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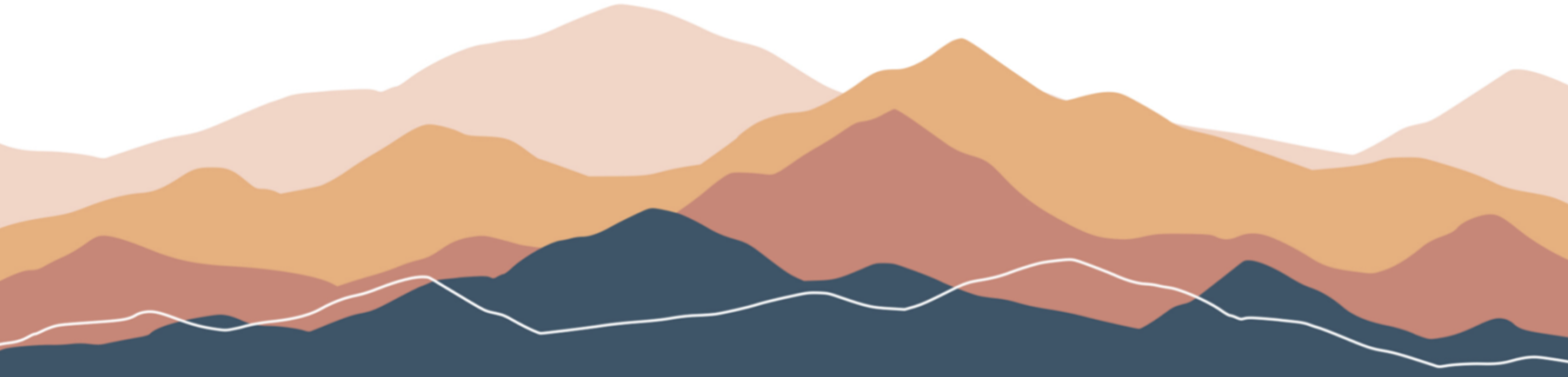

Prepared for the City of Greater Geelong

NWGGA STRATEGIC ASSESSMENT REPORT

Public re-exhibition version

November 2025

Acknowledgement of Country

The Country known now as Geelong is the traditional lands of the Wadawurrung, “the people who belong to the water”. Wadawurrung Country spreads from the Great Dividing Range of Ballarat, through to the coast from Werribee to Aireys Inlet. Wadawurrung Country includes the cities of Geelong (Djilang), Ballarat (Ballaarat) and Torquay (Jan Jook).

Open Lines and Biosis acknowledge the Wadawurrung Ancestors who care for and nurture Wadawurrung country. We acknowledge the harm and hardships Wadawurrung people have suffered, and continue to feel today. We acknowledge the Wadawurrung Traditional Owners today, who continue to practice and share their culture and maintain their role in looking after Country.

Contents of the NWGGA Strategic Assessment Report

Maps used in the Strategic Assessment Report

The Assessment Report presents a range of maps which are provided as separate PDF files. These are accessed by clicking on the map links throughout the report and the maps will open in a separate tab in your internet browser.

The table below outlines the maps in the report. Note that the map number is associated with the relevant chapter (for example, Map 3-1 is the first map in Chapter 3).

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Terms and acronyms used in the Strategic Assessment Report

Term	Acronym / Abbreviation	Description
Biodiversity Conservation Strategy	BCS	The overarching strategy for protecting matters of state environmental significance and national environmental significance.
Catchment Management Authority	CMA	The regulatory body responsible for integrated planning and coordination of water, land, and biodiversity management within each catchment.
Class of Actions	CoA	The term used to describe a single group of actions proposed to be undertaken for development under the strategic assessment
Classes of Actions	CoAs	The term used when referring to all 'class of actions' for the strategic assessment collectively.
Commonwealth Government Department of Climate Change, Energy, the Environment and Water	DCCEEW	The Commonwealth Government department primarily responsible for environment protection and conservation at a national level.
Commonwealth Minister for the Environment	The Minister	The Commonwealth Minister responsible for the *Environment Protection and Biodiversity Conservation Act 1999*.
Cowies Creek Conservation Area		The section of Cowies Creek within the WGGA to be protected and managed for conservation purposes under the Plan.
Cumulative impact assessment	CIA	Cumulative impacts relate to the combined impact of a range of activities within a region. Assessing cumulative impacts recognises that the combined effects of multiple activities on protected matters may be greater than the impact of an individual activity.
Development land		Specified land within the Strategic Assessment Area where development under the Plan is proposed to occur.
Development under the Plan		The broad term used to describe the scope of all development covered by the Class of Actions under the Plan.
Eastern Conservation Area		An area of land within the Northern Geelong Growth Area to be avoided for conservation purposes under the Plan.
Ecological Vegetation Classes	EVC	The standard unit used to classify vegetation types in Victoria.
Ecologically Sustainable Development	ESD	Defined as using, conserving, and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased. An additional definition can be found in Section 3A of the *Environment Protection and Biodiversity Conservation Act 1999*.
Ecology and Heritage Partners	EHP	The consulting company that completed ecological surveys within the Growth Areas.
***Environment Protection and Biodiversity Conservation Act 1999* (Cth)**	EPBC Act	The Commonwealth Government's central piece of environmental legislation, which provides a framework to protect and manage Matters of National Environmental Significance.
Extent of occurrence	EOO	The area contained within the shortest continuous imaginary boundary which can be drawn to encompass all known, inferred, or projected sites of present occurrence of a species or ecological

Term	Acronym / Abbreviation	Description
		community, excluding cases well outside an entity's normal distribution.
External infrastructure footprints		Proposed location of land within the Strategic Assessment Area but outside of the Growth Areas that is subject to development under the Plan.
Finalised priority assessment list	FPAL	List of species, ecological communities, and key threatening processes that have been nominated and approved for assessment and consideration for listing by the Minister responsible for the *Environment Protection and Biodiversity Conservation Act 1999*.
Gully avoidance area		An area of land within the Northern Geelong Growth Area to be avoided under the Plan.
Heales Road East process based development		The portion of the Heales Road East Precinct that is required to follow process based development as set out in Chapter 6 of the Plan
Indirect impacts		Secondary impacts to protected matters which can occur adjacent to or downstream of development from either construction or operational phases of development under the Plan
Interim Biogeographic Regionalisation for Australia subregion	IBRA subregion	Developed by the Commonwealth Government as a key planning tool to identify land for conservation. It has since become a spatial mapping and information source on vegetation communities and ecosystems across Australia.
Land subject to development		Development land within the Growth Areas subject to all classes of actions under the Plan.
Local Government Authority	LGA	The regulatory body responsible for managing local government matters.
Matters of National Environmental Significance	MNES	Defined under the *Environment Protection and Biodiversity Conservation Act 1999* as: • Listed threatened species and communities • Migratory species • Wetlands of international importance (listed under Ramsar) • Commonwealth marine environment • World Heritage properties • National Heritage places • The Great Barrier Reef Marine Park • Nuclear actions • A water resource, in relation to coal seam gas development and large coal mining development
Moorabool avoidance area		An area of land within the Western Geelong Growth Area to be avoided under the Plan.
Native vegetation removal regulations		The Victoria requires a permit to destroy, remove or lop areas of native vegetation. These regulations are referred to as the native vegetation removal regulations and are mostly implemented through the planning schemes for local councils.
Northern Conservation Area		An area of land within the Northern Geelong Growth Area to be avoided for conservation purposes under the Plan.
Northern and Western Geelong Growth Areas	NWGGA	The two Growth Areas identified by the City for urban development.

Term	Acronym / Abbreviation	Description
Northern and Western Geelong Growth Areas Framework Plan	The Framework Plan	The planning document developed by the City to describe the Growth Areas and their future development until 2047.
Northern Geelong Growth Area	NGGA	One of the two Growth Areas identified by the City for urban development.
Precinct Structure Plan	PSP	The master plan for a local area to provide a guide for localised investment and development. Precinct Structure Plans incorporate relevant directions outlined in a higher level Framework Plan.
Process based development		Development that is subject to an additional assessment process prior to development occurring. This is required because there is uncertainty around the location and/or extent of impacts of the development. Includes: • Development within part of the Heales Road East precinct • External infrastructure development
Protected matters search tool	PMST	A database that identifies whether MNES or other matters protected by the *Environment Protection and Biodiversity Conservation Act 1999* are likely to occur within an area or vicinity.
Ramsar Wetlands		A list of Wetlands of International Importance identified in the Ramsar Convention, which is maintained by the Commonwealth.
State Wide Integrated Flora and Fauna Teams	SWIFFT	An independent network comprised of community groups, government agencies and authorities, education and research institutes, conservation organisations, and landholders and managers with an interest in threatened species and biodiversity conservation.
Strategic assessment		Landscape-scale assessments undertaken under Part 10 of the *Environment Protection and Biodiversity Conservation Act 1999*. Unlike project-by-project assessments, which look at individual actions, strategic assessments can consider a much broader set of actions over a much larger scale and timeframe, such as a plan, policy, or program.
Strategic Assessment Agreement		The formal agreement between the Commonwealth Minister for Environment and the City of Greater Geelong to enter into the Strategic Assessment for the Northern and Western Geelong Growth Areas. It is a mandatory requirement under the *Environment Protection and Biodiversity Conservation Act 1999*, and formally establishes the expectations of both parties.
Strategic Assessment Area	SAA	The area subject to assessment of impacts on biodiversity values in the Strategic Assessment Report under the *Environment Protection and Biodiversity Conservation Act 1999*.
Strategic Assessment Report	SAR	An assessment report done in accordance with the Terms of Reference for the strategic assessment provided under the Strategic Assessment Agreement. See also Strategic Assessment Agreement.
Terms of Reference	ToR	Terms of Reference are a requirement under the *Environment Protection and Biodiversity Conservation Act 1999* for undertaking a strategic assessment and are prepared in accordance with the Strategic Assessment Agreement. The Terms of Reference outline the requirements for the Strategic Assessment Report, including how impacts to matters of national environmental significance should be assessed and how outcomes of the Plan are evaluated.

Term	Acronym / Abbreviation	Description
The City of Greater Geelong	The City	The Greater Geelong Local Government Authority. The City is responsible for the implementation of the Part 10 Strategic Assessment.
The Consulting Team		The consultants (including Biosis and Open Lines) commissioned by the City to undertake the Strategic Assessment.
The Northern and Western Geelong Growth Areas EPBC Plan	The Plan	The Northern and Western Geelong Growth Areas EPBC Plan (the Plan) has been prepared as part of the statutory requirements under Part 10 of the EPBC Act.
The Port Phillip Bay (Western Shoreline) & Bellarine Peninsula Ramsar Site.	The Ramsar site	The Ramsar site is one of the MNES relevant to the implementation on the Plan. It is a site listed under the Ramsar convention and occurs within the Study Area downstream of the Growth Areas.
Threatened Ecological Communities	TEC	An ecological community may be listed as vulnerable, endangered, or critically endangered under the *Flora and Fauna Guarantee Act 1988* and/or *Environment Protection and Biodiversity Conservation Act 1999* depending on the level of threat and risk of its collapse.
Victoria Planning Provisions	VPP	Comprehensive planning provisions for reference to construct planning schemes in Victoria.
Victorian Environment Protection Act 2017	EP Act	The Victorian legislation which includes environmental obligations and protections. The EP Act gives the Environmental Protection Authority enhanced authority to prevent impacts to the environment from waste and pollution.
Victorian Planning and Environment Act 1987	P&E Act	The Victorian Government Act which provides a framework for the use and development of land, and urban planning, in Victoria.
Victorian State Department of Environment, Energy and Climate Action	DEECA	The Victorian Government department responsible for environmental protection and conservation of biodiversity amongst other things.
The former Victorian Government Department of Environment, Land, Water and Planning	DELWP	The former Victorian Government department responsible for environmental protection, state planning regulation and various other things. The department has since been rearranged and split into DEECA and DTP
Victorian State Department of Transport and Planning	DTP	The Victorian Government department responsible for regulating state planning policies and frameworks
Western Geelong Growth Area	WGGA	One of the two Growth Areas identified by the City for urban development. Note that this area excludes the following three precincts which are not included in the Strategic Assessment: • Batesford South • Merrawarp Road • McCanns Land

Part 1: Introduction

NWGGA Strategic Assessment Report

Public re-exhibition version

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VERSION CONTROL:	
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PART 1: INTRODUCTION

1 Introduction

1.1 THE STRATEGIC ASSESSMENT

The City of Greater Geelong (the City) has identified two key areas for urban growth in Geelong's northwest, known as the Northern and Western Geelong Growth Areas (the Growth Areas).

The Growth Areas were identified through several State planning strategies for future growth. The City subsequently developed the *Northern and Western Geelong Growth Areas Framework Plan* (the Framework Plan) (The City of Greater Geelong, 2021b), which describes the Growth Areas and outlines considerations for their future development until 2047.

Geelong is considered to be Victoria's primary growth and population centre outside of Melbourne and contains numerous assets that are vital for the state's social, economic and environmental sustainability (Victoria State Government, 2017). The Growth Areas are the key areas identified for development to support Geelong's long-term growth. This growth is driven by a strong economy and employment opportunities that are expected to continue in the coming decades (Geelong Region Alliance, 2007; The City of Greater Geelong, 2021b).

Development within the Growth Areas and associated infrastructure development outside the Growth Areas will lead to impacts to biodiversity values protected under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and biodiversity values protected under Victorian biodiversity regulations.

To support development and protect matters of national environmental significance (MNES), the City is undertaking a strategic assessment under Part 10 of the EPBC Act. This enables a landscape scale assessment and approval of a suite of development actions under the EPBC Act and provides the opportunity to deliver improved environmental and development outcomes compared to project-by-project assessments through strategic consideration of biodiversity issues.

As part of the strategic assessment process, the City has prepared the *Northern and Western Geelong Growth Areas EPBC Plan* (the Plan) (The City of Greater Geelong, 2025). The Plan gives effect to the outcomes of the strategic assessment process and has been prepared in accordance with the Endorsement Criteria under the Agreement to undertake the strategic assessment (the Strategic Assessment Agreement). See Part 2 of this document for a description of the Plan and the associated implementation documents.

The Strategic Assessment Report (SAR) (this document) has been prepared to assess the impacts of the development under the Plan on MNES. The SAR also evaluates the adequacy of the Plan's outcomes, commitments and measures in protecting MNES over the life of the Plan.

1.2 PURPOSE OF THIS REPORT

The SAR assesses the potential impacts of the proposed development under the Plan on biodiversity values and other matters regulated under the EPBC Act. It has been prepared in accordance with the Terms of Reference (ToR) provided under the Strategic Assessment Agreement (refer to this link for the ToR and this link for the Strategic Assessment Agreement) made between the Commonwealth Minister for the Environment and the City of Greater Geelong under the EPBC Act (27 January 2022).

The purpose of the SAR is to address the ToR and assess the impacts of the proposed development taken under the Plan on all matters protected by Part 3 of the EPBC Act (protected matters).

The SAR will be considered by the Commonwealth Environment Minister in deciding to endorse the Plan under the EPBC Act. If the Plan is endorsed by the Minister, the Minister may subsequently consider approval of the proposed development in accordance with the endorsed Plan. If approved, development can proceed in the NWGGA without further approval under the EPBC Act, as long as it is undertaken in accordance with the Plan and any conditions of the Part 10 approval under the EPBC Act.

It is important to note that the SAR does not attempt to assess the impacts and outcomes to State biodiversity matters which are regulated at the State level.

1.3 SUMMARY OF PROJECT STATUS

This SAR along with the associated documents for the strategic assessment (EPBC Plan, Commitments and Measures document, Biodiversity Conservation strategy, and Funding Program) comprises the second round of documents released for public exhibition as part of the NWGGA Strategic Assessment project. This section outlines the:

- Need for re-exhibition
- Outcomes of the initial public exhibition of the Strategic Assessment documents
- Key changes in the revised document package

1.3.1 NEED FOR RE-EXHIBITION

The strategic assessment documentation was initially publicly exhibited in mid-2023. The Strategic Assessment Agreement states that:

> *"If, following consideration of any public comments received, either of the Parties is of the view that significant amendments (i.e. material and substantial amendments) to the draft Plan or draft Strategic Assessment Report are required, either of the Parties may elect to re-advertise the draft Plan and draft Strategic Assessment Report"*

The City with the support of the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) has elected to re-exhibit the strategic assessment documents. The key reason behind this decision was the rediscovery of the Victorian Grassland Earless Dragon (VGED) (*Tympanocryptis pinguicolla*) in Victoria combined with the need to amend the EPBC Plan in response to previous public comments.

VGED is a critically endangered species and was thought to be extinct prior to its rediscovery in January 2023. The rediscovery occurred outside the NWGGA and was an important finding for threatened species conservation. The finding has significant implications for development projects and approvals in Victoria that occur within the historical range of the species (which includes parts of the NWGGA). Importantly, the rediscovery was not publicly announced until after the initial public exhibition period for the strategic assessment was approved and could therefore not be considered as part of the initial document package.

Given the species was thought to be extinct, targeted surveys and habitat mapping for VGED were not undertaken as part of the initial biodiversity survey program for the NWGGA (EHP, 2021). To understand the potential value of the NWGGA for VGED following its rediscovery, Biosis undertook both targeted surveys and detailed habitat assessments between January and May of 2024 (Biosis, 2024). VGED was not recorded during the targeted surveys or opportunistic searches.

The data collected during the detailed habitat assessments was used to inform a VGED habitat attribute analysis (Biosis & Open Lines, 2024), which involved a range of analysis methods and scenarios to understand the potential value of land in the NWGGA for VGED.

Following this work on the VGED, a detailed avoidance planning process was undertaken for the project in 2024 (see Supporting Document C). This process considered both the information collected during the VGED survey program and habitat attribute analysis, and feedback from the first round of public exhibition.

The work completed on VGED and the revised avoidance process were deemed to be material and substantial amendments to the strategic assessment documentation package, and it was considered appropriate to re-exhibit the revised documents in 2025.

1.3.2 OUTCOMES OF THE INITIAL PUBLIC EXHIBITION OF THE STRATEGIC ASSESSMENT DOCUMENTS

The strategic assessment documentation package was publicly exhibited for a period of two months from 26th July 2023 to 25th September 2023 to provide an opportunity for the community and other stakeholders to provide feedback on the documents through formal submissions.

Over 45 formal submissions were received during this period. These submissions were reviewed by the City and the Consulting Team, and were considered in revising the EPBC Plan, Strategic Assessment Report, and the other relevant strategic assessment documents.

Some of the key themes or issues raised throughout these submissions include:

- The need for further avoidance of biodiversity values, particularly for Striped Legless Lizard (*Delma impar*), Natural Temperate Grassland of the Victorian Volcanic Plains, and Golden Sun Moth (*Synemon plana*)
- The importance of the NWGGA for the provision of housing
- The social and economic importance of development within the NWGGA
- The need for strong interim management of avoided land
- Concern regarding the width of riparian corridor buffers
- The importance of connectivity and biolinks within the Growth Areas
- Various concerns on the proposed governance and assurance processes of the EPBC Plan
- Concerns relating to stormwater management and hydrological impacts

A detailed summary report addressing feedback from both the initial and second exhibition periods will be prepared after this exhibition period.

1.3.3 KEY CHANGES IN THE REVISED DOCUMENT PACKAGE

Table 1-1 outlines the key changes made to the revised strategic assessment documentation package and the location of these changes. There were also a range of more minor changes throughout the documents that:

- Respond to comments from the initial public exhibition period
- Reflect progression in the planning for NWGGA that has happened since 2023

Table 1-1: Key changes made to the revised document package

Key change	Description	Key locations of the changes in the document package
Further avoidance	A new detailed avoidance planning process was undertaken in response to both comments from the first exhibition period, and rediscovery of VGED This process is described in Supporting Document C	EPBC Plan: Section 5 BCS: Section 4 Commitments and Measures document Strategic assessment report: Chapters 16, 19, 20, and 21 of Part 4 Supporting Document C: NWGGA Strategic Assessment - final structured decision making process for the layout of the growth areas
Detailed work on VGED	Biosis were commissioned by the City to undertake targeted surveys and detailed habitat assessment for VGED (Biosis, 2024) The work was used to inform the VGED habitat attribute analysis (Biosis & Open Lines, 2024) The results of the survey program and the habitat attribute analysis were used to inform the detailed impact assessment for the species	Strategic Assessment Report: Section 19.5 of Part 4 Supporting Document A: *Victorian Grassland Earless Dragon, targeted surveys, and habitat suitability assessment - Geelong Growth Areas* (Biosis, 2024) Supporting Document B: *Victorian Grassland Earless Dragon Habitat Attribute Analysis* (Biosis & Open Lines, 2024)

Key change	Description	Key locations of the changes in the document package
Incorporating new information	A range of new Conservation Advices, Recovery Plans, and scientific literature was available following the initial public exhibition	Strategic assessment report: Chapters 19, 20, 21 and Attachment A, B, & C of Part 4
Development of key performance indicators (KPIs) for outcomes and commitments	To provide further certainty around the monitoring of achievement of outcomes and commitments under the Plan's MERI framework. KPIs have been developed for outcomes and commitments of the Plan and BCS. Originally the KPIs were scheduled to be developed post approval	Commitments and Measures document: Section 2 for Plan outcomes and commitments and Section 3 for BCS outcomes and commitments
Revision and amendment to the outcomes, commitments and measures	To address a range of updates including further avoidance and VGED impacts, additional commitments and associated measures have been provided. A number of the original outcomes, commitments and measure have also been subject to minor changes	Commitments and Measures document As relevant throughout the Plan, BCS and SAR

2 Regulatory context

This Chapter provides an overview of the key steps in the legislative processes for strategic assessments under Part 10 of the EPBC Act. The key steps are shown in Figure 2-1.

2.1 EPBC ACT

The EPBC Act is Australia's key piece of legislation to protect and manage Australia's nationally and internationally important biodiversity, environment and heritage places. The objectives of the EPBC Act include:

- Providing for the protection of the environment (specifically MNES)
- Promoting Ecologically Sustainable Development (ESD) through the sustainable use of natural resources
- Promoting the conservation of Australian biodiversity and heritage
- Promoting a cooperative approach to the protection and management of the environment
- Assisting in the cooperative implementation of Australia's international responsibilities
- Recognising and promoting the role and knowledge of Indigenous people in the conservation and ecologically sustainable use of Australia's biodiversity

Under Part 10 of the EPBC Act, the Commonwealth Minister for the Environment (the Minister) can agree to undertake a strategic assessment of the impacts of a policy, plan or program on matters protected under the EPBC Act.

The Agreement to undertake the NWGGA strategic assessment was signed by the City of Greater Geelong and the Minister on 27 January 2022. The Agreement includes Terms of Reference (ToR) to guide the preparation of the Strategic Assessment Report (SAR), as well as a set of Endorsement Criteria to ensure the Plan meets the requirements of the EPBC Act and is able to be adequately implemented (refer to this link for the ToR and this link for the Strategic Assessment Agreement).

The ToR outline what the SAR must contain to allow the Minister to endorse the Plan. The Strategic Assessment Agreement, SAR and Plan must all be publicly exhibited, and any public submissions need to be considered to finalise the documentation.

The Strategic Assessment Agreement provides that, in determining whether or not to endorse the Plan, the Minister will consider the Plan against the Endorsement Criteria provided in the agreement to ensure the Plan meets the requirements of the EPBC Act and is able to be adequately implemented.

Following endorsement of the Plan, the Minister may approve the taking of actions in accordance with the endorsed policy, plan or program subject to a range of general considerations (s 146F) and constraints on decision making (s 146G-M), including to not act inconsistently with a recovery plan or threat abatement plan for a protected matter (s 146K).

Actions undertaken in accordance with a policy, plan or program endorsed by the Minister do not require further assessment and approval for impacts on protected matters under the EPBC Act. The Minister may endorse a policy, plan or program if satisfied that the Assessment Report adequately addresses the impacts on protected matters to which the agreement relates (s 146(2)(f)) and that any recommended modifications to the policy, plan or program by the Minister have been made (s 146 (2f(ii))).

2.1.1 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

Matters of National Environmental Significance (MNES) are protected matters under the EPBC Act for which impacts need to be adequately addressed to enable the Minister to endorse a policy, plan or program.

Only a subset of MNES are relevant to this strategic assessment (see Chapter 18: Relevant protected matters for details). They are:

- Wetlands of international importance
- Nationally threatened species and ecological communities
- Migratory species

2.2 OTHER APPROVALS REQUIRED FOR THE PROPOSED DEVELOPMENT

The SAR has been prepared to meet the requirements of the EPBC Act (as discussed above) and does not attempt to assess the impacts and outcomes on State biodiversity matters. However, to enable development to proceed and for successful implementation of the Plan, a range of planning and environmental approvals will be required at the State level, including (but not necessarily limited to):

- Planning approvals under the *Planning and Environment Act 1987*
- Non-Aboriginal heritage approvals under the *Heritage Act 2017*
- Aboriginal cultural heritage approvals under the *Aboriginal Heritage Act 2006*
- Pollution and waste approvals under the *Environment Protection Act 2017*
- Water and waterway related approvals under the *Water Act 1989*

Implementation is described further in the Plan and Part 2 of the SAR.

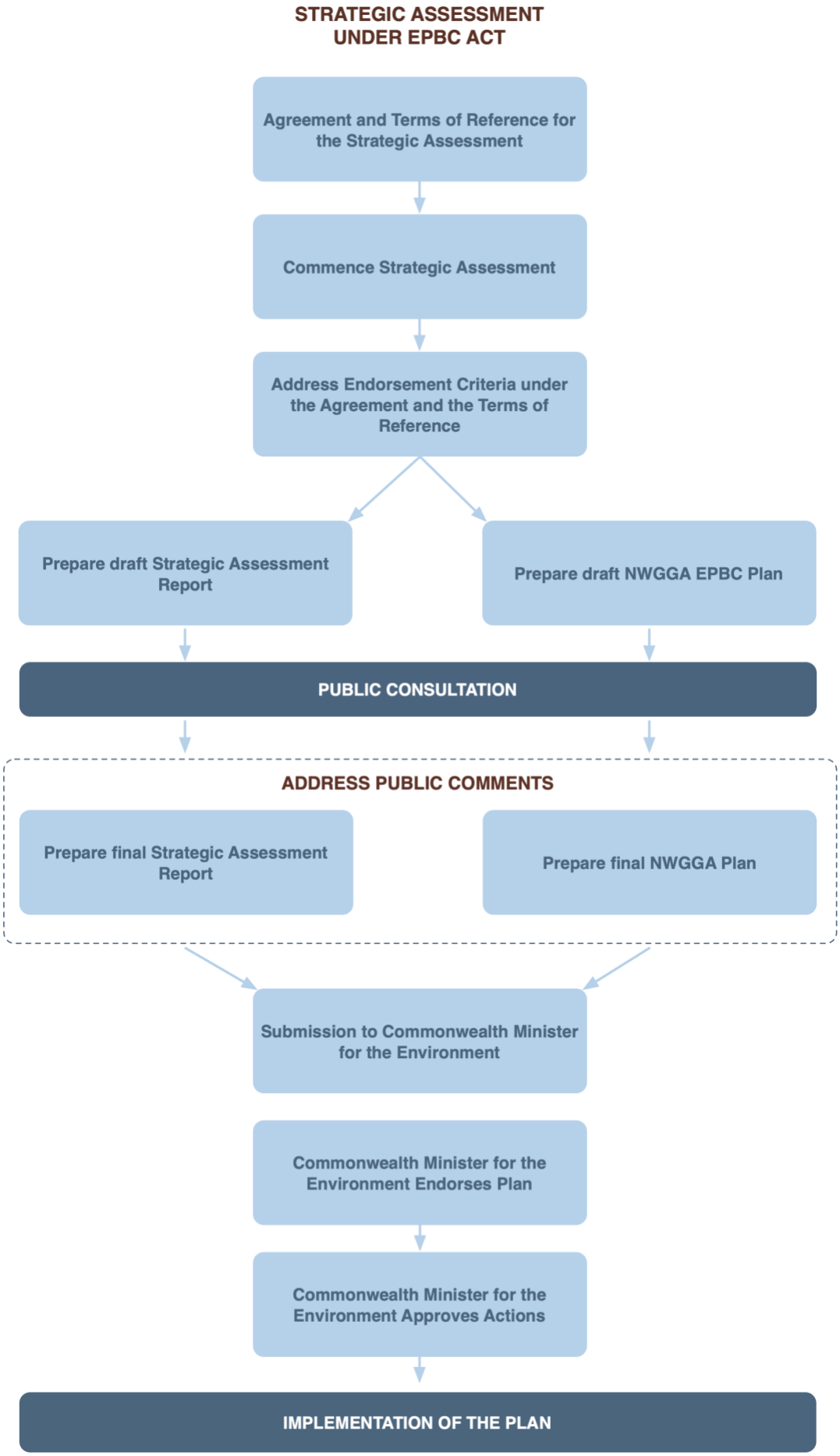

Figure 2-1: Key steps in the strategic assessment process

3 Overview of the Northern and Western Geelong Growth Areas

3.1 INTRODUCTION

The strategic assessment proposes development within two Growth Areas, located on the north-western outskirts of Geelong within Victoria. This chapter provides a brief overview of the landscape context of the region, including key environmental values and threats.

More detailed information regarding baseline data, protected matters, and assessments of potential impacts to protected matters under the Plan, are outlined later in the SAR. See Chapter 4 for a detailed outline of where specific information is located within the SAR.

The relevant items in the ToR relating to the overview of the Growth Areas are outlined in the following text box:

3.1. The Report must describe the nature of the environment within the strategic assessment area that may be impacted by actions proposed to be taken under the Plan. This must include (at a minimum):

a) a description and map of current and historical land-use, including consideration of areas which may pose an environmental risk

b) a description of indigenous land-use and values

c) the broad extent, type and quality of vegetation present in the strategic assessment area, where such information is available or is required in the relevant EPBC Act statutory document for a protected matter (such as a recovery plan)

d) a description of the nature of the terrestrial and aquatic environment, including the state of natural and physical resources, ecological processes, and threatening processes

e) a description of relevant state-protected environmental and heritage values

f) a description of the landscape context and key environmental matters, such as any known habitat connectivity, habitat fragmentation, and ecological processes

g) map or maps of areas that are already protected, including national parks, nature reserves, and known offset areas under both Commonwealth and/or State legislation

…

i) the location of any declared World Heritage properties or National Heritage places in the strategic assessment area and identification of sensitive heritage areas for protected matters

3.2 OVERVIEW OF THE STRATEGIC ASSESSMENT AREA AND GROWTH AREAS

The area covered by the Plan is called the Strategic Assessment Area (SAA) (see Map 3-1). It is 7,101 ha in size and occurs within the Victorian Volcanic Plains Bioregion. It includes:

- The entirety of the Northern Geelong Growth Area (NGGA) that was identified in the Framework Plan. The NGGA is 2,103.9 ha in size and occurs in the Lovely Banks locality
- Two out of the five precincts of the Western Geelong Growth Area (WGGA) that were identified in the Framework Plan. The two precincts occur in the north of the WGGA and are Creamery Road and Batesford North. These precincts are 767.2 ha in size and occur in the Bell Post Hill/Batesford localities

The remaining portion of the WGGA that was identified in the Framework Plan covers 2,472.3 ha and has been excluded from the strategic assessment due to a lack of information and resolution relating to a range of factors needed to support and rationalise a full assessment and approval under the EPBC Act. This includes the anticipated development demand and timing, and the detailed plans for decommission and rehabilitation of the active Batesford Quarry.

The Strategic Assessment Area also includes external infrastructure development outside of the Growth Areas, which are required to support development within the Growth Areas and help deliver the development objectives of the Framework Plan. External infrastructure development is described further in Section 7.4 of Part 2.

3.2.1 LOCALITY

The Strategic Assessment Area occurs towards the northern half of the city of Geelong in southern Victoria, south-west of Melbourne on the western shoreline of Port Phillip Bay.

The Strategic Assessment Area boundary extends to the southern Anakie locality in the north, to the Moorabool locality in the west, and south to the Batesford locality. The eastern boundary of the Strategic Assessment Area is irregular, with two arms extending east, the southern arm capturing the region surrounding Cowies Creek to the shore of Corio Bay, and the northern arm occurring to the north of Geelong Ring Road and extending towards the Princes Freeway.

A 20 km buffer around the Strategic Assessment Area has been used to identify protected matters which may be impacted by the Plan. This area is called the Study Area.

3.2.2 ADMINISTRATIVE CONTEXT

Both of the Growth Areas occur wholly within the boundaries of the Greater Geelong City LGA. A small area of the Strategic Assessment Area (to the west of the WGGA) extends into the neighbouring Golden Plains Shire LGA, otherwise the remainder of the Strategic Assessment Area is located within the Greater Geelong City LGA. The Study area occurs across the Greater Geelong City, Golden Plains Shire, Moorabool Shire, Surf Coast Shire, and Wyndham City LGAs.

The Strategic Assessment Area is wholly contained within the Corangamite Catchment Management Authority (CMA) region. The majority of the Study Area occurs within the Corangamite CMA, with the northern area extending into the Port Phillip and Westernport CMA.

Refer to Map 3-2 for a map showing the administrative context of the Study Area.

3.3 LANDSCAPE CONTEXT

This section sets out the landscape context for the strategic assessment. It provides brief descriptions of:

- Relevant IBRA bioregions
- Climate of the region
- Geology and soil
- Historical and current land uses
- Protected areas
- Terrestrial environmental values of the strategic assessment area
- Other landforms connected to the strategic assessment area
- Topography and surface hydrology

- Groundwater characteristics and connectivity
- Water-based environmental values

3.3.1 IBRA BIOREGIONS

The region surrounding Geelong includes multiple IBRA bioregions, reflecting the diversity of environments present within the wider landscape. Each of the IBRA regions present, and their relationship to the Strategic Assessment Area, is outlined below.

Refer to Map 3-3 for a map showing the IBRA bioregion boundaries of the Study Area.

SOUTHERN VICTORIAN VOLCANIC PLAIN BIOREGION

The Strategic Assessment Area itself is wholly contained within the Southern Volcanic Plain bioregion.

The Southern Volcanic Plain bioregion mostly occurs in Victoria (hence it was previously known as the Victorian Volcanic Plains bioregion), yet it is now recognised to extend into South Australia. It stretches from Melbourne in the east to the Mt Gambier region in the west. The bioregion is characterised by broad basaltic plains, interspersed with areas of lakes and swamps. Native grasslands occur in areas where basalts are older and more weathered to produce heavy clays which are generally fertile yet poorly drained. Younger occurrences of relatively unweathered lava flows occur as stony rises, and support thin soils and woodland vegetation (Dahlhaus *et al.*, 2003; Williams, 2022).

SOUTH-EAST COASTAL PLAIN BIOREGION

To the south and downstream of sections of the Strategic Assessment Area is the Otway Plains subregion of the South-East Coastal Plain bioregion.

The South-East Coastal Plain bioregion is comprised of undulating Tertiary and Quaternary coastal plains and hinterlands, and ranges from Tyrendarra in the west to Lakes Entrance in the east. The Otway Plain subregion includes coastal plains, river valleys and foothills from the Bellarine Peninsula, west to Princetown (Environment Australia, 2000).

The South-East Coastal Plain bioregion as a whole includes a wide variety of vegetation, ranging from lowland forests, grasslands and grassy woodlands, heathlands, shrublands, freshwater and coastal wetlands, mangrove scrubs, saltmarshes, dune scrubs and coastal tussock grasslands (Environment Australia, 2000).

VICTORIAN MIDLANDS BIOREGION

The Victorian Midlands bioregion occurs in the region as higher elevation, wooded areas to the north-east and north-west of the Strategic Assessment Area (including the Brisbane Ranges National Park and You Yangs Regional Park). The closest boundaries of this bioregion to the Strategic Assessment Area occur approximately 8.5 km to the north-east and 6 km to the north-west.

This bioregion comprises extensive areas of isolated ranges and foothills which make up the lower inland slopes of the Great Dividing Range and extends from north-eastern Victoria to Casterton in Western Victoria. Vegetation within this bioregion mostly comprises Eucalyptus forests and woodlands. Flatter and more fertile occurrences of this bioregion have been substantially cleared for agriculture or impacted by timber harvesting. In less fertile areas of this bioregion, substantial areas of native vegetation remain in good condition (Environment Australia, 2000).

3.3.2 CLIMATE

Geelong is located within a temperate climate zone, with dominant westerly winds, variable cloud cover, moderate rainfall and cool temperatures (Agriculture Victoria, 2020).

Geelong experiences average annual rainfall of around 550 mm. Summer temperatures range from average daily maximum temperatures of 24.6°C to average daily minimum temperatures of 13.2°C. Winter temperatures range from average daily maximum temperatures of 14.4°C to average daily minimum temperatures of 5.6°C (Agriculture Victoria, 2020).

The region's climate is predicted to change as a result of climate change, with predicted increases in maximum and minimum daily temperatures, increased variability in rainfall (with lower winter, spring and autumn rainfall, and increased extreme rainfall events), and increases in the length of the fire danger season (The City of Greater Geelong, 2021a).

3.3.3 GEOLOGY AND SOIL

The Victorian Volcanic Plains was created by volcanic activity which occurred between approximately 4.5 million to 10,000 years ago. Volcanic activity was mostly from many small volcanoes which created lava flows of basalt, which filled in valleys and created broad plains. There are some occurrences of more explosive eruptions in the region which created circular craters which today contain lakes and swamps (Williams, 2022).

Today, the geology of the Strategic Assessment Area is dominated by areas of basalt, interspersed with areas of alluvial deposits (associated with the Moorabool River) and aeolian deposits (associated with Cowies Creek). The areas of basalt are characterised as plains with poorly developed drainage and with shallow bedrock. Aeolian deposits tend to be characterised as plains with unconsolidated sedimentary deposits, and areas of alluvium are described as unconsolidated sediment occurring as terraces, floodplains, and coastal plains (DELWP, 2022).

3.3.4 HISTORICAL LAND USES, HERITAGE AND CURRENT LAND USES

INDIGENOUS HISTORICAL LAND USE AND HERITAGE VALUES

The traditional owners of the land are the Wadawurrung Aboriginal people, a recognised tribe consisting of 25 clans (family groups), which form part of the larger Kulin Nation of Aboriginal people. The Country known now as Geelong was occupied for at least 45,000 years by traditional owners prior to European Settlement (Rowe, 2021).

There are a number of registered Aboriginal places across the Growth Areas, comprised mostly of stone artefacts. There has been limited archaeological investigation within the Growth Areas, and the available data may not accurately reflect land use by the Wadawurrung people. Preliminary Aboriginal site sensitivity mapping has indicated areas of high archaeological potential along the waterways on the WGGA and one area in the NGGA near to a registered stone artefact (The City of Greater Geelong, 2021b).

Section 26.3 of Part 4 provides further information about the Wadawurrung people.

EUROPEAN HISTORICAL LAND USE AND HERITAGE VALUES

The open and fertile Southern Volcanic Plains bioregion was quickly colonised by European settlers in the 1830's and 1840's (Dahlhaus *et al.*, 2003). As part of this bioregion, the Geelong locality has experienced substantial historical agricultural development.

The city of Geelong itself also has a long history of development. It was first proclaimed as a town in 1838 (Monument Australia, 2010). A rail link was established between Geelong and Melbourne in 1857, and since the 1930's, Geelong has been the second largest city in Victoria (Victorian Places, 2015).

Refer to Map 3-4 for a map showing historical land uses within the Strategic Assessment Area, as indicated by aerial photographs of the region from 1947.

Post contact heritage values in the NGGA are mostly related to the early settlement of large pastoral estates, and the eventual subdivision to small-scale freehold agricultural enterprises. Post contact heritage values within the WGGA are related to early settlement of large pastoral estates, rail and road infrastructure, quarrying and the history of the Fyansford and Batesford townships (The City of Greater Geelong, 2021b).

Section 26.3 of Part 4 provides further information about post European settlement.

World Heritage Properties and National Heritage Places

There are no World Heritage Properties or National Heritage Places within the Strategic Assessment Area or wider Study Area.

State heritage places

There are two state heritage places within the Growth Areas. These include (The City of Greater Geelong, 2021b; Heritage Council Victoria, 2022):

- The Elcho Homestead, a Gothic homestead constructed in 1867, located in the north-east of the NGGA
- The bridge over Moorabool River, one of the earliest and longest stone arch road bridges in Victoria, constructed in 1859, located in the south-east corner of the WGGA

Outside of the Growth Areas and within the wider strategic assessment area, there are an additional seven state heritage places (Heritage Council Victoria, 2022):

- Cowies Creek Rail Bridge No1, a two-span segmental arch bluestone railway bridge constructed in 1860
- Cowies Creek Rail Bridge No2, a single span semicircular arch bluestone bridge constructed in 1860
- Ford Motor Company Complex, comprising of two steel-framed factory buildings with attached offices
- Former Moorabool Railway Station, a historical railway station constructed in 1861
- Former Travellers Rest Inn, an inn with a Colonial Georgian structure which was erected in 1849
- Laurence Park Homestead – a 'H' shaped colonial building constructed in 1845
- Railway Viaduct – a 396 m railway viaduct constructed over the Moorabool River in 1862

CURRENT LAND USE

Today, the Strategic Assessment Area primarily includes land which has been developed for agricultural purposes. The NGGA is primarily used for pastoral and cropping activities, associated with rural residential housing. The WGGA includes a mix of existing land uses, including agriculture, recreation reserves, Council-managed reserves, rural and medium density housing, and educational facilities. While the WGGA does not contain any formal conservation reserves, there are a number of reserves managed by the City – including the Moorabool River Reserve (EHP, 2021).

The city of Geelong is a large urban centre and supports a population of over 250,000, which is forecast to be nearly 400,000 by the early 2040's (Corangamite CMA, 2022a).

Refer to Map 3-5 for a larger scale map showing current land uses across the wider Study Area, and Map 3-6 for a more detailed map showing current land uses within the Strategic Assessment Area.

3.3.5 PROTECTED AREAS

Due to substantial agricultural development, the Southern Volcanic Plain bioregion has become one of the bioregions most depleted of native vegetation in Victoria. As of 2003, only 4.5 per cent of the bioregion still had a cover of native vegetation. Further, as of 2003, less than 1.2 per cent of the Southern Volcanic Plains bioregion was in a formal conservation reserve (DSE, 2003).

There are minimal protected areas within the Strategic Assessment Area, including:

- Cowies Creek Frontage – A small (approximately 0.9 ha) Natural Feature Reserve occurring adjacent to Cowies Creek downstream from the WGGA
- Moorabool River Water Frontage – A Natural Feature Area which follows the Moorabool River, occurring adjacent to the WGGA and within the southern edge of the Strategic Assessment Area

There is one national park, the Brisbane Ranges National Park, that occurs partially within the Study Area approximately 15 km north of the Strategic Assessment Area. There are a number of protected areas across the broader Study Area, including:

- Inverleigh Nature Conservation Reserve – approximately 18.6 km north of the Strategic Assessment Area
- Serendip Wetlands Educational Facility – approximately 4 km north-east of the Strategic Assessment Area
- Lake Connewarre Wildlife Reserve -approximately 10.7 km south-east of the Strategic Assessment Area
- Limeburners Lagoon - approximately 1.3 km east of the Strategic Assessment Area
- The Spit Nature Conservation Reserve - approximately 9.2 km east of the Strategic Assessment Area
- The Western Grasslands Reserve - approximately 17 – 18 km north-east of the Strategic Assessment Area
- You Yangs Regional Park – approximately 5 km north of the Strategic Assessment Area
- Dog Rocks Flora and Fauna Sanctuary - approximately 0.2 km south of the Strategic Assessment Area

Refer to Map 3-7 for a map showing the existing protected areas of the Study Area.

3.3.6 TERRESTRIAL ENVIRONMENTAL VALUES OF THE STRATEGIC ASSESSMENT AREA

OVERVIEW

The condition of the environment within the Strategic Assessment Area varies and is mostly degraded. Most of the area is highly modified due to agricultural land use and is largely dominated by non-native species. Native vegetation and terrestrial fauna habitat are limited to areas which have not been historically subject to cropping, and to riparian corridors. Where native vegetation is present, much of it is highly modified with a low diversity of native species and lacking in suitable vegetation structure (EHP, 2021).

Despite this, the Strategic Assessment Area supports a range of terrestrial environmental values including habitat for threatened species and threatened ecological communities (TECs), typically in areas which have been subject to reduced levels of historical disturbance. The threatened species and TECs contained within the Strategic Assessment Area are described below.

The existing level of disturbance within the Strategic Assessment Area is consistent with the broader landscape trend within the Southern Volcanic Plains Bioregion, where the vast majority of the bioregion has been developed for agriculture (DSE, 2003).

DESCRIPTION OF NATIVE VEGETATION COMMUNITIES WITHIN THE STRATEGIC ASSESSMENT AREA

Refer to Map 3-8 for a map showing the distribution of native vegetation within the Growth Areas and the Strategic Assessment Area.

Native vegetation within the Growth Areas

Threatened ecological communities

A total of 1,409.4 ha (67 per cent) of the NGGA and 666 ha (86.8 per cent) of the WGGA was subject to site surveys. The following TECs were identified within the surveyed areas of the NGGA (EHP, 2021):

- 12.7 ha of the Commonwealth listed TEC Natural Temperate Grassland of the Victorian Volcanic Plain
- 123.8 ha of the State significant ecological community Western Basalt Plains Grassland

No TECs (either Commonwealth listed or State listed) were identified within the surveyed areas of the WGGA (EHP, 2021).

A total of 694.5 ha (33 per cent) of the NGGA and 101.2 ha (13.2 per cent) of the WGGA have not been surveyed. These areas generally comprise many small, rural residential landholdings which are fragmented by windrows/landscaping and have a much higher proportion of land use for dwellings and driveways compared to the broader Growth Areas. The environment within these unsurveyed areas tends to be more modified or degraded as a result. It is possible that these unsurveyed areas contain additional patches of native vegetation, and additional Natural Temperate Grassland may occur in the unsurveyed areas of the NGGA (EHP, 2021). See Section 13.3.2 of Chapter 13 for more details on the unsurveyed areas, and Section 21.1.1 of Chapter 21 for a description of Natural Temperate Grassland in the unsurveyed areas.

Ecological Vegetation Classes

Within the surveyed areas of the NGGA 146.4 ha of *Low Rainfall* Plains Grassland (EVC 132_63) was recorded (EHP, 2021). Within the surveyed areas of the WGGA a total of 69.5 ha of native vegetation was recorded. This includes (EHP, 2021):

- 23.1 ha of Floodplain Riparian Woodland (EVC 56)
- 4.9 ha of Creekline Grassy Woodland (EVC 68)
- 41.5 ha of *Low rainfall* Plains Grassland (EVC 132_63)

Some additional patches of native vegetation may also occur within the unsurveyed areas of the Growth Areas (EHP, 2021).

Native vegetation outside of the Growth Areas within the Strategic Assessment Area

Modelled EVCs (DELWP, 2005) across the Strategic Assessment Area and broader Study Area indicate that the Study Area contains a range of native vegetation types. Vegetation is relatively fragmented across the landscape, reflecting the historical and current agricultural land use, and urbanised areas. Some large patches of native vegetation occur in protected areas such as the Brisbane Ranges National Park, You Yangs Regional Park, and in areas of the Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar Site.

DESCRIPTION OF THREATENED SPECIES WITHIN THE STRATEGIC ASSESSMENT AREA

Threatened flora

Targeted surveys for six Commonwealth listed threatened flora species were undertaken within the Growth Areas, including: *Lachnagrostis adamsonii* (Adamson's Blown-grass), *Dianella amoena* (Matted Flax-lily), *Glycine latrobeana* (Clover Glycine), *Rutidosis leptorrhynchoides* (Button Wrinklewort), *Senecio macrocarpus* (Large-fruit Fireweed) and *Pimelea spinescens* subsp. *spinescens* (Spiny Rice-flower). No Commonwealth listed threatened flora species were recorded within the surveyed areas, although, *Lachnagrostis adamsonii* (Adamson's Blown-grass) has been assumed to be present in WGGA based on relatively recent historical records, and the presence of suitable habitat (EHP, 2021).

It is considered highly unlikely that any additional Commonwealth listed flora species occur within the areas which were surveyed within the Growth Areas due to the ongoing land use of the site resulting in the absence of suitable habitat, and the highly modified condition of the understory (EHP, 2021).

One state listed flora species, *Maireana aphylla* (Leafless Bluebush) was recorded at the north-eastern boundary of the NGGA. Known records of *Eucalyptus leucoxylon* subsp. *connata* (Melbourne Yellow-gum) were confirmed to occur approximately 1 km south of the WGGA (EHP, 2021).

On site surveys have not been conducted in the Strategic Assessment Area outside the Growth Areas. There are several records of *Lachnagrostis adamsonii* (Adamson's Blown-grass) associated with Cowies Creek outside of the WGGA. One additional Commonwealth listed threatened flora species, *Pimelea spinescens* subsp. *spinescens* (Spiny Rice-flower) has been recorded within the Strategic Assessment Area, east of the NGGA.

Threatened fauna

Ecology Heritage and Partners (EHP, 2021) undertook targeted surveys for the following Commonwealth listed threatened fauna species within the Growth Areas, *Synemon plana* (Golden Sun Moth), *Delma impar* (Striped Legless Lizard), *Litoria raniformis* (Growling Grass Frog), *Prototroctes maraena* (Australian Grayling) and *Galaxiella toourtkoourt* (Little Galaxias) (EHP, 2021).

Surveys recorded the Striped Legless Lizard and Golden Sun Moth within the NGGA. Growling Grass Frogs were recorded in Cowies Creek within the WGGA. Targeted surveys for the Australian Grayling and Little Galaxias within the WGGA did not identify the species. However, the Australian Grayling is considered likely to be present within the broader catchment area. It is noted that the Corangamite CMA has proposed to remove barriers within the Moorabool River which currently prevent fish accessing habitat further upstream adjacent to the WGGA. Future planning for the WGGA PSPs should assume the presence of the Australian Grayling and Little Galaxias following the removal of these barriers (EHP, 2021).

A single state significant fauna species *Aythya australis* (Hardhead) was observed within the NGGA during surveys, although it is considered unlikely that the species would maintain a resident population within the Growth Areas. *Ardea modesta* (Eastern Great Egret) and *Falco subniger* (Black Falcon) have recently been recorded in close proximity to the Growth Areas, and it is likely that these species would use to the Growth Areas for opportunistic forage, or as a steppingstone throughout the broader landscape. An active *Ornithorhynchus anatinus* (Platypus) burrow was observed within the Moorabool River. The NGGA also supports habitat for *Pseudemoia pagenstecheri* (Tussock Skink) and Fat-tailed Dunnart (*Sminthopsis crassicaudata*) (state-significant reptiles) which were recorded by Biosis (Biosis, 2024).

Targeted, on-ground surveys have not been conducted in the broader Strategic Assessment Area outside the Growth Areas for this project. However, there are existing records for a number of Commonwealth listed threatened fauna species which within the Strategic Assessment Area. These include *Callocephalon fimbriatum* (Gang-gang Cockatoo), *Delma impar* (Striped Legless Lizard), *Litoria raniformis* (Growling Grass Frog), *Macquaria australasica* (Macquarie Perch), and *Synemon plana* (Golden Sun Moth).

Following the rediscovery of VGED, Biosis undertook both targeted surveys and detailed habitat assessments between January and May of 2024 (Biosis, 2024). VGED was not recorded during the targeted surveys or opportunistic searches. The data collected during the detailed habitat assessments was used to inform a VGED habitat attribute analysis (Biosis & Open Lines, 2024), which involved a range of analysis methods and scenarios to understand the potential value of land in the NWGGA for VGED. Supporting Document A provides the survey report for VGED, and Supporting Document B provides the VGED habitat attribute analysis report.

3.3.7 OTHER LANDFORMS CONNECTED TO THE STRATEGIC ASSESSMENT AREA

While the Strategic Assessment Area itself is comprised largely of basaltic plains, there are a variety of other landforms within the region which are connected to the Strategic Assessment Area by virtue of being downstream. These include:

- Riparian environments (such as those of the Moorabool and Barwon Rivers)
- Wetlands (such as Limeburners Bay and the Lake Connewarre Complex)
- An estuary (Corio Bay, which is connected to Port Phillip Bay)

The degree to which each of these landforms is connected to the Strategic Assessment Area varies, depending strongly upon the topographical and hydrological characteristics of the landscape, and the distance of the landform from the Strategic Assessment Area.

Refer to Map 3-9 for a map showing the locations of each of these landforms.

3.3.8 TOPOGRAPHY AND SURFACE HYDROLOGY

The Strategic Assessment Area occurs within the Moorabool River Basin. The broader Study Area spans across the Moorabool Basin in the north, the Barwon River Basin in the south, and a small area of the Otway Coast Basin in the southern edge of the Study Area.

There are three catchments which the Growth Areas are hydrologically linked to via overland flow:

- Moorabool River catchment, which occurs to the south of the Strategic Assessment Area. The Moorabool River flows south, joining the Barwon River at Fyansford. The Barwon then continues to flow south, into the Lake Connewarre Complex. This wetland complex then drains into the ocean at Barwon Heads
- Hovells Creek catchment, which occurs to the east of the northern half of the Strategic Assessment Area. This catchment contains Limeburners Bay, and drains southward into Corio Bay
- Cowies Creek catchment, which occurs to the east of the central and southern half of the Strategic Assessment Area. This creek drains eastward into Corio Bay

Refer to Map 3-10 for a map showing the drainage of the Growth Areas to each of these catchments.

The topography of the NGGA is varied. A largely flat, elevated area occurs in the north-western and central areas of the Growth Area. Along the eastern section of the Growth Area, an escarpment occurs, with the landscape falling steeply towards the east, draining into the Hovells Creek catchment, upstream of Limeburners Bay. In the south-west of the Growth Area, the land slopes downwards towards the south-west, draining into the Cowies Creek catchment.

The topography of the WGGA is also varied. The central area of the WGGA is largely flat. The north-eastern corner of the Growth Area slopes towards the north-east, draining into the Cowies Creek catchment. The western section of the Growth Area is steep and drains westwards, into the catchment of the Moorabool River. A small section of the south-eastern corner of the Growth Area slopes gently towards the south-east, also flowing into the catchment of the Moorabool River.

The characteristics and environmental values of each of the catchments and the estuary connected to the Growth Areas is outlined in Section 3.3.10.

3.3.9 GROUNDWATER CHARACTERISTICS AND CONNECTIVITY

Groundwater is present within the Geelong locality. The characteristics of groundwater systems vary depending upon the geological characteristics of the landscape, ranging from small, local systems where water tables rise and fall quickly, through to large, regional aquifers which operate at a basin scale and are very slow to respond to landscape change (Dahlhaus, Cox et al., 2008).

The volcanic basalt plains which dominate the Strategic Assessment Area are associated with very large-scale aquifers with high permeability and slow response times to land use change (Dahlhaus *et al.*, 2008).

However, it is noted that Hovells Creek (including Limeburners Bay) and sections of the Barwon River (including the Lake Connewarre Complex) are characterised by local groundwater systems (Dahlhaus *et al.*, 2008). It is possible that groundwater interactions with surface water play an important role in the hydrological characteristics of these systems.

3.3.10 WATER-BASED ENVIRONMENTAL VALUES

As outlined in Section 3.3.8, the Growth Areas are hydrologically connected to three catchments:

- Hovells Creek catchment, which flows into Limeburners Bay and the Corio Bay estuary
- Cowies Creek catchment, which flows into the Corio Bay estuary
- Moorabool River catchment (which then flows into the Barwon River, followed by the Lake Connewarre Complex, and eventually into the ocean at Barwon Heads)

Refer to Map 3-9 for a map showing the locations of each of these catchments.

A description of these environments is provided below.

HOVELLS CREEK CATCHMENT

Hovells Creek is the principal waterway of the Hovells Creek catchment. The majority of the creek's catchment is agricultural, with some areas of conservation reserves and urban development. In the north, the headwaters of Hovells Creek extends up towards the Anakie locality. The creek flows through a largely agricultural landscape, then flows along the western boundary of You Yangs Regional Park, before flowing through the centre of the township of Lara. Downstream of Lara, the creek widens to flow into Limeburners Bay (part of the Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar Site). The north-eastern section of the Strategic Assessment Area and approximately 52 per cent of the NGGA will drain to the Hovells Creek Catchment (The City of Greater Geelong, 2016).

Based on 2010 data, the state-wide Index of Stream Condition found that the Hovells Creek was in 'very poor' environmental condition (the lowest environmental condition category in the rating system). This index takes into account a range of environmental indictors, including hydrology, physical form, riparian vegetation, water quality and aquatic life (macroinvertebrates). Contributors to the degraded state of Hovells Creek include agricultural and urban impacts to riparian zones and water quality, reduced riparian vegetation width and connectivity, degraded riparian and estuarine vegetation and reduced estuary extent, barriers to fish passage and changes to flow regime (Corangamite CMA, 2014).

The section of Hovells Creek which is downstream of the NGGA is the section which is downstream of Lara, and includes Limeburners Bay. Limeburners Bay is part of an internationally significant wetland which includes a range of aquatic vegetation communities and provides key habitat for birds and amphibians (including migratory and threatened species), in addition to a range of recreational values (Corangamite CMA, 2014).

Table 3-1 identifies the Commonwealth listed threatened species which have been recorded in Hovells Creek and Limeburners Bay.

Further details on the environmental values of Limeburners Bay is provided in Chapter 22 of Part 4, which provides a detailed overview and assessment of the Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar Site.

COWIES CREEK CATCHMENT

Cowies Creek is a small creek, whose catchment occurs between Hovells Creek catchment (to the north-east) and the Moorabool River catchment (to the west and south). The upstream areas of the catchment extend into the Moorabool locality and include agricultural land. Downstream and to the west of the Princes Freeway, Cowies Creek traverses through heavily urbanised areas within the North Geelong locality, before discharging into Corio Bay. Most of the stream length occurs in urban areas. The Cowies Creek catchment occurs in the southern half of the Strategic Assessment Area. Approximately 25 per cent of the NGGA and 61 per cent of the WGGA drains to Cowies Creek (The City of Greater Geelong, 2016).

Cowies Creek is a riparian corridor with remnant Creekline Grassy Woodland (EVC 68) occurring along most of the creek. It supports a range of biodiversity values including a significant population of Growling Grass Frog (*Litoria raniformis*). The corridor is also known to support the Eastern Longneck Turtle (*Chelodina longicollis*). Cropping in adjacent upstream areas of the creek has implications for water quality, with salinity and turbidity in the corridor restricting access to viable habitat for some species (GbLA Landscape Architects, 2022).

Table 3-1 identifies the Commonwealth listed threatened species which have been recorded in Cowies Creek.

MOORABOOL RIVER CATCHMENT

The Moorabool River occurs adjacent to the western border of the WGGA and continues south to into the Barwon River and Lake Connewarre Complex. The sections of the Moorabool River which are adjacent to and downstream of the WGGA contain multiple environmental values, including the environmental values of the Moorabool and Barwon Rivers and the Lake Connewarre Complex. Approximately 39 ha of the WGGA will drain into the Moorabool river adjacent to the WGGA. A small section (~ 2 per cent) of the NGGA is hydrologically linked to the Moorabool river via Sutherland Creek (The City of Greater Geelong, 2016).

The Moorabool River, Barwon River, and Lake Connewarre Complex are described below.

Values of the Moorabool River and Barwon River

The Moorabool River and Barwon River support a diversity of flora and fauna. The Moorabool river is an important biodiversity habitat corridor between the Brisbane Ranges National Park and the Barwon River, and sustains critical ecological processes for native fish, macroinvertebrates, mammals, birds, and vegetation communities (Corangamite CMA, 2016). The Barwon River supports aquatic vegetation communities and provides important breeding and feeding habitat for wetland dependant birds and native fish (Corangamite CMA, 2014).

The condition of the Moorabool and Barwon River is impacted heavily by land use upstream from the Geelong locality. Upstream water extraction has led to significantly reduced flows in both rivers. This trend in declining flow is predicted to continue with climate change. Further, agriculture and land clearing in the upstream catchment reaches has resulted in increased river turbidity and nutrient loads, causing algal blooms and reduced fish habitat (Corangamite CMA, 2022b).

Where the Barwon River flows through Geelong, much of the river is bordered by parkland which is valued and actively used by residents for a range of recreational activities including fishing, water skiing, angling, rowing and paddle sports, and major on-water events. During hot and dry summers, regular algal blooms can disrupt the enjoyment and use of the river for weeks to months (Barwon River Ministerial Advisory Committee, 2020).

The natural water flows of the lower Barwon within Geelong have been substantially disturbed since settlement. A weir (which was first constructed in 1898) is located where the Barwon River discharges into the Lake Connewarre Complex, which prevents the incursion of saline water upstream, and has raised the river level upstream (Barwon River Ministerial Advisory Committee, 2020).

Based on 2010 data, the state-wide Index of Stream Condition found that the Moorabool River and Barwon River segments downstream of the Strategic Assessment Area were in 'very poor' environmental condition (Corangamite CMA, 2014). In the past decade, there has been significant progress to improve the flows and waterway management in the Barwon catchment to improve the environmental condition of the river (Barwon River Ministerial Advisory Committee, 2020).

Table 3-1 identifies the Commonwealth listed threatened species which have been recorded in the Barwon and Moorabool Rivers.

Lake Connewarre Complex

South of Geelong, the Barwon River flows into the Lake Connewarre Complex. This complex includes a series of wetlands, including Lake Connewarre, Reedy Lake, Hospital Swamp, and Murtnaghurt Lagoon. The wetland is an estuarine system which supports a diverse range of aquatic vegetation communities and provides important feeding and breeding grounds for a wide range of native fish, wetland birds, migratory birds, and threatened species (Corangamite CMA, 2014).

The Lake Connewarre Complex is important both culturally and socially. The site is significant for the Wadawurrung people, the traditional owners of Geelong. The area is also used recreationally for fishing (with a recreational fishing

licence), small craft boating (such as canoes, kayaks, and small fishing boats) and duck hunting within designated areas during duck hunting season (March to June) (DELWP, 2020).

Further details on the environmental values of the Lake Connewarre Complex are provided in Chapter 22 of Part 4, which provides a detailed overview and assessment of the Port Phillip Bay and Bellarine Peninsula Ramsar Site. Table 3-1 identifies the EPBC listed threatened species which have been recorded in the Lake Connewarre Complex.

CORIO BAY ESTUARY

Corio Bay is a small bay on the western edge of Port Phillip Bay. Port Phillip Bay is the largest marine embayment in Victoria, covering approximately 1,930 km^2 with a coastline of 333 km in length. While the maximum depth of Port Phillip Bay is 24 m, the majority of the bay (including Corio Bay) is shallower than 8 m (Walker, 1999; DELWP, 2017). Corio Bay occurs to the east of the Strategic Assessment Area.

Drainage into Corio Bay from the Growth Areas will occur through three drainage pathways (The City of Greater Geelong, 2016):

- Wharf Road and St Georges drainage system - 21 per cent of the NGGA
- Hovells Creek and Limeburners Bay – 52 per cent of the NGGA
- Cowies Creek – 25 per cent of the NGGA, and 61 per cent of the WGGA

Cumulatively, a total of 98 per cent of the NGGA and 61 per cent of the WGGA will drain to Corio Bay.

Port Phillip Bay is connected to the ocean via a narrow entrance at Port Phillip Heads. The narrow entrance limits water exchange between the ocean and the bay. Movement of water is important for dispersing water from the bay to ocean, including freshwater, nutrients, and sediments. However, the efficiency of mixing and flushing across the wider bay varies. Due to its location, depth and other hydrodynamic characteristics, Corio Bay has limited mixing and flushing (DELWP, 2017).

Environmental management of Port Phillip Bay, including Corio Bay, is guided by the Port Phillip Bay Environmental Management Plan 2017-2021. This plan outlines a range of priorities, including ensuring nutrient and sediment loads do not exceed current levels, reducing pollutant loads, reducing litter, managing marine pests, and conserving and restoring habitats and marine life (DELWP, 2017).

Corio Bay has a range of significant environmental values. The northern shoreline of Corio Bay is comprised of two areas of the Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar site, Point Wilson / Limeburners Bay area, and Werribee River / Avalon. The point Wilson / Limeburners Bay area supports a seagrass community and is recognised to provide significant habitat for native and migratory species (DELWP, 2017). Further details and assessment of the environmental values of this Ramsar site are provided in Chapter 22 of Part 4.

Further, the shoreline of Point Henry (the south-eastern boundary to Corio Bay) is also recognised to support significant environmental values. Seagrass communities occur along both the eastern and western shores of Point Henry (DELWP, 2017). The locality of Point Henry has been identified as an Important Bird Area by Birdlife Australia, supporting internationally significant numbers of migratory birds, in addition to nationally significant numbers of the critically endangered Curlew Sandpiper (Birdlife Australia, 2020).

Land use of Point Henry peninsula is guided by the Moolap Coastal Strategic Framework Plan, which protects areas for environmental, historical and cultural purposes, in addition to providing opportunities for new residential, industrial and tourism developments. It is noted the peninsula has previously been used as an aluminium smelter and rolling mill, which recently closed operations in 2014 (DELWP, 2019a).

Table 3-1 identifies the Commonwealth listed threatened species which have been recorded in Corio Bay.

Table 3-1: Threatened species recorded within the catchments downstream of the Growth Areas

Scientific name	Common name	EPBC listing	Presence within catchments				
			Hovells Creek	Cowies Creek	Barwon / Moorabool	Lake Connewarre	Corio Bay Estuary
THREATENED FLORA							
Glycine latrobeana	Clover Glycine	Vulnerable			✓		
Lachnagrostis adamsonii	Adamson's Blown-grass	Endangered		✓			
Lepidium aschersonii	Spiny Peppercress	Vulnerable			✓	✓	
Senecio macrocarpus	Large-headed Fireweed	Vulnerable			✓		
THREATENED FAUNA							
Anthochaera phrygia	Regent Honeyeater	Critically Endangered					✓
Aphelocephala leucopsis	Southern Whiteface	Vulnerable					✓
Ardenna grisea	Sooty Shearwater	Vulnerable, Migratory				✓	
Arenaria interpres	Ruddy Turnstone	Vulnerable, Migratory				✓	✓
Botaurus poiciloptilus	Australasian Bittern	Endangered	✓		✓	✓	✓
Calidris acuminata	Sharp-tailed Sandpiper	Vulnerable, Migratory	✓		✓	✓	✓
Calidris canutus	Red Knot	Vulnerable, Migratory	✓			✓	✓
Calidris ferruginea	Curlew Sandpiper	Critically Endangered, Migratory	✓			✓	✓
Calidris tenuirostris	Great Knot	Vulnerable, Migratory				✓	✓
Callocephalon fimbriatum	Gang-gang Cockatoo	Endangered	✓	✓	✓	✓	✓
Charadrius leschenaultii	Greater Sand Plover	Vulnerable, Migratory					✓
Charadrius mongolus	Lesser Sand Plover	Endangered, Migratory					✓
Dermochelys coriacea	Leatherback Turtle	Endangered, Migratory					✓
Diomedea exulans	Wandering Albatross	Vulnerable, Migratory			✓	✓	
Gallinago hardwickii	Latham's Snipe	Vulnerable, Migratory	✓	✓	✓	✓	✓

Scientific name	Common name	EPBC listing	Presence within catchments				
			Hovells Creek	Cowies Creek	Barwon / Moorabool	Lake Connewarre	Corio Bay Estuary
Halobaena caerulea	Blue Petrel	Vulnerable				✓	
Hirundapus caudacutus	White-throated Needletail	Vulnerable, Migratory	✓		✓	✓	✓
Isoodon obesulus obesulus	Southern Brown Bandicoot	Endangered			✓		
Lathamus discolor	Swift Parrot	Critically Endangered	✓		✓	✓	
Lepidochelys olivacea	Pacific (Olive) Ridley	Endangered					✓
Limosa lapponica baueri	Western Alaskan Bar-tailed Godwit	Endangered, Migratory				✓	✓
Limosa limosa	Black-tailed Godwit	Endangered, Migratory				✓	✓
Litoria raniformis	Growling Grass Frog	Vulnerable		✓	✓	✓	✓
Lophochroa leadbeateri	Major Mitchell's Cockatoo	Endangered			✓		
Maccullochella peelii	Murray Cod	Vulnerable			✓		
Macquaria australasica	Macquarie Perch	Endangered			✓		
Macronectes giganteus	Southern Giant-Petrel	Endangered, Migratory				✓	✓
Macronectes halli	Northern Giant Petrel	Vulnerable, Migratory				✓	
Melanodryas cucullata	Hooded Robin	Endangered			✓		
Mirounga leonina	Southern Elephant Seal	Vulnerable					✓
Nannoperca obscura	Yarra Pygmy Perch	Vulnerable			✓	✓	
Neophema chrysogaster	Orange-bellied Parrot	Critically Endangered	✓			✓	✓
Neophema chrysostoma	Blue-winged Parrot	Vulnerable	✓		✓	✓	✓
Numenius madagascariensis	Eastern Curlew	Critically Endangered, Migratory	✓			✓	✓
Pachyptila turtur	Fairy Prion (southern)	Vulnerable		✓		✓	
Pedionomus torquatus	Plains-wanderer	Critically Endangered				✓	✓
Prototroctes maraena	Australian Grayling	Vulnerable			✓	✓	

Scientific name	Common name	EPBC listing	Presence within catchments				
			Hovells Creek	Cowies Creek	Barwon / Moorabool	Lake Connewarre	Corio Bay Estuary
Pluvialis squatarola	Grey Plover	Vulnerable, Migratory				✓	✓
Pteropus poliocephalus	Grey-headed Flying-fox	Vulnerable			✓		✓
Rostratula australis	Australian Painted Snipe	Endangered			✓	✓	
Stagonopleura guttata	Diamond Firetail	Vulnerable			✓		
Sternula albifrons	Little Tern	Vulnerable, migratory	✓			✓	✓
Sternula nereis nereis	Australian Fairy Tern	Vulnerable	✓			✓	✓
Thalassarche carteri	Indian Yellow-nosed Albatross	Vulnerable, Migratory				✓	✓
Thalassarche cauta	Shy Albatross	Endangered, Migratory				✓	
Thalassarche melanophris	Black-browed Albatross	Vulnerable, Migratory				✓	
Thinornis cucullatus cucullatus	Eastern Hooded Plover	Vulnerable				✓	
Tringa nebularia	Common Greenshank	Endangered, Migratory	✓			✓	✓
Xenus cinereus	Terek Sandpiper	Vulnerable, Migratory				✓	✓

3.4 KEY THREATS

A key threat to biodiversity values within the Geelong locality is loss of habitat for development. The region surrounding Geelong has historically been heavily developed for agricultural production, resulting in substantial losses of native vegetation (DSE, 2003). The city of Geelong itself has also long been a centre of development in Victoria and has been the second largest city in Victoria since the 1930's (Victorian Places, 2015). Historical development and clearing has resulted in loss of native vegetation and landscape degradation, reducing habitat availability and quality for native species.

Today, Geelong's population is continuing to grow, with a predicted 2.5 per cent annual growth rate, and is anticipated to have an additional 500,000 residents by 2050 (The City of Greater Geelong, 2021b). Careful management is required to minimise impacts of development to support this forecast increase in population.

Other key environmental threats within the region include:

- Invasive species, including pests and weeds
- Modification of water systems, including historical construction of infrastructure such as dams and weirs, ongoing water abstraction, and water pollution from agricultural and urban sources
- Disturbance pressures upon habitats used recreationally, such as estuarine and beach environments
- Climate change

Each of these is discussed briefly below.

3.4.1 INVASIVE SPECIES

As a result of extensive historical development, there is a high density of weeds within the Geelong locality. For instance, surveys conducted within the Growth Areas found a significant weed coverage and introduced pasture species across most of the surveyed areas (EHP, 2021). Weeds also pose a threat within the wider Study Area, including within the Port Phillip Bay (Western Shoreline) & Bellarine Peninsula Ramsar site (DELWP, 2020).

Pest animals are also present within the region. Within the Growth Areas, there is evidence that sites are occupied by rabbits, hares and foxes (EHP, 2021). Additionally, foxes, cats, rabbits, deer are identified as invasive species of concern at the Port Phillip Bay (Western Shoreline) & Bellarine Peninsula Ramsar site (DELWP, 2020). Other invasive species, such as pigs, goats, are likely to also be present within the region. It is not considered possible to eradicate existing pests within the region and therefore asset protection approaches are considered the most effective management mechanism to minimise potential impacts to MNES (EHP, 2021).

3.4.2 WATER SYSTEM MODIFICATION

All of the major watercourses within the Geelong region have experienced environmental impacts from development.

In-stream dams or similar barriers are located where the Barwon River discharges into Lake Connewarre, and along the Barwon and Moorabool Rivers (upstream of Geelong) (Corangamite CMA, 2014). Dams pose a range of threats to riverine environments, including acting as barriers to fish passage, through altering characteristics of the water (such as water temperature and oxygen content), and through artificially altering water levels.

Water extraction from the Barwon and Moorabool rivers occurs to support consumptive and agricultural purposes. Current environmental water allocations for both of these rivers is not sufficient to meet environmental needs into the future (DELWP, 2021).

The environmental values of the Moorabool River, Barwon River, Hovells Creek, and Lake Connewarre Complex are all threatened by indirect impacts from agricultural and urban development within these catchments, including grazing pressures, invasive species, poor water quality, erosion and sedimentation, and degradation of native vegetation (Corangamite CMA, 2014).

3.4.3 RECREATIONAL DISTURBANCE

The Geelong locality is a popular destination for recreational purposes. Recreational activities in estuarine and coastal environments (including dog walking on beaches, driving vehicles off-road, and water-based activities such as jet skiing, kite surfing, kayaking) can pose a threat of disturbance, particularly to waterbirds and migratory birds which occur in coastal environments, and within and near the Port Phillip Bay (Western Shoreline) & Bellarine Peninsula Ramsar site. The consequence of disturbance impacts upon waterbirds and migratory birds (many of which are protected under the EPBC Act) can be significant, leading to nest abandonment, population declines, or potentially reduced migratory success. The impacts of disturbance are forecast to increase as the human population within the region increases (DELWP, 2020).

3.4.4 CLIMATE CHANGE

Climate change is rapidly emerging as one of the most significant threats to ecosystems and biodiversity (Prober *et al.*, 2019). Victoria's climate is among the driest and most variable globally, and ecosystems in Victoria are particularly vulnerable to climate change (Jin, Cant and Todd, 2009). Various changes in Victoria's climate have been recorded in recent decades: temperatures have increased by over 1.0°C since 1910, and fire season length and severity has increased. Future projections forecast that Victoria will continue to experience increased temperatures, in addition to less rainfall and more extreme weather events (DELWP, 2019b). Victoria's Climate Change Strategy, released in 2021, outlines the Victorian Government's approach to managing climate change, including emissions reductions targets and measures to build climate resilience (DELWP, 2021b).

More locally in the Geelong region, climate change poses specific threats through:

- Sea level rise, which particularly threaten coastal and estuarine habitats, including the Port Phillip Bay (Western Shoreline) & Bellarine Peninsula Ramsar site (DELWP, 2020)
- Increased storm intensity and frequency, which is likely to exacerbate the impacts of sea level rise (DELWP, 2020)
- Decreased water availability, which threatens water supply within the region and environmental values (Corangamite CMA, 2014; DELWP, 2021a)

Further information about climate change is provided in Part 5 of this Strategic Assessment Report (Section 29.5).

4 How to read this report

This chapter:

- Sets out the structure of the report
- Provides advice about how best to navigate the document in electronic form
- Describes how the report addresses regulatory requirements

4.1 STRUCTURE OF THE REPORT

Table 4-1 outlines the structure and content of each of the main components (parts) of the SAR. Each part contains multiple chapters. Please refer to the 'Contents of the NWGGA Strategic Assessment Report' at the beginning of this document for the full SAR contents.

Table 4-1: SAR part structure and descriptions

Report part	Content description
Part 1: Overview	Provides a general introduction to the project, the regulatory context, an overview of the landscape context, and outlines how to read the SAR.
Part 2: Description of the Plan	Describes the Plan, including its development, conservation framework, and assurance and implementation framework.
Part 3: Assessment approach	Provides details of the assessment approach, including: • Methods for identifying relevant protected matters that need assessing in the SAR • Methods for mapping native vegetation, TECs and species habitat • Identification of impacts that may occur as a result of implementing the Plan • The Plan's approach to addressing uncertainty and risk
Part 4: Impact assessment	Covers the requirements of the ToR relating to identifying existing biodiversity values and assessing the impacts of the Plan on relevant protected matters.
Part 5: Evaluation of the outcomes of the Plan	Evaluates how the Plan meets the principles of ecologically sustainable development and the adequacy of the Plan in relation to the ToR and endorsement criteria.

4.2 ADVICE ABOUT HOW BEST TO NAVIGATE THE DOCUMENT IN ELECTRONIC FORM

We recommend viewing the SAR using Adobe Acrobat Reader as per the following instructions:

- Download and install Adobe Acrobat Reader by following this link https://get.adobe.com/reader/
- Download the report and save to your computer
- Right click on the report and select 'Open with Adobe Acrobat Reader'
- Click the bookmark symbol in the Adobe interface - the headings for each report Part will appear
- Click on the > symbol next to the Part headings - the headings for each report Chapter will appear
- Navigate through the report by clicking on the Part and Chapter headings

As outlined previously, the SAR presents a range of maps which are provided as separate PDF files. These are accessed by clicking on the map links throughout the report and the maps will open in a separate tab in your internet browser.

4.3 HOW THIS REPORT ADDRESSES REGULATORY REQUIREMENTS

The requirements for preparing a SAR are set out under the ToR under the Part 10 Strategic Assessment Agreement. Table 4-2 identifies where each of these requirements are addressed.

Table 4-2: Where requirements for addressing the ToR are addressed in the SAR

Section	ToR requirement	Chapter of Assessment Report
1. Purpose of the strategic assessment report	1.1. The Report must assess the impacts of actions under the Plan on all relevant protected matters.	Part 4 (Chapter 16)
	1.2. The Report must address how those impacts will be avoided, mitigated and offset (where necessary or appropriate) to ensure the long-term protection of protected matters.	Part 4 (Chapter 16, 17)
	1.3. The Report must provide sufficient detail to enable an evaluation of the ability of the Plan to ensure the long-term protection and conservation of the relevant protected matters.	Part 4
2. Description of the plan	2.1. The Report must describe the Plan to which the Agreement relates: a) The Report must provide a summary outlining the Plan's overall purpose, key elements, spatial extent, and timeframes, including how long the Plan is proposed to be in effect b) The Report must provide details about the key elements of the Plan, including: i. the outcomes, commitments, and measures to be delivered for protected matters ii. the class or classes of actions likely to be taken under the Plan over the term of the Plan iii. the legal and administrative frameworks to implement and ensure compliance with the Plan, and the persons and authorities responsible for implementation and compliance iv. the relationship of the Plan to other relevant Commonwealth and State policies, plans and guidelines, commitments, regulations and legislation, including environmental approvals, including impacts of the Plan on biodiversity and other state-protected environmental and heritage matters v. an identification of actions or classes of actions that are outside the scope of the Plan vi. management and funding arrangements for implementing the Plan and complying with any approval given with respect to the Plan under Part 10 of the EPBC Act, including but not limited to: • a description of the mechanism that will be used by City of Greater Geelong to verify the persons who are proposing to take an action in accordance with the Plan, and to inform those persons of approval conditions c) The Report must describe the need and justification for the Plan including the environmental, social and economic drivers for its development d) The Report must describe the decision-making framework that was used in considering alternatives and developing conservation outcomes of the Plan. It should identify the alternative options that	Part 2 Part 5 (Chapter 28)

Section	ToR requirement	Chapter of Assessment Report
	were evaluated to reach the final Plan, and why these options were not supported e) The Report must describe how the principles of ecologically sustainable development (as set out in section 3A of the EPBC Act) are considered and promoted in the development of the Plan	
3. Description of the protected matters impacted by the plan	3.1. The Report must describe the nature of the environment within the strategic assessment area that may be impacted by actions proposed to be taken under the Plan. This must include (at a minimum): a) a description and map of current and historical land-use, including consideration of areas which may pose an environmental risk b) a description of indigenous land-use and values c) the broad extent, type and quality of vegetation present in the strategic assessment area, where such information is available or is required in the relevant EPBC Act statutory document for a protected matter (such as a recovery plan) d) a description of the nature of the terrestrial and aquatic environment, including the state of natural and physical resources, ecological processes, and threatening processes e) a description of relevant state-protected environmental and heritage values f) a description of the landscape context and key environmental matters, such as any known habitat connectivity, habitat fragmentation, and ecological processes g) map or maps of areas that are already protected, including national parks, nature reserves, and known offset areas under both Commonwealth and/or State legislation h) a description of the type of baseline data that will be used to inform future monitoring of biodiversity i) the location of any declared World Heritage properties or National Heritage places in the strategic assessment area and identification of sensitive heritage areas for protected matters	Part 1 (Chapter 3) Part 4
	3.2. The Report must identify and describe each protected matter that may be impacted directly, indirectly and/or cumulatively by actions proposed to be taken under the Plan (these are the 'relevant protected matters'), including (at a minimum): a) maps of listed ecological communities and descriptive information including listing status, threatening processes, habitat quality and landscape context b) maps of species records and habitat for listed threatened species including habitat quality and landscape context c) descriptive information for listed threated species including listing status, threatening processes, estimates of population size or abundance and distribution within and adjacent to the strategic assessment area d) extent and condition and ecological character of declared Ramsar wetlands. This must include information on past, present and projected trends in the ecological character and its likelihood to change over time e) spatial and descriptive information for declared world Heritage properties and National Heritage places and their values, located within or adjoining to the strategic assessment area.	Part 4 (Chapters 19 to 25)

Section	ToR requirement	Chapter of Assessment Report
	f) spatial and descriptive information on the environment of Commonwealth land within or adjoining the strategic assessment area g) maps of species records and habitat for listed migratory species located within or adjoining the strategic assessment area, including estimates of habitat usage and species abundance in the context of global populations	
4. Assessment of the impacts of the plan on protected matters	4.1. The Report must describe and assess the likely direct, indirect and cumulative impacts of actions taken under the Plan on all relevant protected matters. This must include, but not necessarily be limited to, an assessment of impacts of clearing, disturbance and fragmentation	Part 3 (Chapter 11) Part 4 (Chapters 17 and 25)
	4.2. The Report must describe and provide justification for the method used to assess likely impacts on all protected matters arising from actions proposed to be taken under the Plan. The method must: a) be appropriate for assessment at a strategic scale b) rely on the best available information c) discuss uncertainty, including reference to the data and information relied upon	Part 3 (Chapters 14 and 14)
	4.3. The Report may also consider protected matters that are potentially eligible for listing as a result of inclusion in a final priority assessment listing held by the Commonwealth, or a recommendation to the Minister for listing by the Threatened Species Scientific Committee prior to the Report being submitted	Part 4 (Chapter 24)
	4.4. The Report must include analysis of: a) how impacts on protected matters will be avoided b) the duration, extent and likely severity of the impacts c) the mitigation measures that will be implemented and their likely effectiveness to reduce impacts on the protected matters. An evaluation of effectiveness must include whether the key mitigation measures for protecting MNES are feasible, achievable and economically viable d) how unavoidable impacts will be offset in accordance with the principles of the Environment Protection and Biodiversity Conservation Act, Environmental Offsets Policy, 2012 e) the proposed funding arrangements and the timeframes for the delivery of mitigation and offset requirements	Part 4 (Chapter 16, 17 Part 5 (Chapter 29)
	4.5. The Report must include an analysis of the conservation benefits (beneficial impacts) of the Plan, including: a) how protected matters will be conserved, protected and managed within the strategic assessment area b) information regarding the process for establishing conservation areas. This must include information regarding land tenure, timing, funding and legal protective mechanisms. c) the adequacy and likely effectiveness of the outcomes, commitments and measures under the Plan in protecting and managing protected matters, including the effectiveness of implementation, funding arrangements and who will be responsible for delivery	Part 2 (Chapter 8, 9) Part 5 (Chapter 29)

Section	ToR requirement	Chapter of Assessment Report
	d) available evidence to support conclusions reached regarding the effectiveness of the outcomes, commitments and measures identified in the Plan	
	4.6. The Report must consider the extent to which the impacts on relevant protected matters of actions proposed under the Plan would be consistent with the EPBC Act, including but not limited to: a) how approving a class of actions to be taken in accordance with the Plan would not be inconsistent with Australia's international obligations, including under the Convention on Biological Diversity, World Heritage Convention, Ramsar Convention and the Convention for Migratory Species to the extent they apply to the relevant protected matters (section 146G, 146J, 146K and 146L of the EPBC Act) b) how approving a class of actions to be taken in accordance with the Plan would not be inconsistent with recovery plans and threat abatement plans (section 146K(2) of the EPBC Act) c) how regard has been and will be given to relevant information in conservation advices (section 146K(3) of the EPBC Act), threat abatement plans and recovery plans d) how approving a class of actions to be taken in accordance with the Plan would not be inconsistent with management plans for National Heritage places (sections 324S and 324X of the EPBC Act), management plans for declared World Heritage properties (sections 146G of the EPBC Act), the Australian World Heritage management principles (section 146G of the EPBC Act) and the National Heritage management principles (section 146H of the EPBC Act)	Part 4 (Chapters 17, 22 and 23)
	4.7. The Report must include information regarding the process for establishing conservation areas. This must include information regarding land tenure, timing, funding and management	Part 2
	4.8. The Report must include justification for key methods used in the assessment	Part 3 (Chapter 13)
	4.9. The Report must include or refer to data from ecological surveys	Part 3 (Chapter 13)
5. Evaluation of the overall outcomes of the plan	5.1. The Report must evaluate the overall outcomes, commitments and measures for protected matters taking into account likely impacts on protected matters from actions proposed to be taken under the Plan	Part 5 (Chapter 29)
	5.2. The evaluation must include: a) the extent to which protected matters are represented in the strategic assessment area b) the extent to which protected matters are represented in areas to be protected or managed under the Plan c) the extent to which any areas to be protected or managed under the Plan will ensure the long-term protection of each protected matter, and the ongoing function of any key ecosystem services needed for the ongoing viability of protected matters d) the extent to which the outcomes, commitments and measures under the Plan address any significant vulnerabilities of protected matters under reasonable climate change scenarios e) the likely effectiveness of the outcomes, commitments and measures under the Plan in protecting and managing protected matters and any risks and uncertainties	Part 5 (Chapter 29)

Section	ToR requirement	Chapter of Assessment Report
	f) an assessment of how the Plan meets the endorsement criteria, asset out in Attachment 2 of the Agreement	
6. Addressing uncertainty and risk	6.1. The Report must identify key uncertainties and risks associated with implementing the Plan, responses to these and proposed adaptations to changing circumstances. Key uncertainties may include: a) knowledge gaps in scientific understanding and responding to new knowledge b) assumptions made in assessing potential impacts and benefits c) how changes to Commonwealth, State and local government legislation, policies, plans and advice are to be accounted for in the management of the areas impacted by the Plan d) the capacity to ensure the Plan is implemented e) differences in survey results relating to MNES and how to evaluate and resolve discrepancies	Part 3 (Chapter 14) Part 5 (Section 29.4 of Chapter 29)
7.Assurance and implementation framework	7.1. The Report must include an evaluation of the adequacy of the Plan's Assurance and Implementation Framework which describes the best practice monitoring programs, regular review, public reporting and independent auditing processes proposed to: a) ensure outcomes, commitments and measures for protected matters contained in the Plan are, documented, delivered and adequately resourced throughout the life of the Plan b) ensure the results of monitoring will be used to understand the effectiveness of commitments and measures for protected matters and improve implementation, in particular, to adapt where monitoring demonstrates delivery of the commitments and measures are not leading to the desired outcomes or where there are risks to protected matters c) ensure new information relating to protected matters, including legislative changes, may be assessed and accounted for in implementation of the Plan d) provide mechanisms that track persons who are relying on a strategic assessment approval to take an action and ensure persons undertaking actions are informed of their obligations under the endorsed Plan and approval e) ensure compliance with the Plan will be monitored and non-compliance will be reported f) provide for a 5-yearly assurance review and report	Part 5 (Section 29.6 of Chapter 29)
	7.2. The Report must include an evaluation of the Plan's framework for monitoring actions taken under the Plan and addressing the responsibilities of the Minister and City of Greater Geelong as to these matters	Part 5 (Section 29.6 of Chapter 29)
8. Social and economic impacts	8.1. The Report must assess the social and economic impacts of the Plan	Part 4 (Chapter 26)
	8.2. The Report must describe the consultation with the public (including affected parties) undertaken during the development of the Plan	Part 4 (Chapter 26)
	8.3. The Report must describe the process by which parties who may be affected by the strategic assessment will be accorded natural justice and procedural fairness as part of the assessment of impacts of the plan	Part 4 (Chapter 26)
9. Information sources	9.1. The Report must identify the sources of information and data relied upon including the reliability and currency of the data.	Part 3 (Chapter 13)

References

Agriculture Victoria (2020) 'Victorian Resources Online: Corangamite Climate'.

Barwon River Ministerial Advisory Committee (2020) 'Our living rivers of the Barwon: A discussion paper for the future'.

Biosis (2024) 'Victorian Grassland Earless Dragon, targeted surveys, and habitat suitability assessment - Geelong Growth Areas'.

Biosis & Open Lines (2024) *Victorian Grassland Earless Dragon Habitat Attribute Analysis*.

Birdlife Australia (2020) 'Australian National Directory of Important Migratory Shorebird Habitat'. Prepared for the Department of Agriculture, Water and the Environment by Birdlife Australia.

Corangamite CMA (2014) 'Corangamite Waterway Strategy 2014 - 2022'.

Corangamite CMA (2016) 'Moorabool River Environmental Water Management Plan'.

Corangamite CMA (2022a) 'Corangamite Catchment Management Authority NRM Planning Portal'.

Corangamite CMA (2022b) 'Corangamite Regional Catchment Strategy'.

Dahlhaus, P. *et al.* (2003) 'Victorian Volcanic Plains Scoping Study'. CSIRO Land and Water.

Dahlhaus, P. *et al.* (2008) 'Beyond hydrogeologic evidence: Challenging the current assumptions about salinity processes in the Corangamite region, Australia', *Hydrogeology Journal*, 16(7), pp. 1283–1298. Available at: https://doi.org/10.1007/s10040-008-0313-2.

DELWP (2005) 'Native Vegetation - Modelled 2005 Ecological Vegetation Classes (with Bioregional Conservation Status)'. Department of Environment, Land, Water and Planning.

DELWP (2017) 'Port Phillip Bay Environmental Management Plan 2017–2027'. Department of Environment, Land, Water and Planning.

DELWP (2019a) 'Moolap Coastal Strategic Framework Plan'. Department of Environment, Land, Water and Planning.

DELWP (2019b) 'Victoria's Climate Science Report 2019'.

DELWP (2020) 'Port Phillip Bay (Western Shoreline) & Bellarine Peninsula Ramsar Site Ecological Character Description'. Department of Environment, Land, Water and Planning.

DELWP (2021a) 'Central and Gippsland Region Sustainable Water Strategy Discussion Draft'. Department of Environment, Land, Water and Planning.

DELWP (2021b) 'Victoria's Climate Change Strategy'. Department of Environment, Land, Water and Planning.

DELWP (2022) 'Geomorphology of Victoria'. Dataset published by Department of Environment, Land, Water and Planning.

DSE (2003) 'Biodiversity Action Planning: Strategic Overview for the Victorian Volcanic Plain Bioregion'. Victorian Government Department of Sustainability and Environment.

EHP (2021) 'Existing Ecological Conditions: Northern and Western Geelong Growth Areas'. Prepared for the City of Greater Geelong.

Environment Australia (2000) 'Revision of the Interim Biogeographic Regionalisation of Australia (IBRA) and the Development of Version 5.1 - Summary Report'.

GbLA Landscape Architects (2022) 'Draft Cowies Creek Geelong Landscape MasterPlan'.

Geelong Region Alliance (2007) 'The Geelong Region Plan'. G21 Geelong Region Alliance.

Heritage Council Victoria (2022) 'Victorian Heritage Register'.

Jin, C., Cant, B. and Todd, C. (2009) *Climate change impacts on wetlands in Victoria and implications for research and policy*. Citeseer.

Monument Australia (2010) 'Centenary of Geelong'.

Prober, S.M. *et al.* (2019) 'Recent climate-driven ecological change across a continent as perceived through local ecological knowledge', *PLOS ONE*. Edited by J. Hewitt, 14(11), p. e0224625. Available at: https://doi.org/10.1371/journal.pone.0224625.

Rowe, D. (2021) 'About Corayo: A Thematic History of Greater Geelong'. The City of Greater Geelong.

The City of Greater Geelong (2016) 'catchments-city-of-greater-geelong'. https://www.geelongdataexchange.com.au/explore/dataset/catchments-city-of-greater-geelong/information/.

The City of Greater Geelong (2021a) 'Climate change response plan 2021-2030'.

The City of Greater Geelong (2021b) 'The Northern and Western Geelong Growth Areas Framework Plan.'

The City of Greater Geelong (2025) 'Draft Northern and Western Geelong Growth Areas EPBC Plan'.

Victoria State Government (2017) 'Plan Melbourne 2017-2050'.

Victorian Places (2015) 'Geelong'. Monash University, University of Queensland.

Walker, S.J. (1999) 'Coupled hydrodynamic and transport models of Port Phillip Bay, a semi-enclosed bay in south-eastern Australia', *Marine and Freshwater Research*, 50(6), pp. 469–481. Available at: https://doi.org/10.1071/MF98071.

Williams, N. (2022) 'Southern Volcanic Plain'. University of Melbourne, Ecolinc.