

96-166 Centre Road, Narre Warren

Annual EPBC Compliance Report 2022 – EPBC 2014/7380

Prepared for Narre Warren Central Pty Ltd

February 2022 Report No. 14090 (18.0)



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1. Introduction

This Compliance Report addresses the conditions of approval EPBC 2014/7380 under the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) held by the approval holder Narre Warren Central Pty Ltd, ACN 600 509 064. This is for the approved action to undertake a residential estate development at 96-166 Centre Road, Narre Warren, Victoria.

The approval was dated 5th February 2016 and is effective until the 1st January 2031. This Compliance Report encompasses the years 2021 and 2022 as no native vegetation monitoring was required in 2021 (year 4 after construction) and thus no annual compliance report was prepared for the year 2021 regarding native vegetation and weed monitoring. Construction activities commenced on the 8th November 2016.

This report provides evidence of compliance with the thirteen (13) conditions of the approval, outlined in Section 3 and Table 1.

This report draws together information from the following sources:

- Onsite monitoring and reporting undertaken by Nature Advisory;
- Monitoring and reporting undertaken by Aquatica Environmental; and
- Correspondence from the approval holder.

This report was prepared by a team from Nature Advisory comprising Annette Cavanagh (Botanist) and Inga Kulik (Senior Ecologist and Project Manager).

The approval holder, Narre Warren Central Pty Ltd, accepts responsibility for this report.

Declaration of accuracy

In making this declaration, I am aware that sections 490 and 491 of the *Environment Protection and Biodiversity Conservation Act* 1999 (Cth) (EPBC Act) make it an offence in certain circumstances to knowingly provide false or misleading information or documents. The offence is punishable on conviction by imprisonment or a fine, or both. I declare that all the information and documentation supporting this compliance report is true and correct in every particular. I am authorised to bind the approval holder in this declaration and that I have no knowledge of that authorisation being revoked at the time of making this declaration.

Signed	J. Unlit	
Full name	Inga Kulik	
Position	Senior Ecologist and Project	Manager / Director
Organisation	Nature Advisory Pty Ltd	ABN 12 095 541 334
Date	22/2/2023	



2. Compliance with approval conditions

The approval conditions (Appendix 1) relate to the controlling condition *Listed threatened species and communities.* Specifically, they relate to the EPBC Act listed vulnerable Dwarf Galaxias (*Galaxiella pusilla*). Dwarf Galaxias are located in suitable habitat in the drainage channels along Centre Road and internally (Figure 1).

All conditions of the EPBC approval have been considered and addressed.

In 2020, the approval holder applied for variations to the EPBC conditions. The revised conditions of the EPBC approval (changes marked in red), and whether compliance or non-compliance with each condition has been achieved, are listed below. The definitions from the approval that apply to the terms shown in bold throughout this document are listed in Appendix 1 of this report.

2.1. Conditions 1 to 4 – Mitigation

- To avoid mortality of dwarf galaxias, prior to construction activities occurring within 30 metres of dwarf galaxias habitat, the Approval Holder must salvage and translocate dwarf galaxias in accordance with a Salvage and Translocation Plan approved by the Victorian Government.
- 2. To mitigate impacts on **dwarf galaxias** movement and dispersal in the local area, the **Approval Holder** must ensure flow connectivity is maintained between the **dwarf galaxias habitat retained**, Troups Creek East Branch, and Hallam Main Drain as indicated in Annex 2.
- 3. To mitigate impacts on dwarf galaxias due to stormwater runoff in dwarf galaxias habitat retained, there must be no impact on water quality between upstream and downstream water sampling points, noting that background fluctuation may impact the overall water quality, and no impact on the water level, during construction activities and 1 year after the completion of construction activities.

The Approval Holder must undertake the following monitoring to determine if these outcomes are being achieved:

- a) prior to the commencement of construction to gain baseline data;
- b) once per fortnight throughout construction activities;

c) once every 3 months for the year following completion of **construction activities**; and

d) after significant rainfall events of greater than 10mm, during both construction and the year following the completion of **construction activities**.

4. To mitigate impacts on **dwarf galaxias**, the **Approval Holder** must ensure that buffer areas identified in Annex 3 are revegetated within 5 years of **commencement of construction** and that vegetation cover is retained until the expiry of the approval. This outcome must meet the following milestones:

a) less than 40% weed cover 5 years from the **commencement of construction**; and b) less than 30% weed cover and at least 70% native vegetation cover 7 years from the **commencement of construction**.

The **Approval Holder** must undertake the following monitoring to determine if these outcomes are being achieved:

a) prior to the commencement of construction to gain baseline data;



- b) 6 months after the commencement of construction;
- c) 12 months after the commencement of construction;
- d) 2, 3, 5, 7 and 10 years after the commencement of construction.

Condition 1 compliance

The approved dwarf galaxias Salvage and Translocation Plan was implemented on the $5^{th}/6^{th}$ October 2016 (prior to commencement of construction), with dwarf galaxias being salvaged from planned removed habitat and translocated to retained habitat.

Compliant

Condition 2 compliance

The dwarf galaxias retained habitat connection to the Centre Road drain has been maintained, as was the case prior to commencement of the project. The Centre Road drain also maintains all of its pre-construction connectivity with upstream inputs and downstream receiving waterways.

Note that the actual connectivity pathway is that the dwarf galaxias retained habitat connects to the Centre Road roadside drain, which then passes under Troupes Creek East Branch to the western side of Troupes Creek East Branch (via a syphon culvert), then passes via another culvert to the southern side of Centre Road and into the Hallam Main Drain floodplain.

There has been no loss or change to pre-existing connectivity due to the project.

Compliant

Condition 3 compliance

Water quality monitoring has been taking place throughout 2021 and 2022 on a fortnightly basis and after >10mm rainfall events.

Water temperature, pH, electrical conductivity, dissolved oxygen levels and turbidity in the retained Dwarf Galaxias habitat and Centre Road roadside drain are highly variable due to natural seasonal variations and upstream impacts/inputs. The overall data of the water quality shows that the project has not resulted in an ecologically significant impact to water quality between upstream and downstream sites, neither in 2021 nor 2022.

Annual Dwarf Galaxias monitoring by Aquatica Environmental since the translocation event has shown that the retained habitat population is thriving (Appendix 2). In 2021, 17 individual Dwarf Galaxias and in 2022 11 individuals of this species were recorded in the retained habitat drain indicating that conditions for the species are being maintained and likely continuing to improve, due to the establishment of further suitable habitat in the constructed swales. The primary reason for this is that the constructed swales result in more water and a more constant water level in the retained habitat drain in a manner that is clearly suited to the resident Dwarf Galaxias population (i.e. still maintaining ephemerality but not allowing over drying).

Based on the 2021 and 2022 annual survey results and data, the development of the Casey Green site to date has been undertaken in accordance the Dwarf Galaxias Salvage and Translocation Plan and associated approvals. No ecologically significant impacts have been observed to the retained habitat, with the constructed swales having improved overall conditions for Dwarf Galaxias on the site and in the region.

Water quality and Dwarf Galaxias monitoring reports by Aquatica Environmental for 2021 and 2022 are provided in Appendix 2 and 3.

Compliant



Condition 4 compliance

This condition was varied to achieve 40% weed cover 5 years from the commencement of construction. The 5 year monitoring of native vegetation and weed cover was undertaken in December 2022.

Sixteen sample quadrats were surveyed in 2022, with 14 out of these quadrat meeting the target of 40% weed cover or less. Only two quadrats still had a weed cover of 50% (quadrats 7 and 9) which was due to Swamp Paperbark dieback resulting in increased Blackberry cover in the understorey. The control of Blackberry still proves to be difficult due to the following factors:

- Issues with accessing the habitat buffers including deep water and often impenetrable vegetation.
- The habitat buffers are surrounded by a sensitive aquatic environment and the amount of herbicide that would need to be sprayed to effectively kill Blackberry could be harmful to aquatic and semi aquatic life, including Dwarf Galaxias.
- The Blackberry is intertwined with native vegetation and spraying it would cause a significant amount of off-target damage to native plants.
- The vegetation that the Blackberry is growing in is too dense and much of the Blackberry would not be able to be accessed.
- Blackberry provides protective habitat for local wildlife, such as small birds and mammals, which is particularly important in heavily developed areas such as Narre Warren.

Unless the current levels of Blackberry can be accepted (and maintained), reduction of Blackberry will be required. It is therefore recommended that potential options to reduce Blackberry be investigated despite the challenges, or further discussion may be required with DEECCW regarding further review of Condition 4.

Naturelinks Landscape Management Pty Ltd was appointed in 2021 and 2022 to undertake weed management. The work included spraying, slashing and brushcutting of weeds, especially Blackberry throughout the Dwarf Galaxias conservation area.

The vegetation monitoring report by Nature Advisory for December 2022 is provided in Appendix 4.

Compliant, except for two quadrats out of 16 (quadrat 7 and 9)

2.2. Conditions 5 to 8 – Offsets

5. To compensate for the loss of dwarf galaxias habitat at the project area, prior to the commencement of construction, the Approval Holder must enter into an Agreement to ensure the long term security of the offset site. The Approval Holder must:

a) provide the **Department** with a signed copy of the **Agreement**, within 2 weeks of confirmation of the **Agreement**; and

b) provide the **Department** with the **offset attributes**, **shapefile** and map(s) clearly defining the location and boundaries of the **offset site**, within 2 weeks of confirmation of the **Agreement**.

6. Prior to **commencement of construction**, the **Approval Holder** must secure the **offset site** with an appropriate **legal conservation mechanism**. Any proposal for an alternative offset must be agreed to in writing with the **Department**.



- 7. After a period of 10 years from the **commencement of construction**, the **offset site** must contain at least 2 hectares of **Dwarf Galaxias habitat** which contains a self sustaining population of **Dwarf Galaxias** and is connected to known **Dwarf Galaxias habitat** in the local area. This outcome must meet the following milestones:
 - a) **Dwarf Galaxias habitat** in the **offset site** must be constructed within 5 years of **commencement of construction**;

b) **Dwarf Galaxias** must be identified as present in the **Dwarf Galaxias habitat** in the **offset site** within 6 years of **commencement of construction**; and

c) **Dwarf Galaxias** presence and abundance must be consistent with that of **control sites** from after 7 years of **commencement of construction** and for the life of the approval.

8. The **Approval Holder** must undertake a monitoring program, which includes the newly constructed **Dwarf Galaxias habitat** in the **offset site** and **control sites**. The monitoring program must ensure the data gathered is adequate to: inform adaptive management; and demonstrate whether the milestones and outcomes described in condition 7 have been met. Monitoring must be undertaken by a **suitably qualified person**.

Condition 5 compliance

The agreement securing Dwarf Galaxias Offset Site was entered into and was provided to the Department. Shapefiles of the offset site and an offset site assessment report (Nature Advisory Report 14090(10.2)) including a description of the attributes and maps were provided to the Department. – Not relevant for the 2022 compliance.

Condition 6 compliance

A S173 Agreement securing Dwarf Galaxias Offset Site was entered into before commencement of construction. This Agreement was provided to the Department in June and September 2016. – Not relevant for the 2022 compliance.

Compliant

Condition 7 compliance

Council issued a planning permit (PInA00545/16) on 22nd December 2016 for vegetation removal for the Dwarf Galaxias offset site. However, in March 2017, Council suggested that the offset site had the possibility of supporting the EPBC Act listed community Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains.

Despite the advice given by Nature Advisory and confirmed by DoE that the offset site does not support the listed community, Melbourne Water asked to review the conceptual design to maximise the retention of vegetation that exist within *Seasonal Herbaceous Wetlands*. An application for conditions for Dwarf Galaxias works was submitted to Melbourne Water in May 2017. The extent of vegetation to be retained was finalised by Melbourne Water in September 2017 and a completed functional design was submitted to Melbourne Water in November 2017. This was accepted by Melbourne Water in May 2018.

The Council issued planning permit expired on the 22nd December 2017 and it was advised in May 2019 that a new permit for the Dwarf Galaxias offset site be applied for. A new permit application for vegetation removal was lodged with Council in July 2019 and a new permit (PlnA00539/19) was issued on the 19th February 2020. Vegetation offsets were paid in May 2020.



Works commenced in summer 2020 when the area had sufficiently dried out. Preparatory works (slashing and vegetation removal) on the Dwarf Galaxias offset site officially commenced on 10/2/2020. It was expected that the Dwarf Galaxias offset site construction be finalised by the end of 2021, within 5 years of commencement of construction. The proponent advised that the infrastructure works were about 80% completed last year (2022) but unfortunately due to Covid and the adverse weather (record rainfalls in 2022) it was not possible to complete the balance of the works. The site is finally dry enough and works have recommenced in January 2023. The infrastructure works will be completed by the end of this week and Melbourne Water is content with the outcome. The only remaining item is the landscaping which has already been appointed to a contractor. They have advised that the best planting season for the terrestrial plants is from April to September and the aquatic plants are from Dec 2023 to before March 2024. Given the above the habitat should be fully completed with landscaping by the end of the year.

Non-Compliant

Condition 8 compliance

Monitoring of the newly constructed habitat at the Dwarf Galaxias offset site will begin after construction of the site is completed by the end of 2023.

2.3. Conditions 9 to 13 – Administrative conditions

- 9. Within 7 calendar days after the **commencement of construction**, the **Approval Holder** must advise the **Department** in writing of the actual date of **commencement of construction**.
- 10. The **Approval Holder** must maintain accurate records substantiating all activities associated with or relevant to the conditions of approval, including measures taken to implement plans/programs and measures taken to achieve outcomes and milestones required by this approval and make them available upon request to the **Department**. Such records may be subject to audit by the **Department** or an independent auditor in accordance with section 458 of the **EPBC Act**, or used to verify compliance with the conditions of approval. Summaries of audits will be posted on the **Department's** website. The results of audits may also be publicised through the general media.
- 11. Within 3 months of every 12 month anniversary of the **commencement of construction**, the **Approval Holder** must publish an annual report of compliance on their website addressing compliance with each of the conditions of this approval, including the implementation of any plans/programs specified in the conditions and whether outcomes and milestones required by these conditions have been or are on track to being met. The compliance report must consider the **Department's** *Annual Compliance Report Guidelines*. Documentary evidence providing proof of the date of publication and non-compliance with any of the conditions of this approval must be provided to the **Department** at the same time as the annual report of compliance is published.
- 12. Upon the direction of the **Minister**, the **Approval Holder** must ensure that an independent audit of compliance with the conditions of approval is conducted and a report submitted to the **Minister**. The independent auditor must be approved by the **Minister** prior to the commencement of the audit. Audit criteria must be agreed to by the **Minister** and the audit report must address the criteria to the satisfaction of the **Minister**.



13. If, at any time after 5 years from the date of this approval, the **Approval Holder** has not **substantially commenced the action**, then the **Approval Holder** must not **substantially commence the action** without the written agreement of the **Minister**.

Condition 9 compliance

Not relevant to the year 2022 compliance.

Condition 10 compliance

Records regarding water quality, fish and vegetation monitoring are being kept and can be made available upon request to the department.

All monitoring reports providing details of the measurements and monitoring events are available on this website: <u>https://natureadvisory.com.au/notifications</u>

Compliant

Condition 11 compliance

This is the annual compliance report for 2021 and 2022 that will be provided to the Department and published on this website: <u>https://natureadvisory.com.au/notifications</u>

Compliant

Condition 12 compliance

There has been no direction from the Minister to undertake an independent audit of compliance.

Not applicable

Condition 13 compliance

The action has been commenced.

Not applicable





Legend



0 50	100	200	9S		
Figure 1:	Dwarf G	alaxias hal	bitat buffer areas		
Project: 96-166 Centre Rd, Narre Warren					
Client: Nar	re Warren	Central Pty	Ltd		
Project No.:14	.090 C	Date: 14/01/2016	Created By: M. Ghasemi / D. Coppolino		
BL&A	Brett Lan	ne & Associates Pty. I Recourch & Manuec	L td.		
 Experience Knowledge Solutions 	Suite 5, 61 - 63 Carnt Hawthorn Fast ,VIC PO Box 337, Cambe	herwell Road 13123 rwell, VIC 3124, Australia	Ph (15) 9815 2111 / Fax (03) 9815 2685 enquiries@ecologicalresearch.com.au www.ecologicalresearch.com.au		



Legend

Tree Protection Zone (TPZ) - 7.44m

 $\overline{}$ Native vegetation removal Study area Native vegetation Title boundary Plains Grassy Wetland - EVC 125 Development layout Swampy Riparian Woodland - EVC 83 Electricity easement Swamp Scrub - EVC 53 Overhead powerline Tall Marsh - EVC 821 Sewer pipe (1.5m pipe; approx. 7.4m below ground) Scattered tree Existing 5.5m wide sewerage easement Access track (4m wide) Structural Root Zone (SRZ) - 4.08m

Metres 25 0 50 Figure 2: Offset site study area and native vegetation Project: 1-39 Centre Road and 120-130 Hallam South Road HAMPTON PARK VIC 3976 Client: Narre Warren Central Pty Ltd Date: 14/08/2019 Project No.:14090 Created By: N. May / I. Kulik Brett Lane & Associates Pty. Ltd. Ecological Research & Management BL&A Maperience Suite 5, 61 - 63 Camberwell Road Ph (03) 9815 2111 / Fax (03) 9815 2685 💮 Knowledge Hawthorn East VIC 3123 enquiries@ecologicalresearch.com.au () Solutions PO Box 337, Camberwell, VIC 3124, Australia www.ecologicalresearch.com.au

3. EBPC approval conditions compliance table

Table 1: EPBC approval conditions compliance table

Condition Number	EPBC Approval condition	Is the project compliant with this condition?	Response
1	To avoid mortality of dwarf galaxias, prior to construction activities occurring within 30 metres of dwarf galaxias habitat, the Approval Holder must salvage and translocate dwarf galaxias in accordance with a Salvage and Translocation Plan approved by the Victorian Government.	Compliant	The approved dwarf galaxias Salvage and Translocation Plan was implemented on the 5th/6th October 2016 (prior to commencement of construction), with dwarf galaxias being salvaged from planned removed habitat and translocated to retained habitat. – Compliant.
2	To mitigate impacts on dwarf galaxias movement and dispersal in the local area, the Approval Holder must ensure flow connectivity is maintained between the dwarf galaxias habitat retained, Troups Creek East Branch, and Hallam Main Drain as indicated in Annex 2.	Compliant	The dwarf galaxias retained habitat connection to the Centre Road drain has been maintained, as was the case prior to commencement of the project. – Compliant.
3	To mitigate impacts on dwarf galaxias due to stormwater runoff in dwarf galaxias habitat retained, there must be no impact on water quality between upstream and downstream water sampling points and no impact on the water level, during construction activities and 1 year after the completion of construction	Compliant	Approval compliance monitoring point b) has been met as fortnightly water quality monitoring was undertaken throughout 2021 and 2022 Approval compliance monitoring point d) has been met as monitoring after >10mm rainfall events was achieved for all rainfall events in the years of 2021 and 2022.



Condition Number	EPBC Approval condition	Is the project compliant with this condition?	Response
	 activities. The Approval Holder must undertake the following monitoring to determine if these outcomes are being achieved: a) prior to the commencement of construction to gain baseline data; b) once per fortnight throughout construction activities; c) once every 3 months for the year following completion of construction activities; and d) after significant rainfall events of greater than 10mm, during both construction and the year following the completion of construction activities. 		Construction activities have not been completed so approval compliance monitoring point c) is not applicable.
4	To mitigate impacts on dwarf galaxias, the Approval Holder must ensure that buffer areas identified in Annex 3 are revegetated within 5 years of commencement of construction and that vegetation cover is retained until the expiry of the approval. This outcome must meet the following milestones: a) less than 40% weed cover 5 years from the commencement of construction; and b) less than 30% weed cover and at least 70% native vegetation cover 7 years from the commencement of construction. The Approval Holder must undertake the following monitoring to determine if these outcomes are being achieved: a) prior to the commencement of construction	Mostly compliant, except for two monitoring quadrats.	 This condition was varied to achieve 40% weed cover 5 years from the commencement of construction. The Year 5 vegetation monitoring was undertaken by Nature Advisory in December 2022, five years after commencement of construction and weed cover was mostly 40% or less across the buffer areas with an average weed cover of 25%. Only two out of 16 monitoring quadrats had a weed cover of 50% due to increased Blackberry growth after Swamp Paperbark dieback.



Condition Number	EPBC Approval condition	Is the project compliant with this condition?	Response
	 to gain baseline data; b) 6 months after the commencement of construction; c) 12 months after the commencement of construction; d) 2, 3, 5, 7, 10 and 15 years after the commencement of construction. 		
5	To compensate for the loss of dwarf galaxias habitat at the project area, prior to the commencement of construction, the Approval Holder must enter into an Agreement to ensure the long term security of the offset site. The Approval Holder must: a) provide the Department with a signed copy of the Agreement, within 2 weeks of confirmation of the Agreement; and b) provide the Department with the offset attributes, shapefile and map(s) clearly defining the location and boundaries of the offset site, within 2 weeks of confirmation of the Agreement.	Not applicable	The agreement securing Dwarf Galaxias Offset Site was entered into and was provided to the Department. Shapefiles of the offset site and an offset site assessment report (14090(10.2)) including a description of the attributes and maps were provided to the Department. Not applicable to the 2020 compliance.
6	Prior to commencement of construction, the Approval Holder must secure the offset site with an appropriate legal conservation mechanism. Any proposal for an alternative offset must be agreed to in writing with the Department.	Compliant	A S173 Agreement securing Dwarf Galaxias Offset Site was entered into before commencement of construction. This Agreement was provided to the Department in June and September 2016.



Condition Number	EPBC Approval condition	Is the project compliant with this condition?	Response
7	After a period of 10 years from the commencement of construction, the offset site must contain at least 2 hectares of Dwarf Galaxias habitat which contains a self sustaining population of Dwarf Galaxias and is connected to known Dwarf Galaxias habitat in the local area. This outcome must meet the following milestones: a) Dwarf Galaxias habitat in the offset site must be constructed within 1 year of commencement of construction; b) Dwarf Galaxias must be identified as present in the Dwarf Galaxias habitat in the offset site within 2 years of commencement of construction; and c) Dwarf Galaxias presence and abundance must be consistent with that of control sites from after 2 years of commencement of construction and for the life of the approval.	Non-compliant	It is expected that the Dwarf galaxias offset site construction will be finalised by the end of 2023, within 7 years of commencement of construction. The infrastructure construction was completed to 80% in 2021, but works were then delayed due to adverse weather conditions (record- breaking rain falls in 2021) and Covid. Construction will be finalised by the end of February 2022 and landscaping works are predicted to be finalised by the end of 2023 (terrestrial plants) and March 2024 (aquatic plants). A variation of this permit condition may have to be sought.
8	The Approval Holder must undertake a monitoring program, which includes the newly constructed Dwarf Galaxias habitat in the offset site and control sites. The monitoring program must ensure the data gathered is adequate to: inform adaptive management; and demonstrate whether the milestones and outcomes described in condition 7 have been met. Monitoring must be undertaken by a suitably qualified person.	Not applicable	Monitoring of the newly constructed habitat at the Dwarf Galaxias offset site will begin after construction of the site is completed by the end of 2023.



Condition Number	EPBC Approval condition	Is the project compliant with this condition?	Response
9	Within 7 calendar days after the commencement of construction, the Approval Holder must advise the Department in writing of the actual date of commencement of construction.	Not applicable	Not relevant to the year 2022 compliance.
10	The Approval Holder must maintain accurate records substantiating all activities associated with or relevant to the conditions of approval, including measures taken to implement plans/programs and measures taken to achieve outcomes and milestones required by this approval and make them available upon request to the Department. Such records may be subject to audit by the Department or an independent auditor in accordance with section 458 of the EPBC Act, or used to verify compliance with the conditions of approval. Summaries of audits will be posted on the Department's website. The results of audits may also be publicised through the general media.	Compliant	Records regarding water quality, fish and vegetation monitoring are being kept and can be made available upon request to the department. – Compliant. All monitoring reports providing details of the measurements and monitoring events are available on this website: https://natureadvisory.com.au/notifications
11	Within 3 months of every 12 month anniversary of the commencement of construction, the Approval Holder must publish an annual report of compliance on their website addressing compliance with each of the conditions of this approval, including the implementation of any plans/programs specified in the conditions and whether outcomes and milestones required by	Compliant	This is the annual compliance report for 2022 that will be provided to the Department and published on this website: https://natureadvisory.com.au/notifications



Condition Number	EPBC Approval condition	Is the project compliant with this condition?	Response
	these conditions have been or are on track to being met. The compliance report must consider the Department's <i>Annual Compliance</i> <i>Report Guidelines</i> . Documentary evidence providing proof of the date of publication and non-compliance with any of the conditions of this approval must be provided to the Department at the same time as the annual report of compliance is published.		
12	Upon the direction of the Minister, the Approval Holder must ensure that an independent audit of compliance with the conditions of approval is conducted and a report submitted to the Minister. The independent auditor must be approved by the Minister prior to the commencement of the audit. Audit criteria must be agreed to by the Minister and the audit report must address the criteria to the satisfaction of the Minister.	Not applicable	There has been no direction from the Minister to undertake an independent audit of compliance.
13	If, at any time after 5 years from the date of this approval, the Approval Holder has not substantially commenced the action, then the Approval Holder must not substantially commence the action without the written agreement of the Minister.	Not applicable	The action has been commenced.



Appendix 1: Varied EPBC Approval 2014/7380





VARIATION OF CONDITIONS ATTACHED TO APPROVAL

Residential development, 96-166 Centre Road, Narre Warren, Victoria (EPBC 2014-7380)

This decision to vary conditions of approval is made under section 143 of the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act).

Approved action								
Person to whom the approval is granted	Narre Warren Central Pty. Ltd. ACN: 600 509 064							
Approved action	To undertake a residential estate development at 96-166 Centre Road, Narre Warren, Victoria (see EPBC Act referral 2014/7380).							
Variation								
Variation of conditions attached to approval The variation is: Delete conditions 3, 4 and 7 attached to the approval and substitute with the conditions specified in the table below								
Date of effect	This variation has effect on the date the instrument is signed							
Person authorised to n	nake decision							
Name and position	Kim Farrant Assistant Secretary Assessments (Vic, Tas) and Post Approvals Branch							
Signature	Justanni X							
Date of decision	4 / 3 / 2021							

Date of decision	Conditions attached to approval
Original dated	Mitigation
5/2/2016	1. To avoid mortality of dwarf galaxias , prior to construction activities occurring within 30 metres of dwarf galaxias habitat , the Approval Holder must salvage and translocate dwarf galaxias in accordance with a Salvage and Translocation Plan approved by the Victorian Government .
Original dated 5/2/2016	2. To mitigate impacts on dwarf galaxias movement and dispersal in the local area, the Approval Holder must ensure flow connectivity is maintained between the dwarf galaxias habitat retained , Troups Creek East Branch, and Hallam Main Drain as indicated in <u>Annex 2</u> .
As varied on the date of signing this instrument	3. To mitigate impacts on dwarf galaxias due to stormwater runoff in dwarf galaxias habitat retained , there must be no impact on water quality between upstream and downstream water sampling points, noting that background fluctuation may impact the overall water quality, and no impact on the water level , during construction activities and 1 year after the completion of construction activities .
	The Approval Holder must undertake the following monitoring to determine if these outcomes are being achieved:
	a. prior to the commencement of construction to gain baseline data;
	b. once per fortnight throughout construction activities ;
	c. once every 3 months for the year following completion of construction activities ; and
	d. after significant rainfall events of greater than 10mm, during both construction and the year following the completion of construction activities .
As varied on the date of signing this instrument	4. To mitigate impacts on dwarf galaxias , the Approval Holder must ensure that buffer areas identified in <u>Annex 3</u> are revegetated within 5 years of commencement of construction and that vegetation cover is retained until the expiry of the approval. This outcome must meet the following milestones:
	a. less than 40% weed cover 5 years from the commencement of construction ; and
	b. less than 30% weed cover and at least 70% native vegetation cover 7 years from the commencement of construction.
	The Approval Holder must undertake the following monitoring to determine if these outcomes are being achieved:
	a. prior to the commencement of construction to gain baseline data;
	b. 6 months after the commencement of construction ;
	c. 12 months after the commencement of construction ; and
	d. 2, 3, 5, 7 and 10 years after the commencement of construction.
Original dated	Offsets
5/2/2016	5. To compensate for the loss of dwarf galaxias habitat at the project area , prior to the commencement of construction , the Approval Holder must enter into an Agreement to ensure the long term security of the offset site . The Approval Holder must:
	 provide the Department with a signed copy of the Agreement, within 2 weeks of confirmation of the Agreement; and
	b. provide the Department with the offset attributes , shapefile and map(s) clearly defining the location and boundaries of the offset site , within 2 weeks of confirmation of the Agreement .
Original dated 5/2/2016	6. Prior to commencement of construction , the Approval Holder must secure the offset site with an appropriate legal conservation mechanism . Any proposal for an alternative offset must be agreed to in writing with the Department .

Date of decision	Conditions attached to approval
As varied on the date of signing this instrument	7. After a period of 10 years from the commencement of construction , the offset site must contain at least 2 hectares of Dwarf Galaxias habitat which contains a self-sustaining population of Dwarf Galaxias and is connected to known Dwarf Galaxias habitat in the local area. This outcome must meet the following milestones:
	 a. Dwarf Galaxias habitat in the offset site must be constructed within 5 years of commencement of construction;
	b. Dwarf Galaxias must be identified as present in the Dwarf Galaxias habitat in the offset site within 6 years of commencement of construction; and
	c. Dwarf Galaxias presence and abundance must be consistent with that of control sites from after 7 years of commencement of construction and for the life of the approval.
Original dated 5/2/2016	8. The Approval Holder must undertake a monitoring program, which includes the newly constructed Dwarf Galaxias habitat in the offset site and control sites . The monitoring program must ensure the data gathered is adequate to: inform adaptive management; and demonstrate whether the milestones and outcomes described in condition 7 have been met. Monitoring must be undertaken by a suitably qualified person .
Original	Administrative conditions
5/2/2016	9. Within 7 calendar days after the commencement of construction , the Approval Holder must advise the Department in writing of the actual date of commencement of construction .
Original dated 5/2/2016	10. The Approval Holde r must maintain accurate records substantiating all activities associated with or relevant to the conditions of approval, including measures taken to implement plans/programs and measures taken to achieve outcomes and milestones required by this approval and make them available upon request to the Department . Such records may be subject to audit by the Department or an independent auditor in accordance with section 458 of the EPBC Act , or used to verify compliance with the conditions of approval. Summaries of audits will be posted on the Department's website. The results of audits may also be publicised through the general media.
Original dated 5/2/2016	11. Within 3 months of every 12 month anniversary of the commencement of construction , the Approval Holder must publish an annual report of compliance on their website addressing compliance with each of the conditions of this approval, including the implementation of any plans/programs specified in the conditions and whether outcomes and milestones required by these conditions have been or are on track to being met. The compliance report must consider the Department's <i>Annual Compliance Report Guidelines</i> . Documentary evidence providing proof of the date of publication and non - compliance with any of the conditions of this approval must be provided to the Department at the same time as the annual report of compliance is published.
Original dated 5/2/2016	12. Upon the direction of the Minister , the Approval Holder must ensure that an independent audit of compliance with the conditions of approval is conducted and a report submitted to the Minister . The independent auditor must be approved by the Minister prior to the commencement of the audit. Audit criteria must be agreed to by the Minister and the audit report must address the criteria to the satisfaction of the Minister .
Original dated 5/2/2016	13. If, at any time after 5 years from the date of this approval, the Approval Holder has not substantially commenced the action , then the Approval Holder must not substantially commence the action without the written agreement of the Minister .

Date of decision	Definitions attached to approval
Original dated 5/2/2016	Agreement - the executed agreement between the Approval Holder and the relevant landowner or organisation, to legally secure the land for conservation for the long term.
Original dated 5/2/2016	Approval Holder - means the person to whom this approval is granted or the person as transferred under section 145B of the EPBC Act.

Date of decision	Definitions attached to approval
Original dated 5/2/2016	Commencement of construction - the date that preparatory works are first undertaken, including, but not limited to, the clearing of vegetation, the erection of any onsite temporary structures and the use of heavy duty equipment for the purpose of breaking the ground for fencing, buildings or infrastructure, including any works for the creation of vegetation buffers.
Original dated 5/2/2016	Construction activities - includes but is not limited to clearing of vegetation, the erection of any onsite temporary structures and the use of heavy duty equipment for the purpose of breaking the ground for infrastructure or earthworks. This does not include maintenance or use of existing access tracks, erection or construction of security fencing and signage, remediation/corrective actions or investigative activities such as accessing the site for surveying or planning purposes.
Original dated 5/2/2016	Control sites - existing known Dwarf Galaxias habitat sites in the local area to be monitored concurrently with the offset site , to provide evidence of the relative presence and abundance in the local area.
Original dated 5/2/2016	Department - the Australian Government Department administering the EPBC Act .
Original dated 5/2/2016	Dwarf Galaxias – means the EPBC Act listed vulnerable species Galaxiella pusilla
Original dated 5/2/2016	Dwarf Galaxias habitat – habitat identified as suitable for the persistence of Dwarf Galaxias , including: slow flowing and still, shallow, permanent and temporary freshwater habitats such as swamps, drains and the backwaters of streams and creeks and containing aquatic and terrestrial native vegetation.
Original dated 5/2/2016	Dwarf galaxias habitat removed – habitat to be removed as part of the proposed action, as identified in <u>Annex 1</u> .
Original dated 5/2/2016	Dwarf galaxias habitat retained – habitat to be retained as part of the proposed action, as identified in <u>Annex 1</u> .
Original dated 5/2/2016	EPBC Act - the Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth).
Original dated 5/2/2016	Impact on the water level - changes that result in unsuitable water levels for the persistence of the Dwarf Galaxias . Suitable water levels range between 0.5 m to 1.5 m or within 10% of the measured water level of control sites if less than 0.5 m.
Original dated 5/2/2016	Impact on water quality - compared to baseline data: a change of 1.0 pH unit, a 10% increase in total suspended solids, a 5% decrease in dissolved oxygen, a 20% change to electrical conductivity, any waste or visible hydrocarbons.
Original dated 5/2/2016	Landowner – the person(s) and/or company who legally owns the property that is secured as an offset site for the long-term management and protection of EPBC Act listed matters.
Original dated 5/2/2016	Legal conservation mechanism - A Trust for Nature covenant under the <i>Victorian</i> <i>Conservation Trust Act 1972</i> or a covenant under section 173 of the <i>Planning and</i> <i>Environment Act 1987.</i>
Original dated 5/2/2016	Minister - the Minister administering the EPBC Act and includes a delegate of the Minister.
Original dated 5/2/2016	Offset attributes - an '.xls' file capturing relevant attributes of the offset site, including the EPBC Act reference ID number, the physical address of the offset site, coordinates of the boundary points in decimal degrees, the EPBC Act protected matters that the offset compensates for, any additional EPBC Act protected matters that are benefiting from the offset, and the size of the offset in hectares.
Original dated 5/2/2016	Offset site – The 3.35 hectare site at 1-39 Centre Road, Hampton Park, Victoria as identified at <u>Annex 4</u> .
Original dated 5/2/2016	Salvage and Translocation Plan – A plan detailing specific actions and management measures of the proposed salvage and translocation of the Dwarf Galaxias present in Dwarf

Date of decision	Definitions attached to approval
	Galaxias habitat to be removed as indicated in <u>Annex 1</u> , to be prepared by a qualified freshwater ecologist.
Original dated 5/2/2016	Shapefile - an ESRI Shapefile containing '.shp', '.shx' and '.dbf' files and other files capturing attributes including at least the EPBC Act reference ID number and EPBC Act protected matters present at the relevant site. Attributes should also be captured in '.xls' format.
Original dated 5/2/2016	Substantially commence(d) - commencement of construction of clearing the land including associated infrastructure (i.e. sewerage, power, water, stormwater) associated with development. This does not include preparatory works.
Original dated 5/2/2016	Suitably qualified person means a real person with relevant tertiary qualifications and/or a minimum of three years demonstrated experience relevant to the task in question.
Original dated 5/2/2016	Trust for Nature – The organisation established under the <i>Victorian Conservation Trust Act 1972.</i> ABN: 60 292 993 543
Original dated 5/2/2016	Victorian Government –the Victorian Government Department administering the <i>Flora and Fauna Guarantee Act 1988</i> and the <i>Fisheries Act 1995</i>

Date of decision	Annexes
Original dated 5/2/2016	Annex 1 - Figure 3: Dwarf Galaxias habitat areas
Original dated 5/2/2016	Annex 2 - Figure 1: Flow connectivity
Original dated 5/2/2016	Annex 3 - Figure 2: Dwarf Galaxias habitat buffer areas
Original dated 5/2/2016	Annex 4 - Figure 3: Offset site location

Annex 1



Legend



0 50 10	0 200	es
Figure 3: Dv	varf Galaxias ha	bitat areas
Project: 96-16	6 Centre Rd, Narre	Warren
Client: Narre	Narren Central Pty	Ltd
Project No.:14090	Date: 17/11/2015	Created By: M. Ghasemi / D. Coppolino
BL&A	Brett Lane & Associative Pt 5, 61 = 63 Cambervell Read hom hase 34C 3123	4. Ltd 45 (U) 9635 311 / Fax (U) 9835 3865 engnines@enskgrantscom.an

Annex 2







Annex 4



Leg	en	C
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Offset site boundary Development site

Existing Melb Water Eastern Dwarf Galaxias site

igure	e 3: Offse	t site location		
Projec	ct: 96-166 C	Centre Rd, Narre V	Warren	
Client	: Narre Wa	rren Central Pty L	td	
Project	No.:14090	Date: 27/10/2015	Created By: M. Ghasemi / I. Kulik	
DI	RA B	ett Lone & Associates Pty, 1 K. Context Pt. Agent & Camberrett Road	-rci. Ph (1)3) 9815 2111 / Fax (03) 9615 2685	×
Experi			encould be after stands, when also are have been and	

Appendix 2: Water quality and Dwarf Galaxias monitoring report 2021 from Aquatica Environmental





220 Old Eltham Road Lower Plenty VIC 3093

t +61 (0) 413 935 497 e info@AquaticaEnvironmental.com.au www.AquaticaEnvironmental.com.au

Our Ref: 000118.10

27 January 2022

Narre Warren Central Pty Ltd Att Mr Paul Nio 52-54 Rathdowne Street Carlton VIC 3053

Via email: pnio@osanrae.com.au CC: cmistica@fidus.com.au; inga@natureadvisory.com.au

Dear Paul

Re: 2021 Annual Report of Water Quality and Dwarf Galaxias Monitoring for Casey Green

Aquatica Environmental was engaged by Narre Warren Central to undertake the 2021 annual monitoring of water quality and Dwarf Galaxias (*Galaxiella pusilla*) at the site of the Casey Green residential development at 96-166 Centre Road, Narre Warren, Victoria (the project).

The annual monitoring was undertaken to meet specific management actions outlined in the project's commonwealth, state and locally approved Dwarf Galaxias Management Plan (DGMP; BL&A 2015) and Dwarf Galaxias Salvage and Translocation Plan (DGSTP; Aquatica Environmental 2015). These actions were interpreted by the federal Department of Agriculture, Water and the Environmental (DAWE) to include the following monitoring requirements (DE 2016, including Aquatica Environmental 2015):

- **Dwarf Galaxias**: Survey Dwarf Galaxias and predatory fish populations at established/baseline and translocation release sites in November/December annually during construction and for least five years post completion of construction on the site.
- Aquatic and riparian habitat condition: Assess condition in conjunction with the Dwarf Galaxias survey.
- Water quality: Assess water quality at established sites once per fortnight and/or after rainfall events >10mm during construction, including during Dwarf Galaxias monitoring (Condition 3b and 3d).

This report has been produce to provide a summary record of the 2020 water quality and Dwarf Galaxias monitoring in accordance with the DGMP and DGSTP.

1 Methodologies

1.1 Sampling Sites

During initial baseline and salvage surveys in 2016-17 a number of water quality and Dwarf Galaxias survey sites were established (Aquatica Environmental 2017). However, in the time since these surveys were undertaken development of the site (and neighbouring sites) has progressed significantly and not all of the originally established site still exist. Figure 1 shows the sites that were monitored during the 2021 monitoring year, with the following changes occurring through the year:

• Due to dense vegetation growth, Sites WQ7 and DG3 were not able to be accessed from about February onwards.





Projection: Transverse Mercator

11/11/2020 4:01 PM

1.2 Dwarf Galaxias and Predatory Fish Monitoring

Dwarf Galaxias and predatory fish monitoring was undertaken at Site DG1 and DG2 identified in Figure 1. This sites align with previous years monitoring, with Sites DG2 corresponding to where Dwarf Galaxia were released during the 2016 salvage and translocation program (Aquatica Environmental 2017).

Sampling for adult Dwarf Galaxias and predatory was undertaken using hand-held dip-nets, sampling in and around areas of suitable habitat, and bait traps set overnight with phosphorescent baits. Sampling for larval Dwarf Galaxias was also undertaken by collecting a sample of water (approximately 10 litres) and placing it in a shallow white tray, where any larva would have been visible.

Active searching using dip-nets and bait-trapping are standard methods for sampling Dwarf Galaxias and are the most effective methods outlined in the Survey Guidelines for Australia's Threatened Fish (DSEWPaC 2004) and Biodiversity Precinct Structure Planning Kit (DSE 2010). They are also most appropriate method for sampling in the small and heavily vegetated water bodies, like those at the site.

Dwarf Galaxias sampling was undertaken by Aquatica Environmental at another nearby site, where Dwarf Galaxias also occur and as reference/baseline as to whether Dwarf Galaxias should have been detectable on the site.

1.3 Aquatic and Riparian Habitat Condition Monitoring

Aquatic and riparian habitat condition was visually and assessed during and at the Dwarf Galaxias survey sites. The assessment was primarily based on a comparison of the aquatic and riparian vegetation condition during this survey as compared to previous surveys (i.e. temporal comparison).

1.4 Water Quality Monitoring

Water quality monitoring was undertaken fortnightly and/or following rainfall events >10 millimetres, and during the annual Dwarf Galaxias survey. In situ water quality data was collected by using a calibrated Hanna Instruments HI9829 multiparameter water quality metre. The parameters collected included temperate, electrical conductivity, pH, dissolved oxygen and turbidity.

2 Results

2.1 Sampling Frequency and Conditions

During the 2021 monitoring year a total of 30 sampling events had occurred in 2020, including 15 scheduled, 14 post >10mm rainfall events and one during annual Dwarf Galaxias monitoring.

The annual Dwarf Galaxias monitoring and associated water quality sampling occurred on the 22nd and 23rd November.

A summary of the 2020 Dwarf Galaxias and water quality sampling schedule is provided in Table 1.

Figure 2 shows the results of the rainfall monitoring, based the average daily rainfall between the Scoresby, Moorabbin and Ferny Creek weather stations.

3

Table 1 2021 sampling schedule

DAY	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	KEY
Wednesday									1/9/21			1/12/21	Standard WQ Monitoring Event
Thursday				1/4/21			1/7/21		2/9/21			2/12/21	Next scheduled
Friday	1/1/21			2/4/21			2/7/21		3/9/21	1/10/21		3/12/21	Post >10mm rainfall event
Saturday	2/1/21			3/4/21	1/5/21		3/7/21		4/9/21	2/10/21		4/12/21	Incident
Sunday	3/1/21			4/4/21	2/5/21		4/7/21	1/8/21	5/9/21	3/10/21		5/12/21	Annual DG Survey
Monday	4/1/21	1/2/21	1/3/21	5/4/21	3/5/21		5/7/21	2/8/21	6/9/21	4/10/21	1/11/21	6/12/21	Rainfall > 10mm
Tuesday	5/1/21	2/2/21	2/3/21	6/4/21	4/5/21	1/6/21	6/7/21	3/8/21	7/9/21	5/10/21	2/11/21	7/12/21	
Wednesday	6/1/21	3/2/21	3/3/21	7/4/21	5/5/21	2/6/21	7/7/21	4/8/21	8/9/21	6/10/21	3/11/21	8/12/21	
Thursday	7/1/21	4/2/21	4/3/21	8/4/21	6/5/21	3/6/21	8/7/21	5/8/21	9/9/21	7/10/21	4/11/21	9/12/21	
Friday	8/1/21	5/2/21	5/3/21	9/4/21	7/5/21	4/6/21	9/7/21	6/8/21	10/9/21	8/10/21	5/11/21	10/12/21	
Saturday	9/1/21	6/2/21	6/3/21	10/4/21	8/5/21	5/6/21	10/7/21	7/8/21	11/9/21	9/10/21	6/11/21	11/12/21	
Sunday	10/1/21	7/2/21	7/3/21	11/4/21	9/5/21	6/6/21	11/7/21	8/8/21	12/9/21	10/10/21	7/11/21	12/12/21	
Monday	11/1/21	8/2/21	8/3/21	12/4/21	10/5/21	7/6/21	12/7/21	9/8/21	13/9/21	11/10/21	8/11/21	13/12/21	
Tuesday	12/1/21	9/2/21	9/3/21	13/4/21	11/5/21	8/6/21	13/7/21	10/8/21	14/9/21	12/10/21	9/11/21	14/12/21	
Wednesday	13/1/21	10/2/21	10/3/21	14/4/21	12/5/21	9/6/21	14/7/21	11/8/21	15/9/21	13/10/21	10/11/21	15/12/21	
Thursday	14/1/21	11/2/21	11/3/21	15/4/21	13/5/21	10/6/21	15/7/21	12/8/21	16/9/21	14/10/21	11/11/21	16/12/21	
Friday	15/1/21	12/2/21	12/3/21	16/4/21	14/5/21	11/6/21	16/7/21	13/8/21	17/9/21	15/10/21	12/11/21	17/12/21	
Saturday	16/1/21	13/2/21	13/3/21	17/4/21	15/5/21	12/6/21	17/7/21	14/8/21	18/9/21	16/10/21	13/11/21	18/12/21	
Sunday	17/1/21	14/2/21	14/3/21	18/4/21	16/5/21	13/6/21	18/7/21	15/8/21	19/9/21	17/10/21	14/11/21	19/12/21	
Monday	18/1/21	15/2/21	15/3/21	19/4/21	17/5/21	14/6/21	19/7/21	16/8/21	20/9/21	18/10/21	15/11/21	20/12/21	
Tuesday	19/1/21	16/2/21	16/3/21	20/4/21	18/5/21	15/6/21	20/7/21	17/8/21	21/9/21	19/10/21	16/11/21	21/12/21	
Wednesday	20/1/21	17/2/21	17/3/21	21/4/21	19/5/21	16/6/21	21/7/21	18/8/21	22/9/21	20/10/21	17/11/21	22/12/21	
Thursday	21/1/21	18/2/21	18/3/21	22/4/21	20/5/21	17/6/21	22/7/21	19/8/21	23/9/21	21/10/21	18/11/21	23/12/21	
Friday	22/1/21	19/2/21	19/3/21	23/4/21	21/5/21	18/6/21	23/7/21	20/8/21	24/9/21	22/10/21	19/11/21	24/12/21	
Saturday	23/1/21	20/2/21	20/3/21	24/4/21	22/5/21	19/6/21	24/7/21	21/8/21	25/9/21	23/10/21	20/11/21	25/12/21	
Sunday	24/1/21	21/2/21	21/3/21	25/4/21	23/5/21	20/6/21	25/7/21	22/8/21	26/9/21	24/10/21	21/11/21	26/12/21	
Monday	25/1/21	22/2/21	22/3/21	26/4/21	24/5/21	21/6/21	26/7/21	23/8/21	27/9/21	25/10/21	22/11/21	27/12/21	
Tuesday	26/1/21	23/2/21	23/3/21	27/4/21	25/5/21	22/6/21	27/7/21	24/8/21	28/9/21	26/10/21	23/11/21	28/12/21	
Wednesday	27/1/21	24/2/21	24/3/21	28/4/21	26/5/21	23/6/21	28/7/21	25/8/21	29/9/21	27/10/21	24/11/21	29/12/21	
Thursday	28/1/21	25/2/21	25/3/21	29/4/21	27/5/21	24/6/21	29/7/21	26/8/21	30/9/21	28/10/21	25/11/21	30/12/21	
Friday	29/1/21	26/2/21	26/3/21	30/4/21	28/5/21	25/6/21	30/7/21	27/8/21		29/10/21	26/11/21	31/12/21	
Saturday	30/1/21	27/2/21	27/3/21		29/5/21	26/6/21	31/7/21	28/8/21		30/10/21	27/11/21		
Sunday	31/1/21	28/2/21	28/3/21		30/5/21	27/6/21		29/8/21		31/10/21	28/11/21		
Monday			29/3/21		31/5/21	28/6/21		30/8/21			29/11/21		
Tuesday			30/3/21			29/6/21		31/8/21			30/11/21		
Wednesday			31/3/21			30/6/21							



Figure 2 Rainfall chart

2.2 Dwarf Galaxias and Predatory Fish

The survey was undertaken on 22nd and 23rd November 2021. The weather during the survey was mild to warm with temperatures ranging between 20°C (day time maximum) and 8.1°C (night time minimum). No rain fell during the survey The seasonal timing for the survey (late spring) was ideal and young of year and adults would be expected to be found following the usual late autumn to spring breeding season.

A total of 17 Dwarf Galaxias were recorded during the November survey, all adults. All were recorded at Site DG2, with none at DG1 was too dry/low water to survey.

Newly recorded was Flathead Gudgeon (*Philypnodon grandiceps*) (Plate 1 and 2), which is a small beneficial native that cohabitates well with Dwarf Galaxias. It is likely they have entered the area due and are utilising the swales.

Based on the number and condition of the individuals recorded during this survey, it appears there has been another good year for the species on the site (i.e. similarly 2019 and 2020). This has also been our experience at other sites in the region, mostly due to above average winter/spring rains and mild temperatures.

The results also confirm that the constructed swales are continuing to function well and as intended, by supplying consistent water levels to the retained habitat, but limiting pest fish ingress to the retained habitat drain. Also see section where it is noted that aquatic an emergent vegetation is improving providing an even larger area suitable for supporting Dwarf Galaxia into the constructed swales.

The results of the November 2021 survey are provided in Table 2 and compared to previous rounds of monitoring.

Similarly to the 2018 and 2019 surveys, Mosquitofish (*Gambusia holbrooki*) (Plate 2a) were recorded, but in larger numbers, especially in the swales where there is more open and warmer water. However, they do not appear to be making inroads into the denser shadier habitat at retained drain. It is also likely as the area and density of new vegetation increases, they will be further excluded.

Table 2 Species and number of individuals recorded

Common Name	Scientific Name					
		2021	2020	2019	2018	2017
Dwarf Galaxias	Galaxiella pusilla		25	12	3	2
Mosquitofish	Gambusia holbrooki	10s	12	6	3	-
Goldfish	Carassius auratus	-	-	2	4	-
Flathead Gudgeon						
Freshwater Burrowing Crayfish	Engeus spp.	-	-	1	1	-
Oriental Weatherloach	Misgurnus anguillicaudatus	-	1			



Plate 1 Dwarf Galaxias, Flathead Gudgeon and tadpoles



Plate 2 Flathead Gudgeon and Dwarf Galaxias

2.3 Aquatic and Riparian Habitat Condition

Aquatic and riparian habitat condition was assessed during the Dwarf Galaxias survey at sites DG1 and DG2 (noting DG3 is no longer accessible).

During the survey sites DG1 had mostly dried, with negligible surface water present at the time. Habitat conditions at this site were similar to previous years of monitoring with some sparse patches of aquatic an emergent vegetation and an overstory of Melaleuca, in much the same overall condition as during previous years of monitoring.

Aquatic and riparian habitat at site DG 2 appeared to have further improved upon that observed during the 2019 and 2020 surveys. As previously reported the constructed swales either side of this habitat maintain a relatively consistent water level yet still allowing some drying and filling on an ephemeral basis. This provides excellent conditions through the retained habitat for aquatic, emergent and overstory vegetation. Compared to the 2020 survey there appeared to be a continued increase in the area, density and abundance in particular of emergent vegetation such as Persicaria and Juncus, and further recruitment of Melaleuca (Plate 3a). This new and improving vegetation is now extending well into and along the constructed swales Plate 3b).



Plate 3 Habitat edge vegetation at Site DG2 (a) and the increasingly vegetated swale (b) both showing Melaleuca recruitment

2.4 Water Quality

The raw water quality data is provided in Appendix B. Table 1 provides a summary of the relevant statistical analysis and/or relevant Environmental Reference Standards (ERS; EPA 2021) objectives for the Urban segment, Lowlands of Western Port catchment.

Overall the data showed the following patterns:

• Temperature was on average very consist across the sites across the year, showing expected heating and cooling phases in summer and winter. The highest temperatures across the sites were experienced in January and the lowest in August. The highest individual temperature was 23.39°C at Site 5 on the 6th January and the lowest was 9.19 °C at Site 6 on 321st August. On average Site 1 had the highest temperatures, apparently due to the discharge of water from the culvert. Site 6 had the lowest due to shading by the dense vegetation at the site.

- pH was on average consistent across all sites, not appearing to be linked to seasonal or weather variations and was withing the ERS objectives at all sites.
- Electrical conductivity was consistently and significantly higher at Sites 6 (mean=794 µS/cm compared to 467-595 µS/cm at Sites 1-5), most likely reflective of the lack of direct flows and the concentration of salts due to evaporation. However, the average at Site 6 was lower than previous years, possibly indicating the effects of dilution from the greater water volumes of the attached swales. The ERS objective of ≤500 µS/cm was exceeded at all sites, but only marginally. The levels observed appeared not attributable to the development of the site, rather occurred naturally and/or other influences, and were clearly of no concern for Dwarf Galaxias due to their ongoing presence and increased abundance at the site.
- Percent dissolved oxygen was consistently low across all sites. The ERS objective of ≥70% was not met at any site. Similarly to electrical conductivity, the levels observed were not attributable to the development of the site, rather occurred naturally and/or other influences, and were clearly of no concern for the resident Dwarf Galaxias population.
- Turbidity was on average highest at Site 1, indicating a high turbidity input from the culvert and unknown
 upstream sources. Site 6 had the lowest average turbidity. The data showed that turbidity reduces through the
 downstream flowing sites (i.e. Site 1 to 5) with no indication of any observable inputs from the development of
 the site. This indicated that the retained Centre Road drain vegetation and construction/vegetation of the
 project's swales are functioning as designed and resulting in an overall reduction turbidity as surface waters pass
 by the site. The ERS of ≤35 NTU was not met at any site more due to catchment inputs than the site.

Parameter		ERS Objective	Centre Road Drain Sites					Habitat Sites	
			Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7
Temperature (°C)	Min.	NA	10.16	9.52	9.65	9.44	9.43	9.19	-
	Max.		15.54	14.68	14.71	14.22	15.23	14.13	-
	Mean		15.76	15.03	15.07	14.64	15.63	14.44	-
рН	25 th %tile	≥6.4	6.48	6.52	6.58	6.75	6.69	6.57	-
	75 th %tile	≤7.9	7.25	7.15	7.11	7.13	7.14	6.96	-
	Mean	NA	6.93	6.87	6.83	6.89	6.89	6.75	-
Electrical Conductivity (µS/cm)	75 th %	≤500	681	684	636	555	508	829	-
	Mean	NA	561	595	552	516	467	794	-
Dissolved Oxygen (%)	75 th %tile	≥70	53.63	50.20	47.40	51.58	61.90	55.98	-
	Max.	130	88.00	85.90	81.90	75.90	84.30	87.40	-
	Mean	NA	41.46	39.58	39.46	28.60	53.86	48.73	-
Turbidity (NTU)	75 th %tile	≤35	67.6	42.6	44.9	39.4	40.4	42.6	-
	Mean	NA	54.9	36.3	41.0	34.7	37.3	34.1	-

Table 3Water quality sampling summary

Orange highlight = parameter did not meet the ERS objective

Red = worst value, Green = best value

3 Summary and Recommendations

The 2021 annual Dwarf Galaxias monitoring event detected 17 individual Dwarf Galaxias in the retained habitat drain (compared to 25 in 2020, 12 in 2019 and 3 in 2018). This was at the higher end of the previous records indicating that conditions for the species are being maintained. The primary reason for this is the constructed swales result in more water and a more constant water level in the retained habitat drain in a manner that is clearly suited to the resident Dwarf Galaxias population (i.e. Still maintaining ephemerality but not allowing over drying).

The recording of a new small native fish species, Flathead Gudgeon, is also a positive sign of the system's improving function.

Considering this and previous rounds of sampling for the project and historical records (Aquatica Environmental 2017, 2019, 2020 and 2021), it is considered likely the abundance and distribution of the Dwarf Galaxias population in the
habitat areas is somewhat dynamic, varying between years and due to seasonal influenced on water availability and therefore habitat. However, with the continued improvement of the retained habitat and expansion of suitable habitat into the constructed swales it is clearly resulting in an overall increase in the quality and area of available habitat for Dwarf Galaxias. This appears to have also correlated with a slight increase in the number of predatory fish species (i.e. Mosquitofish), however their presence doesn't appear to have impacted the successful breeding and increasing numbers of Dwarf Galaxias. This is probably due to the habitat being more suitable to Dwarf Galaxias than the pest/predatory species.

Based on the results of the 2021 survey and data, it is our option that development of the Casey Green site to date has been undertaken in accordance the DGSTP and associated approvals. No ecologically significant impacts have been observed to the retained habitat, with the constructed swales having improved overall conditions for Dwarf Galaxias on the site and in the region.

The 2022 monitoring year has commenced and in accordant with approved DGSTP (and the project Dwarf Galaxias Management Plan; BL&A 2015) the following monitoring should occur during the year:

- Water quality monitoring: Fortnightly and/or after rainfall events > 10 millimetres until all construction is completed (i.e. all works on site completed) and then monthly following completion.
- **Dwarf Galaxias monitoring**: Annually in November/December for at least five years post construction.

Please note, we interoperate the "completion of construction" to be the point at all major works including site cleanup, landscaping, etc. Have been completed and there is not further risk to the Dwarf Galaxias and their habitat (i.e. all possible sources of sediment/contaminant runoff have been mitigated.

If you have any questions or would like to discuss this assessment, report or any other matter further, please do not hesitate to call me on 0413 935 497.

Kind Regards,

andal

Aaron Jenkin Director and Principal Ecologist Aquatica Environmental

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Appendix a: Water Quality Results

Temperature (°C)

Sample Date	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7
6/1/21	23.68	24.19	23.40	22.91	26.39	22.51	22.86
18/1/21	20.75	24.65	22.69	19.50	23.68	23.99	21.56
27/1/21	19.20	21.09	19.68	20.06	22.94	21.38	
1/2/21	20.65	22.55	22.10	20.00	23.56	20.90	
15/2/21	19.93	18.07	19.33	17.00	19.51	17.03	
10/3/21	18.40	16.31	16.74	16.05	16.89	16.03	
15/3/21	19.00	18.04	18.06	18.09	18.69	17.95	
29/3/21	18.11	17.43	16.04	16.05	17.36	14.02	
13/4/21	16.51	15.27	15.94	15.74	14.69	13.95	
22/4/21	16.21	15.26	15.78	15.73	15.59	13.65	
7/5/21	14.85	12.40	13.15	11.99	12.98	10.89	
18/5/21	13.35	11.85	11.57	11.50	12.31	11.98	
7/6/21	12.52	13.10	10.86	10.64	10.56	10.83	
14/6/21	12.38	11.38	11.52	11.08	11.62	11.56	
28/6/21	12.22	10.25	11.10	10.21	11.02	10.36	
14/7/21	11.66	9.52	10.28	9.73	10.02	9.55	
27/7/21	10.90	9.56	10.08	9.73	9.82	10.20	
3/8/21	11.72	10.25	10.79	10.22	10.87	10.18	
17/8/21	12.44	11.03	11.40	10.81	11.81	10.26	
31/8/21	10.16	9.82	9.65	9.44	9.43	9.19	
6/9/21	12.06	10.60	10.68	10.90	10.45	10.01	
20/9/21	13.88	11.57	11.95	12.40	11.38	10.72	
4/10/21	13.58	12.55	12.23	14.92	13.51	13.49	
18/10/21	15.85	13.90	14.02	14.62	15.52	14.62	
25/10/21	15.77	14.23	15.36	14.28	15.85	16.29	
5/11/21	15.88	14.25	15.83	13.31	16.52	13.75	
15/11/21	16.77	15.71	16.09	15.48	16.32	14.51	
22/11/21	16.65	16.16	15.54	15.64	17.11	15.87	
6/12/21	18.40	18.70	18.63	18.80	19.65	18.10	
22/12/21	19.45	21.20	21.69	22.50	22.73	19.50	

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Sample Date	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7
6/1/21	7.24	7.19	7.11	7.15	7.14	6.97	7.02
18/1/21	7.71	6.76	6.70	7.22	6.70	6.61	6.70
27/1/21	7.12	7.15	7.15	7.36	7.15	7.13	
1/2/21	6.74	7.07	6.74	7.13	6.74	6.96	
15/2/21	6.18	6.93	6.30	7.03	6.12	6.87	
10/3/21	6.42	6.52	6.45	6.99	6.85	7.22	
15/3/21	6.26	6.48	6.33	6.42	6.54	6.64	
29/3/21	6.31	6.36	6.48	6.50	6.49	6.55	
13/4/21	6.56	6.43	6.44	6.39	6.71	6.88	
22/4/21	6.39	6.41	6.43	6.43	6.59	6.68	
7/5/21	7.81	7.53	7.28	7.28	6.98	6.66	

Sample Date	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7
18/5/21	7.11	6.88	6.83	6.75	6.76	6.84	
7/6/21	7.67	7.10	7.11	6.95	6.91	6.65	
14/6/21	7.60	7.37	7.13	7.08	7.01	6.45	
28/6/21	7.53	7.49	7.23	7.03	7.06	7.00	
14/7/21	7.87	7.34	7.09	7.11	7.76	6.85	
27/7/21	7.08	6.78	6.82	6.64	6.88	7.48	
3/8/21	7.22	6.91	7.12	6.80	7.14	7.22	
17/8/21	7.25	7.14	7.31	7.06	7.29	7.06	
31/8/21	6.84	6.53	6.81	6.59	6.68	6.64	
6/9/21	6.77	6.50	6.75	6.78	7.34	6.87	
20/9/21	6.72	6.92	7.01	7.21	6.89	6.45	
4/10/21	6.32	6.35	6.35	6.22	6.28	6.75	
18/10/21	6.45	6.78	6.74	6.76	6.63	6.36	
25/10/21	6.45	6.77	6.65	6.76	6.61	6.28	
5/11/21	6.55	7.21	7.07	7.27	6.95	6.29	
15/11/21	6.84	6.59	7.06	6.80	7.22	6.16	
22/11/21	6.62	6.47	6.55	6.82	6.98	6.13	
6/12/21	7.09	6.85	7.01	7.01	7.19	6.96	

Electrical Conductivity (µS/cm)

Sample Date	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7
6/1/21	551	502	498	478	497	623	601
18/1/21	532	509	462	449	415	565	623
27/1/21	902	856	802	752	723	694	
1/2/21	716	654	563	545	494	721	
15/2/21	421	403	377	361	351	681	
10/3/21	356	828	659	673	461	675	
15/3/21	474	437	404	436	442	785	
29/3/21	441	434	442	440	423	629	
13/4/21	434	447	426	436	402	675	
22/4/21	446	431	428	456	426	703	
7/5/21	392	510	484	511	399	832	
18/5/21	384	409	372	341	378	688	
7/6/21	396	416	392	426	386	1101	
14/6/21	376	488	453	484	444	896	
28/6/21	430	528	494	556	412	756	
14/7/21	464	588	515	532	380	661	
27/7/21	512	582	564	541	496	1357	
3/8/21	507	595	578	536	514	1096	
17/8/21	522	628	571	551	512	1159	
31/8/21	499	620	605	580	541	1426	
6/9/21	483	450	425	370	344	821	
20/9/21	768	900	713	620	644	1830	
4/10/21	464	428	439	377	370	692	
18/10/21	631	707	695	540	472	536	
25/10/21	634	710	699	536	475	532	

Sample Date	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7
5/11/21	1006	995	920	692	584	369	
15/11/21	897	811	764	609	544	405	
22/11/21	748	647	568	546	463	461	
6/12/21	756	694	613	575	544	761	

Dissolved Oxygen (%)

Sample Date	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7
6/1/21	38.3	37.8	37.9	32.0	40.2	54.2	40.6
18/1/21	24.9	10.1	15.6	14.3	58.3	43.2	23.9
27/1/21	38.6	26.0	23.9	30.2	51.4	50.7	
1/2/21	48.3	47.8	26.9	42.0	50.2	64.1	
15/2/21	19.0	17.8	42.2	36.5	67.6	29.9	
10/3/21	27.5	33.3	43.6	43.7	67.3	42.0	
15/3/21	15.1	27.4	26.9	26.9	57.9	20.2	
29/3/21	25.6	41.5	32.6	30.7	50.4	35.7	
13/4/21	37.7	39.1	39.1	48.8	63.6	67.3	
22/4/21	41.1	51.0	47.9	50.0	57.3	56.1	
7/5/21	53.7	61.9	55.9	56.8	74.1	58.3	
18/5/21	53.4	52.4	53.3	55.5	78.7	49.6	
7/6/21	60.5	69.7	71.5	75.9	78.7	83.3	
14/6/21	44.2	37.4	31.8	26.7	32.8	38.9	
28/6/21	54.3	37.2	36.4	56.4	26.9	53.1	
14/7/21	88.0	85.9	81.9	58.0	84.3	68.0	
27/7/21	34.7	32.2	31.7	24.9	62.5	36.9	
3/8/21	24.5	29.5	38.5	22.4	55.7	34.5	
17/8/21	13.3	27.8	44.2	20.8	47.8	33.5	
31/8/21	61.1	61.0	55.0	54.5	57.0	47.9	
6/9/21	58.4	47.7	51.3	52.1	60.1	69.4	
20/9/21	28.2	30.8	45.9	52.6	40.6	52.6	
4/10/21	79.8	57.1	51.7	44.0	56.8	87.4	
18/10/21	48.0	38.7	32.9	34.5	54.2	55.2	
25/10/21	48.3	38.1	38.0	44.9	43.8	55.6	
5/11/21	57.4	59.0	29.7	26.1	50.3	24.2	
15/11/21	34.8	14.1	31.8	23.6	32.0	26.5	
22/11/21	2.2	11.2	3.8	11.1	23.7	18.8	
6/12/21	38.3	37.8	37.9	32.0	40.2	54.2	

Turbidity (NTU)

Sample Date	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7
6/1/21	198.0	68.2	73.9	66.0	85.9	51.2	55.0
18/1/21	35.90	34.6	33.9	19.3	21.6	16.1	22.9
27/1/21	52.6	43.5	36.0	39.6	52.9	19.6	
1/2/21	37.75	36.8	38.7	38.6	39.6	26.9	
15/2/21	10.1	9.3	17.4	2.1	4.7	18.8	
10/3/21	16.8	10.3	17.4	11.8	10.2	16.0	
15/3/21	16.4	12.2	9.9	9.5	8.2	28.5	
29/3/21	26.8	23.9	31.8	20.9	35.1	44.9	

Sample Date	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7
13/4/21	56.8	61.4	59.3	48.9	76.1	120.3	
22/4/21	31.6	28.9	31.9	26.7	31.1	68.0	
7/5/21	18.5	10.4	32.1	6.0	9.2	15.9	
18/5/21	66.5	31.8	20.0	12.3	11.9	12.3	
7/6/21	74.2	13.1	31.4	8.8	11.1	7.1	
14/6/21	101.0	35.0	45.1	25.3	40.6	15.6	
28/6/21	55.6	33.4	26.3	15.3	29.9	12.6	
14/7/21	31.9	14.5	21.0	8.8	26.8	16.2	
27/7/21	68.0	40.0	40.4	18.7	16.0	15.8	
3/8/21	42.5	23.6	38.9	16.9	11.1	8.6	
17/8/21	24.1	13.5	44.4	12.8	9.4	11.6	
31/8/21	96.4	151.0	148.0	159.0	165.0	132.0	
6/9/21	50.5	47.8	52.9	72.9	75.0	59.4	
20/9/21	44.6	23.5	26.4	26.8	24.9	27.0	
4/10/21	146.0	93.0	100.5	115.0	118.0	56.6	
18/10/21	102.0	78.0	99.0	128.0	89.0	55.0	
25/10/21	78.9	48.0	45.3	47.7	29.1	21.5	
5/11/21	28.8	13.1	27.8	15.6	19.3	23.0	
15/11/21	64.8	34.2	30.2	20.8	21.6	25.9	
22/11/21	19.8	12.6	11.6	6.9	12.8	29.7	
6/12/21	22.0	15.5	16.2	15.4	12.3	35.7	

Appendix 3: Water quality and Dwarf Galaxias monitoring report 2022 from Aquatica Environmental





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Our Ref: 000118.10

21 December 2022

Narre Warren Central Pty Ltd Att Mr Paul Nio 52-54 Rathdowne Street Carlton VIC 3053

Via email: pnio@osanrae.com.au CC: cmistica@fidus.com.au; inga@natureadvisory.com.au

Dear Paul

Re: 2022 Annual Report of Water Quality and Dwarf Galaxias Monitoring for Casey Green

Aquatica Environmental was engaged by Narre Warren Central to undertake the 2022 annual monitoring of water quality and Dwarf Galaxias (*Galaxiella pusilla*) at the site of the Casey Green residential development at 96-166 Centre Road, Narre Warren, Victoria (the project).

The annual monitoring was undertaken to meet specific management actions outlined in the project's commonwealth, state and locally approved Dwarf Galaxias Management Plan (DGMP; BL&A 2015) and Dwarf Galaxias Salvage and Translocation Plan (DGSTP; Aquatica Environmental 2015). These actions were interpreted by the federal Department of Agriculture, Water and the Environmental (DAWE) to include the following monitoring requirements (DE 2016, including Aquatica Environmental 2015):

- **Dwarf Galaxias**: Survey for Dwarf Galaxias and predatory fish populations at established sites in November/December annually during construction and for least five years post completion of construction on the site.
- Aquatic and riparian habitat condition: Assess condition in conjunction with the Dwarf Galaxias survey.
- Water quality: Assess water quality at established sites fortnightly and/or after rainfall events >10mm during construction, including during Dwarf Galaxias monitoring (Condition 3b and 3d).

This report has been produce to provide a summary record of the 2022 water quality and Dwarf Galaxias monitoring in accordance with the DGMP and DGSTP.

1 Methodologies

1.1 Rainfall Monitoring

There is no rainfall gauge located on the site. The nearest Bureau of Meteorology (BOM) weather stations, with current rainfall monitoring data, are located at Ferny Creek, Moorabbin and Scoresby (Figure 1). To determine whether an approximately >10mm rainfall event had occurred at the site the average of the daily totals from the three BOM weather stations was used.



Figure 1 Bureau of meteorology weather station locations (green) relative to the site (red)

1.2 Sampling Sites

During initial baseline and salvage surveys in 2016-17 a number of water quality and Dwarf Galaxias survey sites were established (Aquatica Environmental 2017). However, in the time since these surveys were undertaken development of the site (and neighbouring sites) has progressed significantly and not all of the originally established site still exist. Figure 2 shows the sites that were monitored during the 2022 monitoring year.





1.3 Dwarf Galaxias and Predatory Fish Monitoring

Dwarf Galaxias and predatory fish monitoring was undertaken at Dwarf Galaxias monitoring location Figure 1. This sites align with previous year's monitoring, with Sites DG1 and DG2 corresponding to where Dwarf Galaxia were released during the 2016 salvage and translocation program (Aquatica Environmental 2017). These site are now effectively merged into one larger monitoring location, representative of the fully connected and wetter portion of the retained habitat and newer swales.

Sampling for adult Dwarf Galaxias and predatory was undertaken using hand-held dip-nets, sampling in and around areas of suitable habitat, and bait traps set overnight with phosphorescent baits. Sampling for larval Dwarf Galaxias was also undertaken by collecting a sample of water (approximately 10 litres) and placing it in a shallow white tray, where any larva would have been visible.

Active searching using dip-nets and bait-trapping are standard methods for sampling Dwarf Galaxias and are the most effective methods outlined in the Survey Guidelines for Australia's Threatened Fish (DSEWPaC 2004) and Biodiversity Precinct Structure Planning Kit (DSE 2010). They are also most appropriate method for sampling in the small and heavily vegetated water bodies, like those at the site.

Dwarf Galaxias sampling was undertaken by Aquatica Environmental at another nearby site, where Dwarf Galaxias also occur and as reference/baseline as to whether Dwarf Galaxias should have been detectable on the site.

1.4 Aquatic and Riparian Habitat Condition Monitoring

Aquatic and riparian habitat condition was visually and assessed during and at the Dwarf Galaxias monitoring locations during most water quality sampling events and the annual Dwarf Galaxias survey. The assessment was primarily based on a comparison of the aquatic and riparian vegetation condition during this survey as compared to previous surveys (i.e. temporal comparison).

1.5 Water Quality Monitoring

Water quality monitoring was undertaken fortnightly and/or following rainfall events >10 millimetres, and during the annual Dwarf Galaxias survey. In situ water quality data was collected by using a calibrated Hanna Instruments HI9829 multiparameter water quality metre. The parameters collected included temperate, electrical conductivity, pH, dissolved oxygen and turbidity.

2 Results

2.1 Sampling Frequency and Conditions

During the 2022 monitoring year¹ a total of 31 sampling events had occurred, including 12 scheduled, 18 post >10mm rainfall events and one during annual Dwarf Galaxias monitoring (Table 1).

The overall number of post >10mm rainfall events sampling was higher than in previous years, namely due to an extremely wet and high rainfall period In spring (i.e. August to December 2022). For the 2022 survey season there was a total of 35 days with >10mm rain (Figure 3), as compared to 2021 where there was 24 days.

The annual Dwarf Galaxias monitoring and associated water quality sampling occurred on the 3rd and 4th November 2022.

¹ The final water quality monitoring event, scheduled for 29th December will be included in the 2023 monitoring data.

Table 1 2022 sampling schedule

DAY Saturday	Jan 1/1/2	022	Fe	b		Mar	-	Ap	r	-	May		JL	me		Ju	ÿ		Aug		8	ept		1/1	0/202	2	No	W.	-	Dec	•	Star	ıdan	i wa	Mar	itorin	g Ev	vent
Sunday Monday Tuesday Wednesday Thursday	2/1/2 3/1/2 4/1/2 5/1/2 6/1/2	022 022 022 022 022	1/2 2/2 3/2	2022	1 2 3	/3/20: /3/20: /3/20:	22				1/5/20 3/5/20 1/5/20 5/5/20	022 022 022 022	1/1	5/202	2				1/8/2 2/8/2 3/8/2 4/8/2	022	-	9/20	22	2/1 3/1 4/1 5/1	0/202 0/202 0/202 0/202 0/202	22	1/11 2/11 3/11	/2023	2	1/12/	2022	Pos Inci Ann Oth	tech t≥10 dent ual 0	odule Imm i OG Si	ainfa urvey	ill avı	ant	
Friday Saturday Sunday Monday	7/1/2 8/1/2 9/1/2 10/1/2	022 022 022 022	4/2 5/2 8/2 7/2	2022 2022 2022 2022	4 5 6	/3/20 /3/20 /3/20	22	1/4 2/4 3/4 4/4	2022 2022 2022 2022	1 1 10 0	5/5/20 7/5/20 3/5/20 9/5/20	022 022 022	3/4 4/4 5/4 6/4	5/202 5/202 5/202 5/202	2 2 2 2 2	1/7 2/7 3/7 4/7	2022 2022 2022 2022		5/8/2 6/8/2 7/8/2 8/8/2	022 022 022 022	2	9/20 9/20 9/20 9/20	22 22 22 22	7/1 8/1 9/1	0/202 0/202 0/202	2	4/11 5/11 6/11 7/11	/202 /202 /202 /202		2/12/ 3/12/ 4/12/ 5/12/	2022 2022 2022 2022	Rain	nfall	> 10	m			
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Figure 3 2022 rainfall chart

2.2 Dwarf Galaxias and Predatory Fish

The annual Dwarf Galaxias survey was undertaken on 3rd and 4th November 2022. The weather during the survey was mild to warm with temperatures ranging between 17°C (day time maximum) and 5.8°C (night time minimum). Approximately 7 millimetres of rain fell across the 24 hour survey period (BOM 2022).

Due to recent significant rain, the retained habitat and survey area was extremely inundated (Plate 3), meaning resident fish were disburse and more difficult to detect. The seasonal timing for the survey (late spring) was typically ideal and young of year and adults would be expected to be found following the usual late autumn to spring breeding season, however, .

A total of 11 Dwarf Galaxias were recorded during the November survey, including 3 adult males and 8 juveniles from the most recent breeding season, which likely occurred through August to October based on the juvenile's size (Plate 1).

Based on the number and condition of the individuals recorded during this survey, it appears there has been another good year for the species on the site. I.e. similarly 2019, 2020 and 2021 and commensurate with the La Nina climate cycle south-eastern Australia has been experiencing. This has also been our experience at other sites in the region, mostly due to above average winter/spring rains and mild temperatures.

The results also confirm that the constructed swales are continuing to function well and as intended, by supplying consistent water levels to the retained habitat, but limiting pest fish ingress to the retained habitat drain.

The results of the November 2022 survey are provided in Table 2 and compared to previous rounds of monitoring.

Similarly to all previous surveys (i.e. 2021-2018, excluding 2017) the Section 75 of the *Fisheries Act 1995* listed as 'noxious' Mosquitofish (*Gambusia holbrooki*) were recorded in small numbers the retained habitat. They were also observed in large numbers in the open areas of the Centre Road drain (both sides of the road), culvert openings across the site and in the constructed swales.

A single oriental Weatherloach was also recorded (Plate 2). The species is also listed as 'noxious under Section 75 of the *Fisheries Act 1995.*

Common Name	Scientific Name	Sampling Event										
		2022	2021	2020	2019	2018	2017					
Dwarf Galaxias	Galaxiella pusilla	11	17	25	12	3	2					
Mosquitofish	Gambusia holbrooki	10s	10s	12	6	3	-					
Goldfish	Carassius auratus	-	-	-	2	4	-					
Flathead Gudgeon												
Freshwater Burrowing Crayfish	Engeus spp.	-	-	-	1	1	-					
Oriental Weatherloach	Misgurnus anguillicaudatus	1	-	1	-	-	-					

Table 2 Species and number of individuals recorded



Plate 1 Dwarf Galaxias adult male (top and juvenile (bottom)



Plate 2 Oriental Weatherloach

2.3 Aquatic and Riparian Habitat Condition

During the Dwarf Galaxias survey the monitoring location (also WQ6) was heavily inundated due to high spring rainfall (Plate 3), especially when compared to its usual water level (Plate 4). The inundation had been present for long enough to drown-out much of the lower-lying macrophytes, leaving mostly just the Phragmites, Juncus and Melaleuca visible above water. It is assumed that the lower-lying macrophytes will re-establish and return once water levels drop closer to baseline.

Aquatic and riparian habitat condition at the other five water quality monitoring sites along Centre Road (WQ1-5) remained mostly this same previous surveys.



Plate 3 Habitat vegetation and inundation at Site Dwarf Galaxias survey location in November 2022



Plate 4 Habitat vegetation at Site Dwarf Galaxias survey location in March 2022

2.4 Water Quality

The raw water quality data is provided in Appendix B. Table 1 provides a summary of the relevant statistical analysis and/or relevant Environmental Reference Standards (ERS; EPA 2021) objectives for the Urban segment, Lowlands of Western Port catchment.

Overall the data showed the following patterns:

• Temperature was on average very consist across the sites across the year, showing expected heating and cooling phases in summer and winter. The highest temperatures across the sites were experienced in January and the

lowest in July. The highest individual temperature was 26.39°C at Site 5 on the 12^h January (the most sun exposed site) and the lowest was 6.34°C at Site 6 on 13th July (the. Most shaded site). On average Site 1 had the highest temperatures, apparently due to the discharge of water from the culvert. Site 6 had the lowest due to shading by the dense vegetation at the site. There is no ERS objective for temperature.

- pH was on average consistent across all sites (mean range=6.80-6.98), not appearing to be linked to seasonal or weather variations and was withing the ERS objectives at all sites.
- Electrical conductivity was consistently higher at Sites 6 (mean=567 µS/cm compared to mean=366-458 µS/cm at Sites 1-5), most likely reflective of the lack of direct flows and the concentration of salts due to evaporation. However, the average at Site 6 was lower than previous years, possibly indicating the effects of dilution from much higher than average rainfall and the greater water volumes of the attached swales. The ERS objective of 75th %ile ≤500 µS/cm was exceeded at Sites 1, 2 and 6. The levels observed appeared not attributable to the development of the site, rather occurred naturally and/or other influences, and were clearly of no concern for Dwarf Galaxias due to their ongoing presence and increased abundance at the site.
- Percent dissolved oxygen was again consistently low across all sites (mean range=28.1-44.0%). The ERS objective of ≥70% was not met at any site. Similarly to electrical conductivity, the levels observed were not attributable to the development of the site, rather occurred naturally and/or other influences, and were clearly of no concern for the resident Dwarf Galaxias population.
- Turbidity was on average highest at Site 1 (mean=62.1 NTU), indicating a high turbidity input from the culvert and unknown upstream sources. Site 6 had the lowest average turbidity (mean=31.7 NTU). The data showed that turbidity reduces through the downstream flowing sites (i.e. Site 1 to 5) with no indication of any observable inputs from the development of the site. This indicated that the retained Centre Road drain vegetation and construction/vegetation of the project's swales are functioning as designed and resulting in an overall reduction turbidity as surface waters pass by the site. The ERS of ≤35 NTU was not met at any site due to catchment inputs and localised influences.

Parame	eter	ERS	Centi	re Road Drain	Sites		Habitat Sites	
		Objective	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
Temperature	Min.	NA	9.89	7.74	7.71	7.28	8.43	6.34
(°C)	Max.		23.75	24.65	23.79	23.50	26.39	23.99
	Mean		16.33	15.22	15.22	15.08	15.77	14.82
рН	25 th %tile	≥6.4	6.57	6.57	6.69	6.64	6.63	6.88
	75 th %tile	≤7.9	7.21	7.00	7.03	7.01	7.05	7.12
	Mean	NA	6.90	6.81	6.83	6.80	6.84	6.98
Electrical	75 th %	≤500	531	532	489	446	410	657
Conductivity (µS/cm)	Mean	NA	440	458	394	383	366	567
Dissolved	75 th %tile	≥70	38.5	37.0	43.4	41.7	49.9	50.7
Oxygen (%)	Max.	130	83.7	55.4	55.2	60.3	67.6	101.5
	Mean	NA	30.6	28.1	34.1	33.9	40.2	44.0
Turbidity	75 th %tile	≤35	99.9	69.0	64.8	57.5	55.0	39.3
(NTU)	Mean	NA	62.1	44.5	37.2	35.4	37.5	31.7

Table 32022 water quality sampling summary

Orange highlight = parameter did not meet the ERS objective

3 Summary

The 2022 annual Dwarf Galaxias monitoring event detected 11 individual Dwarf Galaxias in the retained habitat drain (compared to 17 in 2021, 25 in 2020, 12 in 2019 and 3 in 2018). This was at about the average of the previous survey records indicating that conditions for the species are being maintained and likely continuing to improve, due to the establishment of further suitable habitat in the constructed swales. The primary reason for this is that the constructed swales result in more water and a more constant water level in the retained habitat drain in a manner

that is clearly suited to the resident Dwarf Galaxias population (i.e. still maintaining ephemerality but not allowing over drying).

Considering this and previous rounds of sampling for the project and historical records (Aquatica Environmental 2017, 2019, 2020, 2021 and 202), it is considered likely the abundance and distribution of the Dwarf Galaxias population in the habitat areas is somewhat dynamic, varying between years and due to seasonal influenced on water availability and therefore habitat. However, with the continued improvement of the retained habitat and expansion of suitable habitat into the constructed swales it is clearly resulting in an overall increase in the quality and area of available habitat for Dwarf Galaxias. This appears to have also correlated with a slight increase in the number of predatory fish species (i.e. Mosquitofish), however their presence doesn't appear to have impacted the successful breeding and increasing numbers of Dwarf Galaxias. This is probably due to the habitat being more suitable to Dwarf Galaxias than the pest/predatory species.

Based on the results of the 2022 annual survey and data, it is our option that development of the Casey Green site to date has been undertaken in accordance the DGSTP and associated approvals. No ecologically significant impacts have been observed to the retained habitat, with the constructed swales having improved overall conditions for Dwarf Galaxias on the site and in the region.

The 2023 monitoring year will commence on 1st January 2022, will included any remaining sampling for the 2022 year and in accordance with approved DGSTP (and the project DGMP; BL&A 2015) the following monitoring should occur during the year:

- Water quality monitoring: Fortnightly and/or after rainfall events > 10 millimetres until all construction is completed (i.e. all works on site completed) and then monthly following completion.
- **Dwarf Galaxias monitoring**: Annually in November/December for at least five years post construction.

Please note, we interoperate the "completion of construction" to be the point at all major works including site cleanup, landscaping, etc. Have been completed and there is not further risk to the Dwarf Galaxias and their habitat (i.e. all possible sources of sediment/contaminant runoff have been mitigated.

If you have any questions or would like to discuss this assessment, report or any other matter further, please do not hesitate to call me on 0413 935 497.

Kind Regards,

Aamola

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Appendix A: Raw Water Quality Results

Temperature (°C)

Sample Date	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
12/1/2022	23.68	24.19	23.40	22.91	26.39	22.51
28/1/2022	23.75	24.65	23.79	23.50	25.36	23.99
1/2/2022	23.66	23.14	23.01	22.58	24.18	23.20
15/2/2022	23.16	21.11	21.95	21.58	22.54	20.60
28/2/2022	22.54	21.10	21.66	21.56	22.29	18.99
7/3/2022	21.64	20.10	19.66	19.57	20.29	18.99
21/3/2022	21.38	19.01	18.95	17.89	17.57	16.35
13/4/2022	19.11	17.52	16.23	16.20	15.85	15.96
21/4/2022	18.36	16.27	15.48	12.45	14.99	15.21
2/5/2022	15.56	13.33	13.35	13.27	13.55	12.20
16/5/2022	14.81	12.07	12.59	12.03	12.90	11.95
8/6/2022	9.89	9.96	9.69	9.89	10.07	9.85
22/6/2022	10.38	10.47	10.18	10.40	10.57	9.95
28/6/2022	10.54	9.15	8.91	8.88	9.46	7.15
13/7/2022	10.73	7.74	7.71	7.28	8.43	6.34
27/7/2022	10.92	8.46	8.60	8.20	9.08	7.39
10/8/2022	11.22	9.23	9.42	9.17	9.78	8.49
22/8/2022	11.50	10.03	10.30	10.16	10.49	9.57
1/9/2022	11.69	10.73	11.10	11.06	11.11	10.65
12/9/2022	12.06	10.60	10.90	10.45	10.01	10.24
21/9/2022	13.88	11.57	12.40	11.38	10.72	10.66
5/10/2022	15.58	14.55	15.49	14.50	14.50	14.56
10/10/2022	15.85	13.90	14.62	15.18	15.52	16.62
17/10/2022	15.80	14.16	14.46	14.99	15.63	16.48
28/10/2022	15.77	14.23	14.28	15.51	15.85	16.29
4/11/2022	14.66	15.00	14.82	14.63	15.43	15.24
17/11/2022	16.10	16.65	15.54	17.20	17.66	17.50
21/11/2022	17.75	17.73	17.85	18.79	20.61	20.22
7/12/2022	18.40	18.70	18.63	18.80	19.65	18.10
15/12/2022	19.45	21.20	21.69	22.50	22.73	19.50

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12/1/2022	7.24	7.09	7.11	7.15	7.14	6.97
28/1/2022	7.37	6.76	6.70	7.02	6.90	6.91
1/2/2022	7.05	6.84	6.84	6.29	6.61	7.12
15/2/2022	7.32	7.00	6.98	6.92	6.98	7.10
28/2/2022	7.50	7.18	7.13	7.11	7.13	7.35
7/3/2022	7.70	7.38	7.29	7.10	7.07	7.55
21/3/2022	7.21	7.24	7.19	7.12	7.05	7.29
13/4/2022	7.12	7.09	7.06	7.11	7.03	7.23
21/4/2022	7.55	7.32	7.03	7.20	7.11	7.13
2/5/2022	7.23	7.00	6.85	7.01	6.98	7.15
16/5/2022	7.20	6.85	6.41	6.45	6.45	7.01
8/6/2022	6.96	7.47	7.47	6.81	7.43	6.98

12/1/2022	7.24	7.09	7.11	7.15	7.14	6.97
22/6/2022	6.57	6.57	6.73	6.64	6.71	7.07
28/6/2022	6.55	6.71	6.82	6.88	6.95	6.59
13/7/2022	6.92	6.77	6.39	6.45	6.27	7.30
27/7/2022	6.48	6.52	6.72	6.65	6.59	6.67
10/8/2022	7.05	6.91	7.06	6.78	6.54	6.64
22/8/2022	6.77	6.75	6.94	6.84	6.82	6.88
1/9/2022	6.95	6.82	6.90	6.86	6.50	6.75
12/9/2022	6.08	6.34	6.68	6.71	6.38	6.38
21/9/2022	6.26	6.43	6.51	6.62	6.58	6.79
5/10/2022	6.77	6.75	6.94	6.84	6.82	6.88
10/10/2022	6.76	6.51	6.48	6.77	7.35	6.86
17/10/2022	6.57	6.57	6.73	6.64	6.71	7.07
28/10/2022	6.59	6.56	6.67	6.71	6.86	6.91
4/11/2022	6.22	6.21	6.30	6.29	6.69	6.97
17/11/2022	6.45	6.44	6.39	6.51	6.75	6.97
21/11/2022	6.57	6.57	6.73	6.64	6.71	7.07
7/12/2022	6.99	6.85	7.01	7.01	7.09	6.96
15/12/2022	7.01	6.93	6.95	6.95	6.92	6.95

Electrical Conductivity (µS/cm)

Sample Date	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
12/1/2022	551	502	498	478	497	623
28/1/2022	532	509	462	449	415	565
1/2/2022	484	638	517	466	346	987
15/2/2022	532	540	502	479	420	825
28/2/2022	526	572	504	475	404	692
7/3/2022	181	479	421	412	403	551
21/3/2022	830	753	505	438	446	576
13/4/2022	1079	953	568	556	509	594
21/4/2022	825	749	387	388	352	684
2/5/2022	522	494	356	370	345	661
16/5/2022	319	338	325	351	338	862
8/6/2022	226	339	268	339	412	523
22/6/2022	264	428	413	377	370	692
28/6/2022	284	355	355	375	399	646
13/7/2022	325	376	397	415	367	961
27/7/2022	400	369	361	350	348	476
10/8/2022	526	456	419	361	336	481
22/8/2022	432	409	369	349	315	465
1/9/2022	216	235	246	256	260	465
12/9/2022	226	339	268	289	312	444
21/9/2022	273	292	288	286	294	365
5/10/2022	260	282	278	282	285	384
10/10/2022	295	316	300	303	302	325
17/10/2022	282	306	294	294	298	343
28/10/2022	280	297	292	289	297	352

Sample Date	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
4/11/2022	304	329	310	307	310	302
17/11/2022	361	365	344	335	293	405
21/11/2022	398	399	325	320	281	595
7/12/2022	756	694	613	575	544	551
15/12/2022	696	634	643	525	474	601

Dissolved Oxygen (%)

Sample Date	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
12/1/2022	38.3	37.8	37.9	32.0	40.2	54.2
28/1/2022	24.9	10.1	15.6	14.3	58.3	43.2
1/2/2022	0.1	1.3	3.3	2.9	10.7	58.9
15/2/2022	19.0	17.8	42.2	36.5	67.6	29.9
28/2/2022	27.5	33.3	43.6	43.7	47.3	42.0
7/3/2022	14.2	11.1	6.4	7.6	11.0	15.2
21/3/2022	14.6	18.6	28.4	31.0	22.3	39.4
13/4/2022	16.9	27.8	52.3	56.3	53.3	43.5
21/4/2022	23.0	21.8	46.2	40.5	62.6	44.9
2/5/2022	12.6	16.6	16.4	29.0	20.3	46.3
16/5/2022	18.9	22.8	24.4	24.9	45.4	53.1
8/6/2022	83.7	53.0	55.2	45.3	41.6	29.6
22/6/2022	24.9	10.1	26.3	14.3	58.3	43.2
28/6/2022	38.6	26.0	31.5	30.2	51.4	50.7
13/7/2022	44.8	40.2	31.3	29.3	33.5	101.5
27/7/2022	39.2	55.4	46.8	32.3	36.5	36.3
10/8/2022	36.2	25.5	46.9	60.3	37.4	37.4
22/8/2022	31.1	33.6	42.8	58.6	42.3	45.6
1/9/2022	40.3	28.2	26.7	17.6	22.4	35.6
12/9/2022	39.2	55.4	46.8	32.3	36.5	36.3
21/9/2022	36.2	25.5	46.9	60.3	37.4	37.4
5/10/2022	31.1	33.6	42.8	58.6	42.3	45.6
10/10/2022	42.9	37.4	38.3	39.4	48.7	52.1
17/10/2022	36.8	35.6	40.9	42.1	34.8	38.6
28/10/2022	17.4	19.0	29.7	26.1	50.3	24.2
4/11/2022	28.5	22.2	17.3	19.5	16.0	27.1
17/11/2022	38.3	37.8	37.9	32.0	40.2	54.2
21/11/2022	22.0	21.5	37.5	38.2	45.9	48.7
7/12/2022	38.3	37.8	37.9	32.0	40.2	54.2
15/12/2022	38.6	26.0	23.9	30.2	51.4	50.7

Turbidity (NTU)

Sample Date	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
12/1/2022	35.9	34.6	33.9	19.3	21.6	16.1
28/1/2022	52.60	43.5	36.0	39.6	52.9	19.6
1/2/2022	4.4	17.6	11.6	11.7	15.8	20.1
15/2/2022	10.10	9.3	17.4	2.1	4.7	18.8
28/2/2022	16.8	10.3	17.4	11.8	10.2	16.0
7/3/2022	122.0	13.8	13.4	10.6	17.6	48.9

Sample Date	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
21/3/2022	113.0	12.6	15.3	16.4	12.7	33.0
13/4/2022	7.2	10.8	14.8	10.9	8.5	15.3
21/4/2022	26.8	22.3	18.4	15.8	12.8	26.0
2/5/2022	93.3	15.6	15.3	16.7	13.0	19.0
16/5/2022	31.4	19.6	16.3	10.6	9.3	19.7
8/6/2022	135.0	70.1	82.6	36.4	30.0	23.6
22/6/2022	96.4	51.0	68.3	59.0	65.1	32.0
28/6/2022	104.0	81.7	54.3	73.9	95.1	40.5
13/7/2022	127.0	47.3	33.4	28.2	24.8	17.5
27/7/2022	130.0	47.0	38.6	57.5	49.3	18.4
10/8/2022	94.1	107.0	84.5	87.0	95.7	95.7
22/8/2022	153.0	69.0	75.9	66.0	85.9	55.9
1/9/2022	58.8	118.8	85.5	110.0	108.0	46.3
12/9/2022	101.0	99.9	81.0	88.7	95.5	66.1
21/9/2022	46.6	130.0	17.7	57.5	49.3	18.4
5/10/2022	94.1	107.0	84.5	46.0	55.7	55.6
10/10/2022	53.0	69.0	75.9	66.0	85.9	55.9
17/10/2022	31.4	19.6	16.3	10.6	9.3	26.0
28/10/2022	26.8	22.3	18.4	15.8	12.8	26.0
4/11/2022	12.5	15.3	17.7	25.4	19.0	15.5
17/11/2022	16.8	10.3	17.4	11.8	10.2	16.0
21/11/2022	17.8	17.7	17.9	18.8	20.6	20.2
7/12/2022	22.0	15.5	16.2	15.4	12.3	35.7
15/12/2022	28.9	27.1	21.6	24.0	20.6	32.1

Appendix 4: Vegetation monitoring report 2022 from Nature Advisory





96-166 Centre Road, Narre Warren – Dwarf Galaxias habitat buffer

Year 5 Vegetation Monitoring

Prepared for Narre Warren Central Pty Ltd c/- The Fidus Group

December 2022 Report No. 14090.8 (17.0)



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1. Introduction

Nature Advisory (formerly Brett Lane & Associates) were engaged by Fidus Group, on behalf of Narre Warren Central Pty Ltd (the Proponent), to conduct vegetation monitoring within Dwarf Galaxias habitat buffer areas at 96-166 Centre Road, Narre Warren, approximately 37 kilometres south-east of Melbourne's CBD. The buffers of native vegetation have been retained for the purpose of protecting drainage channels known to support a population of Dwarf Galaxias from neighbouring construction. Dwarf Galaxias is listed as critically endangered under the Commonwealth *Environmental Protection and Biodiversity Conservation Act* 1999 (EPBC Act).

The vast majority of the property has been approved for a residential subdivision, with construction having commenced in November 2016. Condition 4 of the EPBC Act approval for the project (EPBC 2014-7380) requires that buffer areas around Dwarf Galaxias habitat (Figure 1) are revegetated within 2 years of the commencement of construction and that vegetation cover is retained until the expiry of the approval.

The following targets were set to achieve this objective:

- Less than 10% weed cover 6 months from the commencement of construction; and
- Less than 40% weed cover 5 years from the commencement of construction.

The following monitoring timeline was set in order to determine if these targets are being met:

- Prior to the commencement of construction to gain baseline data;
- Six months after the commencement of construction;
- Twelve months after the commencement of construction; and
- Two, three, five, seven, 10 and 15 years after the commencement of construction.

A baseline study was conducted in October 2016, before construction started in November 2016, during which $15 \times 1m^2$ quadrats were established within representative areas of the habitat buffers for future monitoring. The quadrats were surveyed again in September 2017 to collect monitoring data at six months post the commencement of construction, though it was actually undertaken 10 months after construction commenced. The twelve months survey (November 2017) was missed and the Year 2 survey (scheduled for November 2019) was delayed by six months (May 2020). The Year 3 survey was conducted in November 2020. This report presents the Year 5 monitoring data which was collected in December 2022.

This report is divided into the following sections:

Section 2 describes the methods used for the field survey.

Section 3 describes the limitations of the assessment.

Section 3 describes the results of the field survey.

Section 4 provides a review of the monitoring program.



Section 5 provides the recommendations for management of the habitat buffers.

This investigation was undertaken by a team at Nature Advisory comprising Cody Hajnal (Botanist), Caroline Tan (Senior Botanist) and Inga Kulik (Senior Ecologist and Project Manager).



2. Methods

The field assessment was conducted on the 16th December 2022. During this assessment, the study area was surveyed on foot and 16 of the 20 previously established quadrats/quadrat locations within the Dwarf Galaxias habitat buffer areas (Figure 1) were assessed.

During the baseline survey, quadrats were established in the following vegetation types:

- Swamp Scrub (EVC 53) nine quadrats (1, 3, 4, 6, 7, 9, 10, 16, 19 & 20).
- Swampy Riparian Woodland (EVC 83) vegetation two quadrats (11 & 15).
- Non-native vegetation four quadrats (2, 5, 13 & 17).
- Quadrats 12, 14 and 18 are not to be surveyed anymore as it was decided during the 6-month assessment that they were too close to other monitoring quadrats and would not add any additional information. Quadrat 8 was removed after the area was disturbed and the marking stake lost.

Under Condition 4 of the EPBC Act, areas of non-native vegetation were required to be revegetated with indigenous species.

At the time of establishment, each quadrat was marked with a single wooden stake in the north-west corner and positioned along a north-south to east-west axis.

A photograph was taken at the north-west corner of the accessible quadrats at a height of approximately 1.3 metres, looking south-east over the quadrat, and the following data was collected:

- Total vegetation cover;
- Native vegetation cover;
- Weed cover;
- Cover of bryophytes, bare ground and litter; and
- Each flora species recorded.

This assessment methodology was repeated during the current survey, however as explained in the following section, there were significant limitations which prevented the quadrats from being accessed and as such the methodology was amended as appropriate to the circumstances and to determine if Condition 4 will be met.

In addition to the quadrat assessments, incidental observations of rubbish, stockpiles or other disturbances in the habitat buffers were recorded while traversing between quadrats. Incidental observations of high-threat weed species were also recorded, however it was not the purpose of this field assessment to undertake a weed survey for the study area.



3. Limitations

Of the 16 quadrats, none were able to be accessed and surveyed directly (i.e. close-up assessment from standing directly adjacent to the quadrat) during the current survey, due to the habitat buffers being surrounded by deep water and/or impenetrable vegetation.

The habitat buffer located alongside Centre Road and west of the entry to Billy Button Drive was unable to be accessed due to being surrounded by water, as both the drainage channel along the southern edge of the buffer (separating the buffer from Centre Road) and the deep swale that ran along the northern edge of the buffer were full of water. The habitat buffer that continued east of the entry to Billy Button Drive was also inaccessible due to the barrier of deep water in the drainage channel and swale, as well as impenetrable vegetation (mainly Blackberry) on the channel slopes.

The habitat buffer which ran between Centre Road and the Packenham Railway line – which supported quadrats 11, 13, 15, 16 & 17 – was unable to be accessed due to the large swale drains containing deep water along both the eastern and western sides (Photo 1). Access at the entry from the Centre Road onto Billy Button Drive and the crossing between quadrat 1 and 4 were attempted, however there was still deep water and/or impenetrable vegetation at those locations, and the habitat buffers could not be accessed safely.

As a result of the access limitations above, assessment of the quadrats (cover estimates and flora species) was undertaken from across the drains and photographs were taken to support the qualitative descriptions of the vegetation condition at each quadrat location.



Photo 1. Swale drain with deep water (foreground) preventing access to the habitat buffer between Centre Road and the Packenham Railway line, which supported quadrats 11, 13, 15, 16 & 17.



4. Results

The cover of native vegetation was generally high; 70-80% for nine out of 16 quadrats, 50-60% for five quadrats and less than 50% for two quadrats. This was mostly attributable to Swamp Paperbark (including mature individuals and heavy recruitment) with Black Wattle also present. It was further noted that the aquatic vegetation in the swales and drainage channels were usually dominated by native Narrow-leaf Cumbungi, Common Reed and (to a lesser extent) Slender Knotweed and Spike Rush.

It should be noted that at quadrats 7, 9, 19 and 20, the Swamp Paperbark appeared to have dieback occurring, i.e. moderate to severe crown decline.

The cover of weeds was generally medium to high; 40-50% for six out of 16 quadrats, 25-30% for four quadrats, 5-10% for four quadrats and 0% for two quadrats. This was mostly attributable to the high-threat species Blackberry. Other high threat weed species observed included Flax-leaf Broom, Patterson's Curse, Spear Thistle and Ox-tongue.

Based on email correspondence with the Project Manager at Naturelinks Landscape Management Pty Ltd, weed spraying and removal of weed material was conducted in the week prior to the current monitoring. Effective control of Flax-leaf Broom along the drainage channel west of the habitat buffer between Centre Road and the Pakenham Railway line was evident. However, some recruitment had become established again in this area and a new high-threat weed species Patterson's Curse was also observed on the slope of the channel (near quadrat 15). Spear Thistle was previously reported as common around the study area; while there has been an overall reduction of this species across the study area, individuals of Spear Thistle and Ox-tongue were common along the edge of the vegetation along Centre Road.

Rubbish was observed within or close to the buffer areas, including polystyrene, plastic materials including bottles, cardboard, fast food containers and construction waste. Rubbish came from construction activities within the study area as well as from public littering along Centre Road. Some litter was recorded at the location of quadrat 19. The hard rubbish that was photographed during the previous monitoring had been removed.

Sediment fencing between the habitat buffers and swales/drains was in generally good condition across the study area. A few areas of sediment fencing had collapsed or been damaged, as mapped in Figure 1. The previous monitoring had reported collapsed fencing with erosion channelling occurring in the central part of the study area; the current monitoring found this has been rectified with intact fencing and the erosion was addressed with some rock fill, hay bales and sandbags.

Algal blooms were observed in the water inside the habitat buffer along Centre Road, as seen and photographed from the entry to Billy Button Drive from Centre Road.

Observations made within the general quadrat locations are provided in Table 1 below and quadrat photos are provided Appendix 1. Other general photos of the study area are provided in Appendix 2.



Table 1: Qualitative vegetation quadrat data - Year 5

Quadrat No.	Vegetation Type	Description	Weed cover (estimated)	Native vegetation cover (estimated)
1	Swamp Scrub	Swamp Paperbark dominated. Blackberry present	5	80
2	Non- native	Co-dominated by Common Reed and Blackberry	30	70
3	Swamp Scrub	Co-dominated by Swamp Paperbark and Blackberry	40	50
4	Swamp Scrub	Very dense, dominated by Swamp Paperbark, with some Slender Knotweed and Rush on water's edge	0	80
5	Non- native	Co-dominated by Swamp Paperbark, Narrow-leaf Cumbungi and Slender Knotweed. Blackberry, Toowoomba Canary-grass and Drain Flat-sedge on water's edge	30	70
6	Swamp Scrub	Dominated by Swamp Paperbark	10	80
7	Swamp Scrub	Co-dominated by Swamp Paperbark and Blackberry. Swamp paperbark experiencing dieback	50	40
9	Swamp Scrub	Dominated by Swamp Paperbark. Blackberry present. Swamp paperbark experiencing dieback	50	50
10	Swamp Scrub	Blackberry dominated. Swamp Paperbark present	40	60
11	Swampy Riparian Woodland	Very dense, dominated by Swamp Paperbark, high cover of Blackberry, with Black Wattle nearby	40	60



Quadrat No.	Vegetation Type	Description	Weed cover (estimated)	Native vegetation cover (estimated)
13	Non- native	Co-dominated by Swamp Paperbark and Black Wattle, high cover of Blackberry	40	15
15	Swampy Riparian Woodland	Very dense, dominated by Swamp Paperbark, with Black Wattle and Narrow-leaf Cumbungi present	10	80
16	Swamp Scrub	Co-dominated by Swamp Paperbark and Black Wattle, moderate cover of Blackberry	30	70
17	Non- native	Dominated by Swamp Paperbark. Blackberry present	0	50
19	Swamp Scrub	Swamp Paperbark, Common Reed and Blackberry present. Swamp paperbark experiencing dieback	25	75
20	Swamp Scrub	Dominated by Swamp Paperbark, with a low cover of Common Reed. Swamp paperbark experiencing dieback	10	70





5. Discussion and recommendations

The following EPBC Benchmarks were to be met:

- Ensure that buffer areas are revegetated within 2 years of commencement of construction; and
- Less than 40% weed cover 5 years from the commencement of construction.

Active revegetation

Active revegetation through planting was not undertaken due to the dense vegetation cover and difficulties in managing Blackberry. Further, revegetation has been considered to not be required along the habitat buffers, as natural recruitment should be successful and likely to occur in areas where weeds are removed. The current monitoring supports this approach as the native vegetation cover is generally high (up to 80%) and mostly attributable to Swamp Paperbark. Further, the vegetation in the swales and drainage channels was usually dominated by native aquatic plants.

Weed management

As described in the results, the current level of weeds in the study area indicates that the EPBC Act approval benchmark has not been met as six of the 16 quadrats had weed covers of 40% or more (due to Blackberry) – these are quadrats 3, 7, 9, 10, 11 and 13.

The original target of less than 5% weed cover within 2 years from construction commencement has recently been revised to less than 40% weed cover within 5 years from construction commencement, following agreement with the Australian Department of Agriculture, Water and Environment (DAWE). This is mainly due to the high prevalence of Blackberry throughout the study area. Unlike other woody weeds, Blackberry cannot be easily treated with herbicide via the cut and spray method, due to its scrambling habit and the fact that a single plant has many main stems. Although Blackberry can be sprayed with herbicide, this is not advised for the following reasons:

- Issues with accessing the habitat buffers including deep water and often impenetrable vegetation.
- The habitat buffers are surrounded by a sensitive aquatic environment and the amount of herbicide that would need to be sprayed to effectively kill Blackberry could be harmful to aquatic and semi aquatic life, including Dwarf Galaxias.
- The Blackberry is intertwined with native vegetation and spraying it would cause a significant amount of off-target damage to native plants.
- The vegetation that the Blackberry is growing in is too dense and much of the Blackberry would not be able to be accessed.
- Blackberry provides protective habitat for local wildlife, such as small birds and mammals, which is particularly important in heavily developed areas such as Narre Warren.



The above issues with Blackberry removal currently pose an obstacle to meeting the EPBC Benchmark target for weed cover, as the recorded weed covers of 40% or more at six quadrats are due to Blackberry. Unless the current levels of Blackberry can be accepted (and maintained), reduction of Blackberry will be required. It is therefore recommended that potential options to reduce Blackberry be investigated despite the challenges, or further discussion may be required with DAWE regarding further review of Condition 4. It is also relevant to note that the potential issue of Swamp Paperbark dieback may further increase the difficulty in reducing Blackberry in the habitat buffers (see recommendation for dieback monitoring below).

Notwithstanding the above, Nature Advisory recommend that weed control efforts should also continue to remove the other woody weeds in the study area, namely Montpelier Broom, Flax-leaf Broom, Hawthorn and Desert Ash, that can be easily treated via the cut and paint method, providing they can be accessed. Treatment of herbaceous and grassy weeds along the edges of the swales/drainage channels around the habitat buffers should be continued. Weed treatment should include the recruiting Flax-leaf Broom and Patterson's Curse located on the slope of the drainage channel west of quadrat 15. The high-threat herbaceous weeds Spear Thistle and Ox-tongue should also be treated via spot-spraying.

For all weed species, weed management within the habitat buffers would be difficult to achieve given the access issues and weed management would be required to be undertaken by boat.

Monitoring of Swamp Paperbark dieback

As previously described, the Swamp Paperbark at quadrats 7, 9, 19 and 20 appeared to have dieback occurring. Concurrently, quadrats 7 and 9 also had the highest weed covers of the 16 quadrats (50%) due to Blackberry. There may have been less Blackberry at quadrats 19 and 20 due to very dense Swamp Paperbark and/or very wet conditions indicated by the presence of Common Reed.

The cause(s) of the dieback are not evident and it is possible that the lost foliage cover from Swamp Paperbark may return. However, it is strongly recommended that dieback in the habitat buffers be monitored regularly over the next year and at the next monitoring event, given the consequences of declining cover from Swamp Paperback would be less native vegetation cover and likely increase of Blackberry. If this should occur, early detection would help support more effective intervention.

Regular visual monitoring should suffice and could be conducted as part of the ongoing weed control works or as a separate program.

Rubbish removal

Rubbish should be removed from the study area as soon as possible. This is to be undertaken by the proponent within private land and by Council along Centre Road. It is strongly recommended that signage should be employed along the drainage channels, particularly along Centre Road where there is a public walking path, to deter rubbish dumping and littering. Rubbish management should be undertaken at regular intervals.



Sediment fencing

Collapsed or damaged sediment fencing (as mapped on Figure 1) should be rectified to prevent further sedimentation and run-off into the swales/drains. It is strongly recommended that all sediment fencing surrounding the habitat buffers are regularly checked and any collapsed/damaged fencing rectified in a timely manner, as part of routine on-ground works. Any sediment fencing that is no longer serving its purpose is to be removed to avoid the fencing becoming litter.

Algal bloom management

Algal blooms are an indicator of excess nitrogen and phosphorus in the water, and the algal blooms may impact on native aquatic plants (and therefore the quality of Dwarf Galaxias habitat) by consuming oxygen and blocking sunlight. Preventing soil erosion and run-off into the habitat buffers, as well as maintaining vegetation cover, will help to reduce algal blooms. In particular, sediment fencing around the habitat buffers will be required to be effective in controlling soil erosion and run-off (discussed above). Rubbish management will also support reduction of algal blooms.


Appendix 1: Representative photos of general quadrat locations















Appendix 2: General photos taken within the study area

The drainage channel along Centre Road was full of water and contained algal bloom.



Sediment fencing in good condition, with efforts to control erosion through the use of rock fill, hay bales and sandbags along the northern edge of the swale in the central part of the study area.





Sediment fencing along the path south of Billy Buttons Drive was generally intact but portions of it had begun to break down. The broken-down fencing must be rectified as soon as possible.



Example of sediment fencing in good condition along the northern edge of the swale in the eastern part of the study area.

