night, blue star for a single possum not in a drey, and white star for a possum or possums in a drey. Note that spotlighting occurred only in the four small areas where night sightings were made.

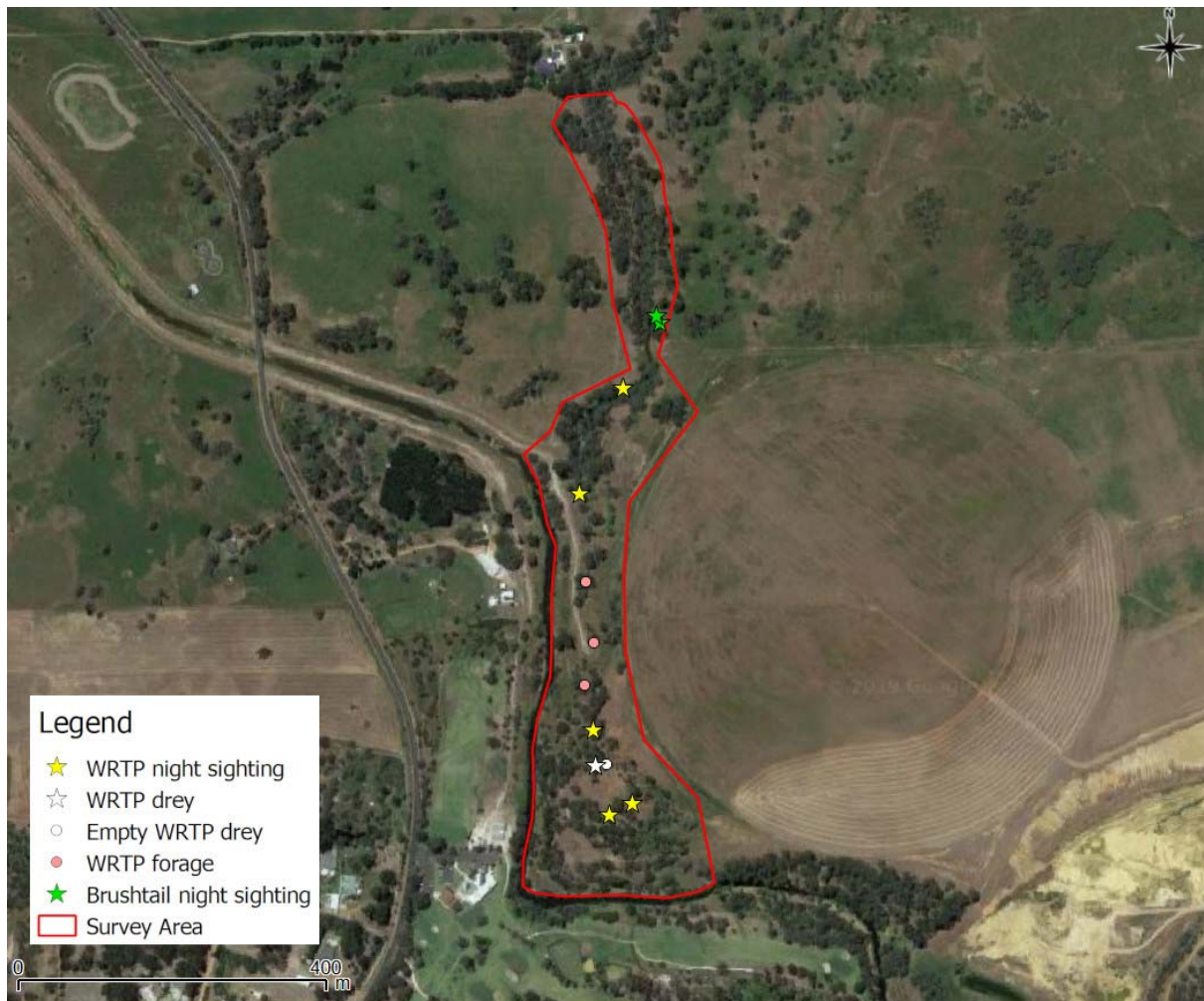


Figure 7. The southern project area (enclosed by red line) along the Vasse Main Drain and extending north along a natural drainage line. Western Ringtail Possum (WRTP) records are indicated: yellow star for a possum or possums at one location at night, and white star for a possum or possums in a drey. Green stars indicate locations of Brushtail Possums.



Figure 8. Large trees in southern area but with extensive areas of grassland.



Figure 9. Peppermint forest. In this tall and rather open vegetation there were no possum dreys.



Figure 10. Tall thicket of Peppermint adjacent to the Busselton Bypass Road. There were three dreys and one possum in this thicket.



Figure 11. Detail of drey distribution along part of the Vasse Main drain. White dots are empty dreys, white stars are dreys with one or more possums, and blue stars are possums not in dreys. The black dot is a dead possum.

Table 1. Distribution of dreys by plant species.

Plant species	N dreys
<i>Agonis flexuosa</i> (Peppermint)	102
<i>Corymbia calophylla</i> (Marri).	23
<i>Melaleuca priessiana</i> (Modong or Stout Paperbark)	21
<i>Melaleuca raphiophylla</i> (Freshwater Paperbark).	7
<i>Melaleuca nesophylla</i>	6
<i>Melaleuca cuticularis</i> (Saltwater Paperbark)	4
<i>Eucalyptus rudis</i> (Flooded Gum)	5
<i>Eucalyptus marginata</i> (Jarrah)	1
<i>Acacia saligna</i> (Coojong).	5
<i>Acacia sp.</i>	1
<i>Kunzea sp.</i> (Spearwood)	16
<i>Spyridium globulosum</i> (Basketbush)	2
<i>Banksia littoralis</i> (Swamp Banksia)	2
<i>Hardenbergia comptoniana</i> (Native Wisteria)	3
<i>Nuytsia floribunda</i> (Christmas Tree)	1

Spotlighting surveys

Spotlighting recorded 25 possums across the four areas where spotlighting was carried out in the northern area, and nine Ringtail Possums plus two Brushtail Possums in the southern area (raw data in Appendix 2). Numbers of possums in each area and their density are presented in Table 2. Plant species where possums were seen during spotlighting are given in Table 3.

Possums were found wherever searching was undertaken and were in trees close to the drain as well as further back. They were often encountered in twosomes (only seven were found as singletons); almost certainly an adult female and a near-grown young. Possum density in the northern area ranged from just over four to over eight animals/ha. The highest density was found where no dreys had been recorded, in an area of Flooded Gum, Marri, Coojong and Peppermint where there were many hollows (east north of the drain). The next highest density was in another area of low drey density but where there were large eucalypts (east, south of the drain). The overall possum density in the northern area was 5.83/ha. According to anecdotal accounts this is not an especially high density for the Busselton area. The recorded density suggests a population of about 170 possums in the 30ha of the northern survey area, but spotlighting was conducted in high quality habitat and parts of the 30ha probably do not support possums (grassland), or at least support much lower numbers (tall Peppermint forest). Therefore, the possum population in the northern survey area is likely to be in the range of 100-150 animals, with highest numbers along the southern side of the drain between Queen Elizabeth Avenue and the Busselton Bypass Road. Possum density in the southern area was much lower, but this area was extensively cleared and possums were restricted to small patches of dense vegetation.

Possums seen while spotlighting were feeding, and they displayed a strong bias in favour of Marri (which was flowering), Flooded Gum and Coojong. Five of the animals in Flooded

Gum were in the southern area, and were probably emerging from hollows in the trees in which they were seen. Only five of the 34 possums seen were in Peppermint, indicating that the animals feed on a variety of plants and do not especially favour Peppermint for foraging, at least when species like Marri are in flower.

Table 2. Numbers of Ringtail Possums and estimated density in each spotlighting location. The size of the southern area excludes the northern extremity which was parkland cleared.

	Location	Approx. Size (ha)	N Possums	N/ha
Northern area	North	0.7	3	4.29
	West	1.13	5	4.43
	East (south of drain)	1.56	9	5.76
	East (north of drain)	0.8	8	8.89
	Mean density			5.83
Southern area		10	9	0.9

Table 3. Distribution of spotlighted possums by plant species.

Plant species	N possums
<i>Agonis flexuosa</i> (Peppermint)	5
<i>Corymbia calophylla</i> (Marri).	7
<i>Melaleuca priessiana</i> (Modong or Stout Paperbark)	
<i>Melaleuca raphiophylla</i> (Freshwater Paperbark).	
<i>Melaleuca nesophylla</i>	
<i>Melaleuca cuticularis</i> (Saltwater Paperbark)	
<i>Eucalyptus rudis</i> (Flooded Gum)	6
<i>Eucalyptus marginata</i> (Jarrah)	
<i>Acacia saligna</i> (Coojong).	4
<i>Acacia sp.</i>	
<i>Kunzea sp.</i> (Spearwood)	1

DISCUSSION

The Western Ringtail Possum is clearly abundant in the project area, with a population in excess of 100 animals. They are present in almost every area of available habitat and are not restricted by limited habitat where the drain crosses the Broadwater. However, they are most abundant in areas of dense, low and mixed forest of Peppermint, Marri and other trees and tall shrubs. The presence of large trees that provide hollows appears to be important but not essential. This sort of dense, low forest is well-developed along the outer parts of the project

area between Queen Elizabeth Drive and the Busselton Bypass Road. While commonly associated with Peppermint trees, possums' nesting and especially their feeding is biased towards less common trees in the area such as Marri and Coojong. Foraging may therefore be concentrated away from the line of trees closest to the drain.

In the northern area, remnant vegetation along the Vasse Main drain provides habitat and a connectivity function for possums, linking the last two large tracks of native vegetation south of the Busselton Bypass Road to tracts of vegetation fringing The Broadwater, and to the inner suburbs of Busselton where older-style gardens still support the species. The proposal to widen the Vasse Main drain will result in the loss of some nesting and foraging habitat in this section, but wherever the drain is widened there will be retained habitat. Connectivity function will remain but there will be some reduction in population size. This can be considered to be roughly proportional to area of habitat loss and in particular the proportion of more or less continuous Peppermint and mixed forest and woodland. A final development footprint is not available but could be in the order of 15-20% of the preferred habitat, thus affecting approximately 10-15 possums of the total population in the project area. Removal of trees on the south side of the drain in this section will be more significant than along the north side, where there are very few trees close to the drain and thus where expansion might occur. The calculated mean density of 5.83/ha could be used for all continuous native vegetation along the drain in the northern section to estimate numbers of possums that might be impacted and the effect on the total population.

The southern section differs, with a low density of possums and effectively no connectivity along the drain or to the north (due to parkland clearing and grazing along the Vasse River). The possums in this southern area are probably part of a population associated with remnant vegetation in and around the golf course.

Some impacts upon possums will be inevitable as a result of the proposed drain widening. Suggestions for ameliorating impacts include:

- Immediately prior to clearing, trees should be checked for possums and these animals moved. Relocation is not considered a viable offset by SEWPaC (2011) and has variable success, but given the narrowness of the clearing, simply moving animals to trees outside the clearing zone may mean they are still within their own home range. Providing nest-boxes may offset the increase in population density in remaining habitat, as it appeared that density was naturally higher where large trees provide hollows for shelter and all animals did not have to rely on dreys. Construction of nest-boxes could be done in conjunction with local schools (some are very close to the drain).
- While fragmentation is not considered a concern as a result of the proposed development, there are already sections along the drain where habitat is limited. Replanting these sections would improve connectivity and offset some habitat loss. This would be especially important where the drain crosses The Broadwater. Connectivity could also be improved in the southern area by replanting along the Vasse River where it is currently parkland cleared and grazed.

- There may be opportunities along the project area to create new habitat through planting in areas where trees are sparse or absent. While Peppermint is an important tree for the species, planting Marri, Spearwood and Coojong in addition would be very helpful. Foraging habitat would probably be available within two to three years, and nesting habitat within about five years.
- Alternative habitat could also be created elsewhere through a planting programme.
- Planting of possum food and shelter trees could be encouraged in new suburbs in the vicinity of the drain.
- The drain does represent a barrier to possum movement; they can cross the drain only where there are bridges which requires them coming to the ground. Rope bridges have been used elsewhere in the region to allow possums to cross major roads, and could be considered to facilitate drain crossing.

REFERENCES

- DEWHA (2009). Significant impact guidelines for the vulnerable Western Ringtail Possum *Pseudocheirus occidentalis* in the southern Swan Coastal Plain, Western Australia. Dept of Environment, Water, Heritage and the Arts, Canberra.
- GHD (2017). Vasse Diversion Drain Upgrade Flora and Fauna Study. Unpubl. report to the Water Corporation by GHD, Perth.
- Jones, B. (2000). Western Ringtail Possum. Pp. 252-254 *in* The Mammals of Australia. *Ed.* R. Strahan. Australian Museum and Reed Holland, Sydney.
- SEWPaC (2011). Survey guidelines for Australia's threatened mammals. Dept of Sustainability, Environment, Water, Population and Community, Canberra.

Appendix 1. Raw data from drey surveys. The plant species in which is drey was located is indicated (key to plant names at end of table).
 Coordinates are UTM Zone 50, datum GDA90.

Drey survey 10-12 March 2019.

easting	northing	Drey	Possum present	A. flex	C. calo	M. pries	M. rhaph	M. neso	M. cutic	E. rudis	E. marg	A. sal	A. sp.	K. sp	S. glob	B. litt	H. comp.	N. flo	Possum forage
344574.6	6274364	x																	
344517.7	6274307	x	x																
344703	6273835	x		x															
344731.7	6273823	x		x															
344840.7	6273806	x		x															
344839.1	6273798	x		x															
344843.6	6273801	x		x															
344860.2	6273803	x		x															
344874	6273799	x	?x																
344873.5	6273801	x		x															
345071.2	6273764	x												x					
345089	6273756	x	x											x					
345125.8	6273753	x												x					
345130.4	6273764	x	x											x					
345193.8	6273750	x			x														
345213.1	6273741	x3	x											x					
345229.9	6273740		x	x															
345235.9	6273737	x												x					
345287.3	6273731	x		x															
345312.4	6273726	x	?x	x															
345320.4	6273733		x dead																
345354.6	6273724	x		x															
345396.3	6273715	x		x															

Western Ringtail Possum along Vasse Main Drain

easting	northing	Drey	Possum present	A. flex	C. calo	M. prius	M. raph	M. neso	M. cutic	E. rudis	E. marg	A. sal	A. sp.	K. sp	S. glob	B. litt	H. comp.	N. flo	Possum forage
345424.7	6273716	x		x															
345437.1	6273709	x3		x															
345436.1	6273707	x												x					
373312.6	6298089		x2																
373384.5	6298117																		
373376.9	6298154		x2																
373320.3	6298145	x		x															
373435.5	6298138		x		x														
373431.8	6298075		x																
373369.5	6298062		x	x															
373385.7	6298063		x								x								
373354.2	6297991		x2		x														
373401.2	6297961		x		x														
373417.4	6297963		x2		x														
344666.1	6273834	x													x				
344668.5	6273827	x												x					
344707.5	6273795	x										x							
344747.2	6273805	x	x		x														
344759.4	6273793	x			x														
344777.9	6273791	x			x														
344824.4	6273789	x	x		x														
344948.9	6273777	x												x					
344974	6273754	x															x		
344951.1	6273784	x		x															
345055.9	6273752	x				x													
345112.3	6273732	x	x	x															
345131.7	6273713	x	x?			x													

Western Ringtail Possum along Vasse Main Drain

easting	northing	Drey	Possum present	A. flex	C. calo	M. prius	M. rhaph	M. neso	M. cutic	E. rudis	E. marg	A. sal	A. sp.	K. sp	S. glob	B. litt	H. comp.	N. flo	Possum forage
345219.1	6273621	x		x															
345165.9	6273625	x	x?	x															
345155.4	6273637	x	x?	x															
345144.1	6273662	x	x		x														
345143.2	6273671	x	x																
345167.3	6273706	x			x														
345238.9	6273718	x												x					
345249.5	6273714	x										x							
345268.6	6273704	x	x													x			
345351.2	6273691	x		x															
345374.2	6273684	x																x	
345426.1	6273685	x	x?														x		
345448	6273682	x				x													
345506.5	6273681	x4	x?					x											
345515.6	6273675	x				x													
345541.1	6273681	x				x													
345563.8	6273665	x				x													
345567.8	6273664	x						x											
345582.3	6273674	x		x															
345602.2	6273672		x													x			
345621.5	6273668	x		x															
345658.9	6273636	x	x?	x															
345673.2	6273625	x				x													
345682.4	6273652	x		x															
345672.3	6273659	x		x															
345664.1	6273656	x		x															
345604.6	6273686	x		x															

Western Ringtail Possum along Vasse Main Drain

easting	northing	Drey	Possum present	A. flex	C. calo	M. prius	M. rhaph	M. neso	M. cutic	E. rudis	E. marg	A. sal	A. sp.	K. sp	S. glob	B. litt	H. comp.	N. flo	Possum forage
345597.8	6273686	x												x					
346347.1	6273221	x		x															
346346.2	6273221			x															x
346348	6273249			x															x
346137	6273380	x		x															
345156.7	6273810	x		x															
344769.6	6273882																		x
344739	6273899	x		x															
344621.1	6274146	x							x										
344620.2	6274154	x2							x										
344617.2	6274182	x							x										
344613.3	6274236	x					x												
344616.8	6274245	x		x															
344617.5	6274249	x					x												
344499.8	6274296	x					x												
344504.5	6274299	x2					x												
346223	6273181	x		x															
346125.9	6273277	x		x															
346122.8	6273262		x	x															
346126.6	6273261	x		x															
346061.8	6273256	x		x															
346057.9	6273258	x		x															
346051.7	6273259	x	x?	x															
345969.5	6273322	x		x															
345930.3	6273339	x					x												
345862.6	6273384	x					x												
345843.6	6273418	x		x															

Western Ringtail Possum along Vasse Main Drain

easting	northing	Drey	Possum present	A. flex	C. calo	M. prius	M. rhaps	M. neso	M. cutic	E. rudis	E. marg	A. sal	A. sp.	K. sp	S. glob	B. litt	H. comp.	N. flo	Possum forage
345783.4	6273445	x			x														
345773	6273445	x			x														
345753.7	6273458	x	x?		x														
345844	6273513	x		x															
345880.2	6273496	x	x	x															
345885	6273460	x		x															
345901.8	6273462	x	x	x															
345924.3	6273441	x		x															
345950.4	6273419	x		x															
345985.3	6273402	x		x															
346196.1	6273106	x		x															
346046.4	6273106	x		x															
346286.1	6273277	x		x															
346291.5	6273426	x		x															
346300.4	6273445	x	x	x													x		
346326.3	6273463	x				x													
346321.1	6273502	x				x													
346322.4	6273509	x4				x													
346309.6	6273501	x						x											
346291.8	6273479	x																	
346275	6273454	x	x										x						
346250.5	6273430	x				x													
346155.9	6273411		x	x															
346105.5	6273431	x				x													
346048	6273479	x	x	x															
346034	6273488	x	x	x															
346023.6	6273493	x		x															

Western Ringtail Possum along Vasse Main Drain

easting	northing	Drey	Possum present	A. flex	C. calo	M. prius	M. raph	M. neso	M. cutic	E. rudis	E. marg	A. sal	A. sp.	K. sp	S. glob	B. litt	H. comp.	N. flo	Possum forage
345926.2	6273542	x	x	x															
345871.3	6273612	x										x							
345854.6	6273627	x	x		x														
345823.3	6273648	x				x													
345814.8	6273658	x		x															
345809.8	6273659	x		x															
345769.6	6273692	x			x														
345759.5	6273705	x	x?	x															
345632.6	6273780	x			x														
345519.1	6273780	x								x									
345487.6	6273793	x										x							
345404.4	6273810	x								x									
345397.1	6273801	x		x															
345380.1	6273811	x	x			x													
345350.4	6273806	x				x													
345237.6	6273805	x	x	x															
344665.7	6273942	x	x?							x									
344659	6273945	x	x							x									
344704.4	6273904	x		x															
344714.3	6273918	x	x	x															
344720.1	6273917	x		x															
344716.1	6273901	x2	x2	x															
344604	6274444	x		x															
344604.9	6274483	x		x															
344562.7	6274702	x		x															
344572.7	6274366	x	x	x															
346166.2	6273253	x	x	x															

Western Ringtail Possum along Vasse Main Drain

easting	northing	Drey	Possum present	A. flex	C. calo	M. prius	M. raph	M. neso	M. cutic	E. rudis	E. marg	A. sal	A. sp.	K. sp	S. glob	B. litt	H. comp.	N. flo	Possum forage
346240.2	6273200	x	x	x															
346238.5	6273178	x			x														
346222.9	6273185	x			x														
346268.4	6273087	x		x															
346278.5	6273087	x2	x			x													
346292.7	6273088	x2		x															
346296.5	6273083	x	x	x															
345991.6	6273320	x		x															
345880.8	6273393	x													x				
345844.8	6273421	x		x															
345832.6	6273447	x												x					
345778.6	6273487	x		x															
345791.6	6273502	x		x															
345794.8	6273535	x	x	x															
345816.3	6273524	x	x2	x															
345825	6273533	x												x					
345901.8	6273460	x			x														
345926	6273441	x		x															
345938.2	6273397	x												x					
346020.4	6273350	x		x															
346059.2	6273291	x				x													
346093.9	6273320	x	x	x															
346101.6	6273332	x										x							
346236	6273123	x		x															
346146.3	6273119	x	x		x														
346129.4	6273124	x		x															
346052.7	6273117	x	x		x														

Western Ringtail Possum along Vasse Main Drain

easting	northing	Drey	Possum present	A. flex	C. calo	M. pries	M. rhaph	M. neso	M. cutic	E. rudis	E. marg	A. sal	A. sp.	K. sp	S. glob	B. litt	H. comp.	N. flo	Possum forage
346016.1	6273119	x		x															
345797.3	6273081	x			x														
346052.5	6273079	x	x?	x															
346087.6	6273082	x		x															
346133.5	6273083	x		x															
346164.3	6273083	x		x															
346173.3	6273081		x							x									

Drey survey, 27 March 2019.

Easting	Northing	Drey	Possum present	A.flex	Possum forage
348478.7	6271231				X
348489.3	6271152				X
348478.2	6271097				X
348505.8	6270995	X		X	
348492.2	6270991	X	x	x	

Key to plant species. *A. flex* = *Agonis flexuosa* (Peppermint). *C. calo* = *Corymbia calophylla* (Marri). *M. pries* = *Melaleuca priessiana* (Modong or Stout Paperbark). *M. rhaph* = *Melaleuca rhapsiophylla* (Freshwater Paperbark). *M. neso* = *Melaleuca nesophylla*. *M. cutic* = *Melaleuca cuticularis* (Saltwater Paperbark). *E. rudis* = *Eucalyptus rudis* (Flooded Gum). *E. marg* = *Eucalyptus marginata* (Jarrah). *A. sal* = *Acacia saligna* (Coojong). *A. sp.* = *Acacia sp.* (unidentified wattle from eastern Australia). *K. sp.* = *Kunzea sp.* (Spearwood). *S. glob.* = *Spyridium globulosum* (Basketbush). *B. litt* = *Banksia littoralis* (Swamp Banksia). *H. comp* = *Hardenbergia comptoniana* (Native Wisteria). *N. flor* = *Nuytsia floribunda* (Christmas Tree).

Appendix 2. Raw data from spotlighting surveys; 10th and 12th March.

Easting	Northing	N possums	A. flex	C. calo	M. pries	M. raph	M. neso	M. cutic	E. rudis	E. marg	A. sal	A. sp.	K. sp
344517.7	6274307	x											
344556.9	6274414	x2											
344839.1	6273806	x2											
346023.1	6273330	x2											
346121.7	6273268	x											
346224.7	6273354	x2											
344669.4	6273815	x											x
344776.8	6273801	x2		x									
346151.6	6273261	x2		x									
346073.3	6273276	x							x				
346035.1	6273330	x		x									
346011	6273334	x2		x									
346237	6273372	x2	x										
346237.1	6273367	x2									x		
346223.6	6273405	x2									x		

27th March

Easting	Northing	Species	Number seen	A. flexuosa	C. calophylla	E. rudis
348489.1	6271038	Ringtail Possum	1	x		
348509.3	6270928	Ringtail Possum	1			x
348539.8	6270942	Ringtail Possum	2	x		
348470.5	6271345	Ringtail Possum	2			x
348526.7	6271482	Ringtail Possum	3			x
348574.4	6271567	Brushtail Possum	1		x	
348570.7	6271577	Brushtail Possum	1		x	

