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Edithvale-Seaford Wetlands Ramsar Site Management Plan

Prepared for: Melbourne Water

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Cover photo: Constructed wetlands in the north of Edithvale Wetlands, 6 June 2016.

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Summary Management Plan

The following table outlines prioritised management actions required to maintain and enhance biodiversity values within the Edithvale-SeafordWetlands Ramsar Site. A map for each site displaying management zones referred to in the table is provided below. Specific details pertaining to values, threats and associated management are provided in the body of the report.

Key: MZ Management Zone | EPBC *Environment Protection and Biodiversity Conservation Act 1999* | MW Melbourne Water | KCC Kingston City Council

CPS Critical components, process and services (highlighted in **bold** type) | CaLP *Catchment and Land Protection Act 1994* | FCC Frankston City Council

Action	Legislation applicable	Management Zone	Risk (based on risk assessment)	Values/CPS	Management Category	Target	Edithvale Wetlands Estimated cost	Seaford Wetlands Estimated cost	Management Responsibility (Seaford)	Timing
Priority 1 – Legislative Obligations										
Where possible, grooming of Common Reed to maintain Ecological Character	*EPBC Act 1999*	Edith: MZ 1, 2 Seaf: MZ 1, 2	High	**Waterbird diversity and abundance; physical habitat for waterbirds; and threatened waterbird species.** Flora and vegetation communities.	Program maintenance	Edithvale: MZ 1 groomed annually (c. 33 ha); MZ 2 groomed in a rotational pattern with return frequency determined based on fauna habitat utilisation monitoring (c. 5 ha per year if on five year rotation) Seaford: MZ 1 groomed every two (to five) years depending on access due to seasonal conditions that may prevent slashing for one or more years (c. 61 ha); MZ 2 groomed in a rotational pattern with return frequency determined based on fauna habitat utilisation monitoring (c. 8 ha per year if on five year rotation)	$114,000 per year ($3,000 per hectare)	$115,500 per year ($3,000 per hectare)	MW	Autumn, after Common Reed has flowered, but before seed set.
Conduct a machinery trial for options to cut Common Reed at Seaford Wetland where soft sediments are restricting grooming machinery	*EPBC Act 1999*	Seaf: MZ 1	High	**Waterbird diversity and abundance; physical habitat for waterbirds; and threatened waterbird species.** Flora and vegetation communities.	Investigation	Trial of machinery options completed by Year 3 to determine if alternative mechanically grooming options are viable. This is to occur in conjunction with the above grooming regime and is expected to involve trialing various machinery to cut the Common Reed in locations with soft sediments	NA	$12,000 one-off cost (over three years) Includes additional investigation and hire costs beyond the grooming regime above.	MW	Autumn, after Common Reed has flowered, but before seed set.
Monitor Common Reed management program performance to maintain Ecological Character	*EPBC Act 1999*	Edith: MZ 1, 2 Seaf: MZ 1, 2	-	**Waterbird diversity and abundance; physical habitat for waterbirds; and threatened waterbird species.** Flora and vegetation communities.	Monitoring and assessment	**Flora:** Quadrats established/assessed in Year 1, and reassessed annually **Fauna:** Waterbird abundance, diversity and visitation rates assessed across grooming regimes three times per year by year 3	**Flora**: $9,000 per year **Fauna**: $8,000 per year	**Flora**: $9,000 per year **Fauna**: $8,000 per year	MW	**Flora**: Mar/Apr **Fauna**: Sep–Dec
Where possible, maintain current hydrological regime in wetlands to maintain Ecological Character	*EPBC Act 1999*	Edith: MZ 1, 2 Seaf: MZ 1, 2	Medium	**Waterbird diversity and abundance; waterbird breeding; physical habitat for waterbirds; and threatened waterbird species.** Flora and vegetation communities.	Program maintenance	Where possible, wetlands inundated in winter and early spring, with gradual drawdown to the end of December (noting that this is largely driven by rainfall and evaporation with Melbourne Water able to input minimal influence). Ephemeral areas ideally dry between January and April while deeper pools remain inundated year round.	Running costs to be determined	Running costs to be determined	MW	All year

Action	Legislation applicable	Management Zone	Risk (based on risk assessment)	Values/CPS	Management Category	Target	Edithvale Wetlands Estimated cost	Seaford Wetlands Estimated cost	Management Responsibility (Seaford)	Timing
Undertake a cost-benefit analysis of management option associated with climate change to: - prolong the system as a freshwater to brackish environment; and - manage and facilitate the inevitable change of the system to a more saline environment.	*EPBC Act 1999*	Edith: MZ 1, 2 Seaf: MZ 1, 2	Extreme	**Waterbird diversity and abundance; waterbird breeding; physical habitat for waterbirds; and threatened waterbird species.** Flora and vegetation communities.	Investigation	Build upon the Jacobs (2016b) impacts of climate change assessment to develop a cost-benefit analysis, completed by Year 6 with recommendations incorporated into the revised Ramsar management plan in Year 7.	$10,000 for one-off assessment	$10,000 for one-off assessment	MW	Any time
Monitor abiotic and biotic changes associated with climate change: - Salinity and water quality - Groundwater and surface water level - Bird surveys - Floristic surveys	*EPBC Act 1999*	Edith: MZ 1, 2 Seaf: MZ 1, 2	-	**Waterbird diversity and abundance; waterbird breeding; physical habitat for waterbirds; and threatened waterbird species.** Flora and vegetation communities.	Monitoring and assessment	Monthly surveys undertaken to document surface water levels, water quality, salinity and bird populations, Quarterly surveys undertaken to record ground water levels, Annual surveys to monitor floristic changes	Abiotic: $12,000 per year Floristic: $6,000 per year (note monthly bird monitoring cost is addressed below)	Abiotic: $12,000 per year Floristic: $6,000 per year (note monthly bird monitoring cost is addressed below)	MW	All year
Manage CaLP listed "Regionally Controlled" weeds (Tables 13 and 14), particularly *Spiny Rush	*CaLP Act 1994*	All	High	**Waterbird diversity and abundance; physical habitat for waterbirds; and threatened waterbird species.** Flora and vegetation communities	Program maintenance	Targets (eliminate, control, contain) as specified in Tables 13 and 14	$24,000 per year	$24,000 per year	MW and FCC	All year, 12 visits/yr
Control foxes with soft-jaw traps, maintaining fencing and destroying dens and other harbour (if present)	*CaLP Act 1994*	All	Extreme	**Waterbird diversity and abundance; and threatened waterbird species.** Small mammals, frogs and reptiles.	Program maintenance	Soft-jaw traps checked daily for two weeks between April and May, and data on trap success rates collected and submitted to Melbourne Water Maintain predator-proof fence at Edithvale Wetlands No active warrens/harbour, new dens/harbour fumigated and destroyed within 3 months	$4,000 per year $2,000–$4,000 per year $0–$3,000 per year	$4,000 per year NA $0–$3,000 per year	MW and FCC	April-May All year
Control rabbits and hares by destroying warrens and other harbour (if present)	*CaLP Act 1994*	All	Medium	Flora and vegetation communities.	Program maintenance	No active warrens/harbour, new warrens/harbour fumigated and destroyed within 3 months	$0–$3,000 per year	$5,000–$10,000 per year (more for the first three years)	MW and FCC	Sep
Undertake mosquito monitoring and control (if necessary)	*Health (Infectious Diseases) Regulations 2001 and Public Health and Wellbeing Regulations 2009*	Seaf: MZ1	-	Human health.	Program maintenance	Monthly dip needing for larvae and CO_2 light trapping undertaken in spring and summer (Sept-March/April) If monitoring data indicate that larvae are in high abundance, control with ProLink Briquettes will be undertaken	NA	$8,000 per year	MW	Sept-Feb

Action	Legislation applicable	Management Zone	Risk (based on risk assessment)	Values/CPS	Management Category	Target	Edithvale Wetlands Estimated cost	Seaford Wetlands Estimated cost	Management Responsibility (Seaford)	Timing
Monthly monitoring of bird populations and water level to detect limits of acceptable change to maintain Ecological Character	*EPBC Act 1999*	All	-	**Waterbird diversity and abundance; waterbird breeding; physical habitat for waterbirds; and threatened waterbird species.**	Monitoring and assessment	Bird surveys and monitoring of water levels undertaken monthly and annual reporting to Melbourne Water	$15,000 per year (this is an existing program)	$15,000 per year (this is an existing program)	MW	All year
Potential Acid Sulfate Soil Management	*EPBC Act 1999, CaLP Act 1994, Environmental Protection Act 1970, Coastal Management Act 1995, Planning and Environment Act 1986 and Crown Land (Reserves) Act 1978*	All, especially Seaford	Medium	**Waterbird diversity and abundance; physical habitat for waterbirds; and threatened waterbird species.** Flora and vegetation communities.	Program maintenance	Ensure an Acid Sulfate Management Plan is prepared prior to any excavation works	$6,000 per one-off assessment	$6,000 per one-off assessment	MW	Any time
Implement fire management recommendations provided by Terramatrix (2013)	*Country Fire Authority Act 1958*	Edith: MZ3 Seaf: MZ3, 4	High	Flora and vegetation communities.	Program maintenance	Vegetation within the recommended Asset Protection Zones and Bushfire Moderation Zone managed accordingly from Year 1.	NA	$8,000 per year	MW and FCC	All year
Priority 2 – Best Practice Management										
Incorporate "Downs Estate" into the Ramsar boundary	-	Seaf: MZ 5	-	**Physical habitat for waterbirds;**	Capital/Grants Program	Down's Estate incorporated into Ramsar site by Year 2	NA	$5,000 per one-off investigation	MW and FCC	Any time
Manage high threat weeds (Tables 13 and 14)	-	All	High	Flora and vegetation communities.	Program maintenance	Targets (eliminate, control, contain) as specified in Tables 13 and 14	$8,000 per year	$12,000 per year	MW and FCC	All year, 4-6 visits/yr
Maintain current dog access restrictions (i.e. no dogs in wetlands, on-leash in buffers), install interpretative signage to educate the public of dog and cat impacts	-	All	-	**Waterbird diversity and abundance; waterbird breeding; and threatened waterbird species.**	Capital/Grants program	Signage installed by Year 2. These can be in the form of regulatory and educational interpretative signage.	$5,000–$10,000 for signage/letter drop	$5,000–$10,000 for one-off signage/letter drop	MW, KCC and FCC	Any time
Distribute letters to landholders in the local area regarding cat and dog impacts	-	All	Extreme	**Waterbird diversity and abundance; waterbird breeding; and threatened waterbird species.** Small mammals, frogs and reptiles.	Program maintenance	Letter distributed in Years 2, 5 and 8 to all registered cat and dog owners within 500 m of either wetland.	$5,000 per year	$6,000 per year	MW, KCC and FCC	All year
If incursions occurs in future, undertake pig trapping to remove released pigs (as had occurred at Seaford Wetland)	-	Seaford: All	Medium	Flora and vegetation communities	Program maintenance	Pig(s) removed within 6 months of confirming occurrence	NA	NA	MW and FCC	All year
Check nest boxes, document occupants and remove Common Myna nests and bee hives	-	All	-	**Waterbird breeding.**	Program maintenance	All nest boxes check and cleaned in May each year. Occupancy of nest boxes recorded and submitted to Melbourne Water.	$1,600 per year	$1,600 per year	MW and FCC	May

Action	Legislation applicable	Management Zone	Risk (based on risk assessment)	Values/CPS	Management Category	Target	Edithvale Wetlands Estimated cost	Seaford Wetlands Estimated cost	Management Responsibility (Seaford)	Timing
Revegetation of areas disturbed by management works (e.g. weed control, den destruction)	-	All	-	Flora and vegetation communities	Program maintenance	Bare ground revegetated within two months; all plant losses replaced with 90% survival to year 7; all guards removed once plants are established (c. 1-3 years depending on species and health of plant). To be undertaken in accordance with the species lists provided in Appendix 12 and the revegetation prescriptions prepared by TBLA and Australian Ecosystems (2005; Appendix 13)	Guarded: $11/ plant Unguarded: $3/plant Maintenance: $2/plant	Guarded: $11/ plant Unguarded: $3/plant Maintenance: $2/plant	MW and FCC	Ideally May-Oct
Consolidate Frankston City Council and Melbourne Water boundaries at Seaford Wetland (as per Section 2.5)	-	Seaf: All	-	**Waterbird diversity and abundance; waterbird breeding; physical habitat for waterbirds; and threatened waterbird species.** Flora and vegetation communities.	Capital/Grants program	Divide Seaford Wetland manager boundaries so that Melbourne Water manages all wetland areas and Frankston City Council manages all the exterior areas.	NA	$5,000 for one-off investigation	MW and FCC	Anytime
At Seaford Wetland, investigate feasibility of extending the path through Downs Estate and along the northern boundary to create a complete loop track	-	Seaf: MZ 3, 5	-	**Waterbird diversity and abundance; waterbird breeding; physical habitat for waterbirds; and threatened waterbird species.** Flora and vegetation communities.	Investigation	Investigation undertaken by year 1, and findings implemented by year 2	NA	$4,000 for one off assessment	MW and FCC	Anytime
Maintain fencing around the wetlands	-	Edith: MZ3 Seaf: MZ2, 3, 4, 5	-	**Waterbird diversity and abundance; waterbird breeding; physical habitat for waterbirds; and threatened waterbird species.** Flora and vegetation communities.	Program maintenance	Undertake fence checks twice per year and repair breaches.	$1,000 per year (plus repairs)	$1,000 per year (plus repairs)	MW and FCC	Anytime
Consider the potential need for fencing or seasonal closure of the internal path at Seaford Wetland, and fencing at Down's Estate if included in the Ramsar site (see proposed fencing on Figure 4).	-	Seaf: MZ 1, 2, 5	-	**Waterbird diversity and abundance; waterbird breeding; physical habitat for waterbirds; and threatened waterbird species.** Flora and vegetation communities.	Investigation	Investigation undertaken by year 2, and findings completed by year 4.	NA	$3,000 for one-off investigation	MW and FCC	Anytime
Photo-point monitoring	-	All	-	Flora and vegetation communities	Program maintenance	Monitoring of photo-points undertaken every year	$1,000 per year	$1,000 per year	MW	In line with previous monitoring (October and March)
Native vegetation condition monitoring	-	All	-	Flora and vegetation communities	Monitoring and assessment	Habitat Hectare Assessment or other suitable monitoring approach collected at Year 5	$9,000 for one-off assessment	$9,000 for one-off assessment	MW	Sep–Dec
Monitor pest plant control performance	-	All	-	Flora and vegetation communities	Program maintenance	Distribution and cover of weeds of management concern assessed each year	$2,000 per year	$2,000 per year	MW and FCC	Sep–Nov

Action	Legislation applicable	Management Zone	Risk (based on risk assessment)	Values/CPS	Management Category	Target	Edithvale Wetlands Estimated cost	Seaford Wetlands Estimated cost	Management Responsibility (Seaford)	Timing
Monitor pest animal (rabbit/hare/fox) control performance	-	All	-	**Waterbird diversity and abundance; and threatened waterbird species.** Flora and vegetation communities	Program maintenance	Inspection for warrens / dens at least once per year (if active warrens found undertake more frequent inspections) BirdLife Australia to continue to record foxes and cats observed during monthly bird surveys	$1,000 per year (more if active warrens found)	$1,000 per year (more if active warrens found)	MW and FCC	Sep–Oct
Monitor Eastern Grey Kangaroo population	*Wildlife Act 1975 and Wildlife Regulations 2002*	Edith (south): MZ 1–3	Low-medium	Flora and vegetation communities	Program maintenance	Undertake annual monitoring of the Eastern Grey Kangaroo population using the sweep count procedure to ensure population is maintained between 16-27 kangaroos (see EcoPlan Australia 2015)	$5,000 per year	NA	MW	March-April
Priority 3 – Other Management Priorities										
Manage medium threat weeds (Tables 13 and 14)	-	All	High-Medium	Flora and vegetation communities	Program maintenance	Targets (eliminate, control, contain) as specified in Tables 13 and 14	$8,000 per year	$8,000 per year	MW and FCC	All year, 4 visits/yr
Investigate potential for using fire as a management tool at Seaford Wetlands for #Coast Tea-tree control in MZ3.	-	Seaf: MZ 1–3	High	Flora and vegetation communities	Program maintenance	Feasibility of using fire as a management tool at Seaford for #Coast Tea-tree investigated by Year 3 and implemented accordingly.	NA	$5,000 for one-off investigation	MW and FCC	Any time
Revegetation and supplementary plantings in Damp Sands Herb-rich Woodland and Swamp Scrub vegetation	-	Edith: MZ3 Seaf: MZ 3, 4	-	Flora and vegetation communities	Capital/Grants program	- Clustered plantings of shrubby and robust ground layer species in the Damp Sands Herb-rich Woodland vegetation with primarily mown lawn understorey - Supplementary and expansion plantings of Swamp Scrub - Revegetation of non-remnant areas opposite Seaford North Primary School - All plant losses replaced with 90% survival to year 7; all guards removed once plants are established (c. 1-3 years depending on species and health of plant). - To be undertaken in accordance with the species lists provided in Appendix 12 and the revegetation prescriptions prepared by TBLA and Australian Ecosystems (2005; Appendix 13)	Guarded: $11/ plant Unguarded: $3/plant Maintenance: $2/plant	Guarded: $11/ plant Unguarded: $3/plant Maintenance: $2/plant	FCC	May-Oct
User related issues: rehabilitate unauthorised tracks and disturbances	-	All	-	Flora and vegetation communities	Program maintenance	Negligible unauthorised tracks or disturbances by year 2, new disturbances rehabilitated within 2 months of identification	$1,000–$5,000 per incursion (depends on extent of damage)	$1,000–$5,000 per incursion (depends on extent of damage)	MW and FCC	All year
User related issues: undertake general litter collection and clear litter traps	-	All	Medium	**Physical habitat for waterbirds.** Flora and vegetation communities	Program maintenance	Negligible litter observed onsite and in litter traps	$6,000–$8000 per year	$6,000–$8000 per year	MW and FCC	All year
Mapping and monitoring of significant flora species (Appendix 2)	-	All	-	Flora and vegetation communities	Monitoring and assessment	Distribution and population size mapped and compared in Year 5	$7,000 for one-off assessment	$7,000 for one-off assessment	MW and FCC	Oct–Nov
Targeted surveys for reptiles (Swamp Skink)	-	Edith: MZ 1, 2 Seaf: MZ 1, 2	-	Reptiles.	Monitoring and assessment	One targeted survey completed by Year 3	$8,000 per one-off assessment	$8,000 per one-off assessment	MW and FCC	Nov-Mar
Fish survey to document fish species occurrence	-	Edith: MZ 1, 2 Seaf: MZ 1, 2	-	Fish.	Monitoring and assessment	Fish survey completed by Year 4	$6,000 per one-off assessment	$6,000 per one-off assessment	MW and FCC	Dec–May

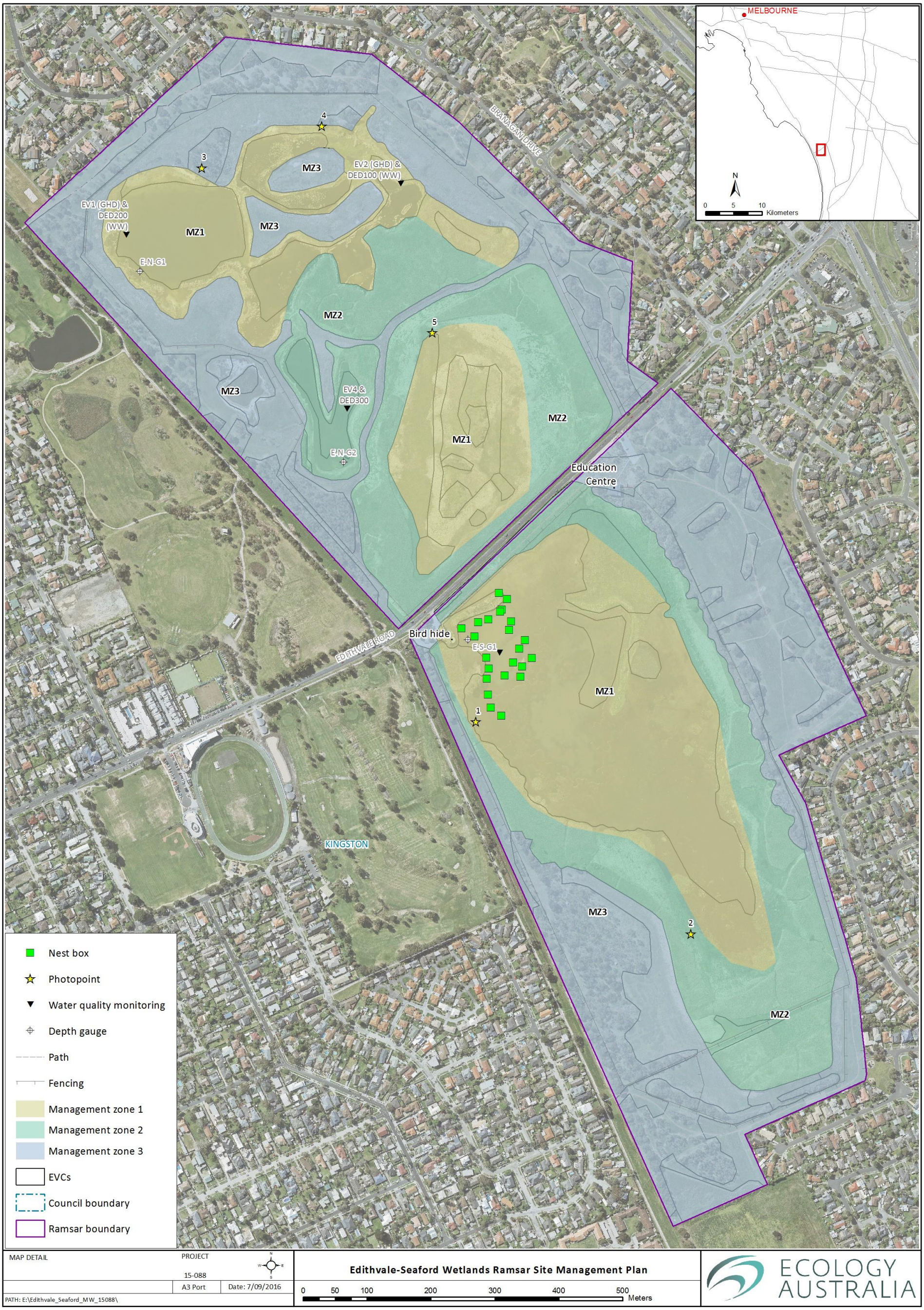
Action	Legislation applicable	Management Zone	Risk (based on risk assessment)	Values/CPS	Management Category	Target	Edithvale Wetlands Estimated cost	Seaford Wetlands Estimated cost	Management Responsibility (Seaford)	Timing
Invertebrate survey, with the first priority on aquatic invertebrates and the lower priority on terrestrial invertebrates	-	All	-	Invertebrates	Monitoring and assessment	Invertebrate survey undertaken by Year 6	$6,000 per one-off assessment	$6,000 per one-off assessment	MW	Spring

Costs do not consider CPI.

Summary of estimated costs to undertake priority management actions at Edithvale and Seaford Wetlands:

Site	Priority	Estimated costs per year ^	Estimated costs for one-off assessments
Edithvale Wetland	Priority 1 management actions	$194,000-$202,000	$16,000
	Priority 2 management actions	$29,600-$34,600	$9,000
	Priority 3 management actions	$15,000-$21,000	$27,000
Seaford Wetland	Priority 1 management actions	$214,500-$222,500	$28,000
	Priority 2 management actions	$29,600-$34,600	$26,000
	Priority 3 management actions	$15,000-$21,000	$32,000

^ Does not include revegetation costs of $11 / guarded plant or $3 / unguarded plant, and $2 / plant for maintenance.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MZ3
EV4 & DED300
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E-N-G2
Education Centre
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EDITHVALE ROAD
E-S-G1
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KINGSTON
MZ3
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MZ2
Nest box
Photopoint
Water quality monitoring
Depth gauge
Path
Fencing
Management zone 1
Management zone 2
Management zone 3
EVCs
Council boundary
Ramsar boundary
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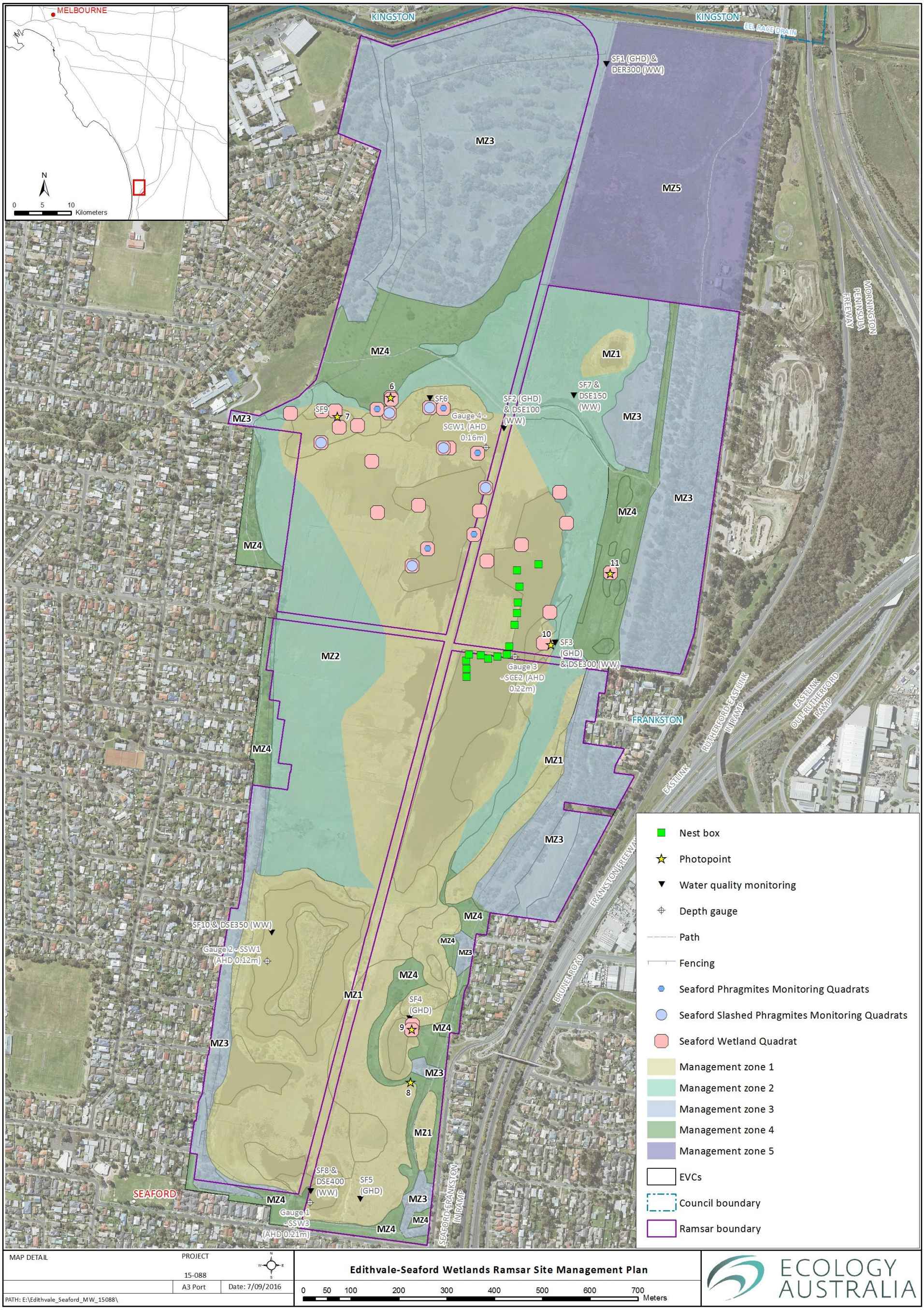
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MZ3
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MZ2
MORNINGTON PENINSULA FREEWAY
SF7 & DSE150 (WW)
SF6
SF9
SF2 (GHD) & DSE100 (WW)
Gauge 4 - SGW1 (AHD 0.16m)
6
7
11
10
SF3 (GHD) & DSE300 (WW)
Gauge 3 - SGE2 (AHD 0.22m)
FRANKSTON
RUTHERFORD-EASTLINK IN-RAMP
EASTLINK OUT-RUTHERFORD RAMP
EASTLINK
FRANKSTON FREEWAY
BRUNEL ROAD
SF10 & DSE350 (WW)
Gauge 2 - SSW1 (AHD 0.12m)
SF4 (GHD)
9
8
SF8 & DSE400 (WW)
SF5 (GHD)
SEAFORD
Gauge 1 - SSW3 (AHD 0.21m)
SEAFORD-FRANKSTON IN-RAMP
Nest box
Photopoint
Water quality monitoring
Depth gauge
Path
Fencing
Seaford Phragmites Monitoring Quadrats
Seaford Slashed Phragmites Monitoring Quadrats
Seaford Wetland Quadrat
Management zone 1
Management zone 2
Management zone 3
Management zone 4
Management zone 5
EVCs
Council boundary
Ramsar boundary
MAP DETAIL
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1 Introduction

1.1 Background

The Edithvale-Seaford Wetlands represent remnant ecosystems of the once extensive Carrum Carrum Swamp which was located on the eastern shoreline of Port Phillip Bay, separated from the sea by a beach ridge-dune barrier system. The wetlands have long been recognised as supporting important habitat for birds (Carter 1975; Watkins 1993; ANCA 1996; Ecology Australia 2000; GHD 2006). The significance of the wetlands was acknowledged by their inclusion in the Directory of Important Wetlands in Australia (ANCA 1996). Further recognition of the diversity of values led to their listing as wetlands of international significance in 2001 under the Ramsar Convention (KBR 2009), shortly after the preparation of the first management plan for the site (Ecology Australia 2000).

Edithvale Wetlands are owned and managed by Melbourne Water, whilst Seaford Wetlands are owned and managed jointly by Melbourne Water and Frankston City Council (KBR 2009; DSE 2012). In accordance with the Australian Ramsar Management Principles, Melbourne Water needs to conduct seven year reviews of existing Ramsar Wetland Management Plans. The existing, 2009, Edithvale-Seaford Ramsar Site Management Plan (KBR 2009) is due for a comprehensive review with preparation of this new Management Plan to guide best practice management of these important wetland sites. This management plan will guide management at the site from 2016 until a new plan is prepared in 2023.

Furthermore, the sites contain a number of important biodiversity values that sees them included in Melbourne Water's Sites of Biodiversity Significance (SoBS) register (Melbourne Water 2013a and 2013b). Thus, the Management Plan is cognisant of Melbourne Water's requirements under the SoBS program.

1.2 Objectives of the Management Plan

Consistent with requirements of the Convention, the primary purpose of the Edithvale-Seaford Wetlands Ramsar Management Plan is to maintain ecological character and promote wise use of the site. Wise use is defined by the Convention as (Ramsar Convention 2005):

- *"the maintenance of their ecological character, achieved through the implementation of ecosystem approaches, within the context of sustainable development".*

More plainly, this means balancing conservation with sustainable use of wetlands that benefits both people and nature. The primary objective of this Edithvale-Seaford Wetlands Ramsar Site Management Plan is:

- ***"To maintain, and where possible improve, the ecological character of the Edithvale-Seaford Wetlands Ramsar site and promote wise use".***

More specifically, the objectives of the Management Plan are to:

- fulfil international, federal, state and local government requirements for Ramsar management plans;
- incorporate the views of local community groups;

- provide a comprehensive description of the Ramsar site;
- discuss the legislative and policy framework that may affect management of the Ramsar site;
- describe the values of the site, including those pertaining to the "Ecological Character" of the wetlands, those that satisfy the criteria for Ramsar listing, and other values, such as vegetation, wetland types, drainage function, cultural heritage and social amenity;
- identify management zones associated with the wetlands, including the values of the different zones;
- identify threats associated with the different management zones;
- undertake a risk assessment of the threats;
- propose prioritised management actions to address the threats and maintain the unique biodiversity values of the wetlands, according to zones;
- outline management requirements of the different zones; and
- protect cultural heritage values.

1.3 Ramsar Management Policies and Guidelines

The plan structure and contents of this Ramsar Site Management Plan is in-line with relevant Ramsar legislation, government policies and strategies, including the requirements of:

- the Australian Government (2000) - Australian Ramsar Management Principles;
- Department of Natural Resources and Environment (DNRE) (2002) - Management of Victoria's Ramsar Wetlands Strategic Directions Statement;
- Ramsar Contracting Parties (2002) - New Guidelines for Management Planning for Ramsar Sites and Other Wetlands. Adopted by Resolution VIII.14 (2002) of the Ramsar Convention;
- Thomas and Middleton (2003) - Guidelines for Management Planning of Protected Areas; and
- Chatterjee A, Phillips B and Stroud D (2008) - Wetland Management Planning: A Guide for Site Managers.

1.4 Consultative Framework

This Management Plan has been developed collaboratively in order to represent the interests of the agencies and community groups, involve interested parties in the decision making process regarding future management of the wetlands and identify areas or actions for continuing community input and involvement with implementation of the Plan. An inception meeting (19 November 2015) and site familiarisation visit with staff from Melbourne Water (23 February 2016) were undertaken. Ecology Australia also met the Edithvale-Seaford Wetlands Community Liaison Committee on 24 February 2016. A workshop was run by Jenny Hale with stakeholder involvement on 8 March 2016 and a site visit to areas identified during the workshop was undertaken with the stakeholders on 16 March 2016.

Stakeholders comprised of staff or members from Melbourne Water, Kingston City Council, Frankston City Council, BirdLife Australia, Friends of Edithvale-Seaford Wetlands, Seaford Community Group and Aspendale Gardens Residents Association.

All comments received during the consultative phase were considered in finalising the Management Plan.

The draft Ramsar Management Plan was distributed by Melbourne Water to all of the stakeholders mentioned above as well as several additional stakeholders - Downs Estate Community Group, Department of Environment, Land, Water and Planning (DELWP). All of these stakeholders were encouraged to provide feedback on the plan and were given six weeks to do so.

The Management Plan also provides for continuing community involvement in implementation of the Plan through identification of areas of management that can be undertaken by the community in Section 9.

2 Ramsar Site Description

2.1 Location

The Edithvale-Seaford Wetlands Ramsar Site is located in Melbourne's south eastern suburbs, c. 30 km from the Melbourne Central Business District (CBD). The site is comprised of two separate wetlands: Edithvale (104 ha) and Seaford (158 ha) (Figure 1). The site is owned predominantly by Melbourne Water with some sections of Seaford Wetlands, including "Downs Estate", owned by the City of Frankston (KBR 2009; DSE 2012; DEPI 2013a).

The Edithvale-Seaford Wetlands Ramsar Site is located in the Gippsland Plain bioregion, which extends from Melbourne's CBD in the west to Lakes Entrance in the west and to Moe in the north (DSE 2012). The bioregion comprises coastal and lowland alluvial plains and is characterised by generally flat to undulating terrain, vegetated in parts with open grassy forest and areas of Swamp Scrub (DSE 2012).

The area experiences a temperate climate with an average annual rainfall of 709 mm recorded at Moorabbin Airport (Station Number 86077; Lat. 37.98° S; Lon. 145.10° E; Elevation: 12 m asl; data 1950-current), the closest weather station with long-term rainfall data. The wettest month is May with an average of 69.5 mm and the driest month is January with an average of 44.2 mm. The monthly mean maximum temperatures at Moorabbin Airport (from 1971 to current) range from 26.1^{o}C in February to 13.7^{o}C in July. The monthly mean minimum temperatures at Moorabbin Airport range from 14.4^{o}C in February to 6.2^{o}C in July (Bureau of Meteorology, 2016).

2.2 Wetland Description

The Edithvale-Seaford Wetlands Ramsar Site is the only Victorian Ramsar site located in an urban landscape. The Ramsar site has experienced a long history of disturbance, and subsequently, the condition of the vegetation, hydrology and water quality has been modified (Ecology Australia 2001; KBR 2009; DSE 2012; Section 6).

The distribution and occurrence of Ecological Vegetation Classes (EVCs) identified at Edithvale and Seaford Wetlands is in a constant state of flux primarily responding to water levels and salinity; the following EVCs have been identified (TBLD and Australian Ecosystems 2005; Australian Ecosystems 2011a, 2015; Section 4.1.5):

- Damp Sands Herb-rich Woodland (EVC 3);
- Swamp Scrub (EVC 53);
- Tall Marsh (EVC 821);
- Brackish Aggregate Wetland (EVC 656);
- Brackish Aquatic Herbland (EVC 537)
- Plains Sedgy Wetland (EVC 647);
- Aquatic Herbland (EVC 653);
- Brackish Herbland (EVC 538); and
- Wet Saltmarsh (EVC 9).

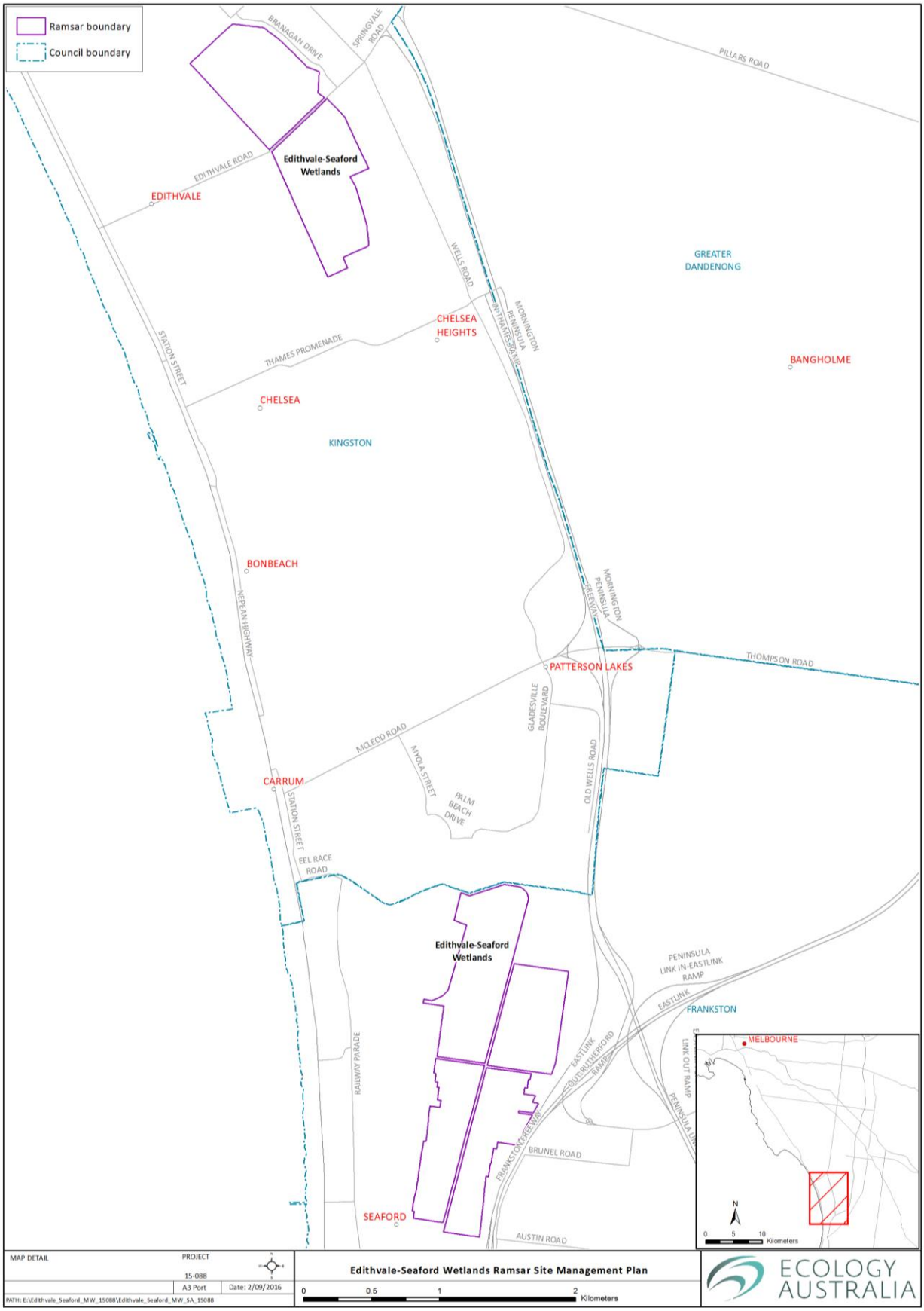


Figure 1 The location of the Edithvale Wetlands near Chelsea and the Seaford Wetlands to the north of Frankston.

Tall Marsh is the dominant wetland vegetation throughout both Edithvale and Seaford Wetlands. It is highly invasive of other habitats, especially of important mudflat areas for migratory waders, but Melbourne Water management is attempting to reduce the extent of invasion (Australian Ecosystems 2015; Greet and Rees 2015). It provides habitat for a number of waterbird species and marshland-dependent passerine species (Sections 4.1.3, 4.1.4 and 4.1.6; Birds Australia 2004; BirdLife Australia 2015a). Damp Sands Herb-rich Woodland surrounds Seaford Wetlands and provides habitat for terrestrial birds, mammals and reptiles (Birds Australia 2004; KBR 2009; Australian Ecosystems 2015).

2.3 Wetland Types

Victorian wetlands have been mapped and classified according to a Victorian Wetland Classification (DELWP, in prep.) in the WETLAND_CURRENT spatial layer. This identifies four wetland types in the Ramsar site:

- Fresh, intermittent, sedge/grass/forb – 116 hectares
- Fresh seasonal/episodic unknown vegetation – 11 hectares
- Fresh seasonal / episodic, forest/woodland – 4 hectares
- Fresh, intermittent, open water – 1.4 hectares.

However, knowledge of the site, and mapped EVCs indicate that there are areas of saline / brackish wetland on site (EVC 656 - Brackish wetland Aggregate; EVC 538 - Brackish Herbland; and EVC 537 - Brackish Aquatic Herbland).

Using all available information, this translates into four wetland types according to the Ramsar wetland classification, within the Edithvale-Seaford Wetlands Ramsar site. In order of dominance, these are:

- Ts - Seasonal / intermittent freshwater marshes/pools on inorganic soils;
- Ss - Seasonal/intermittent saline/brackish/alkaline marshes/pools;
- Xf - Freshwater, tree-dominated wetlands;
- P - Seasonal/ intermittent freshwater lakes.

2.4 Wetland Significance and Listings

2.4.1 Ramsar Criteria

When the Edithvale-Seaford Wetlands were first nominated in 2001, the original documents considered that the site met three of the then eight criteria (see Brett Lane and Associates 2001). The criteria under which a Ramsar site can be designated have gone through a series of changes, with the most recent major revisions occurring at the 9th Ramsar Conference in Kampala, Uganda 2005, when a ninth criterion was added. The most recent assessment of the site against Ramsar criteria (Hale 2016) indicated that there is insufficient evidence to suggest that the site met criteria 1 and 3, but continues to meet three criteria (2, 4 and 6; Table 1).

Table 1 Assessment against the nine Ramsar listing criteria. Criteria that the site meets are also highlighted in blue.

Criteria	Justification	Meets Criterion (Yes/No)
1. Contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region.	The appropriate bioregion for the site is the South-east Coastal Drainage Division which includes all of the coastline of Victoria and New South Wales and a small portion of the South Australian coast (Department of the Environment, Water, Heritage and the Arts 2008). There is no comprehensive wetland inventory for this bioregion. As such the application of the terms "representative" and "rare" are difficult. It terms of "representative" advice from the Convention (Ramsar 2009) is that contracting parties should select the "best examples" of each wetland type within a bioregion and that the wetlands should be in "near-natural" condition. The Edithvale-Seaford wetlands are remnants of what was once the Carrum Carrum Swamp, a large freshwater wetland, largely drained in the late 19th century. The wetland types within the site may be locally important, however, they are currently highly modified and part of a regional drainage system for storing stormwater from surrounding urban landscapes. It is difficult to make the argument that these sites are rare, representative or near-natural. As such, the site does not meet this criterion and did not meet it at the time of listing.	No
2. Supports vulnerable, endangered, or critically endangered species or threatened ecological communities.	The site regularly supports two wetland dependent fauna species listed under the EPBC Act and / or IUCN Red List: • Australasian Bittern *Botaurus poiciloptilus* – Endangered • Curlew Sandpiper *Calidris ferruginea* – Critically Endangered	Yes
3. Supports populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region.	Guidance from the Convention indicates that this criterion should be applied to "hotspots" of biological diversity and centres of endemism within a biogeographical region. The Edithvale-Seaford Wetlands is within a very large bioregion (southeast coast drainage division) and there is no evidence to suggest it is more species rich than other wetlands and Ramsar sites in this region.	No
4. Supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions.	The Edithvale-Seaford Ramsar Site regularly supports eight international migratory waterbirds, provides habitat for many breeding birds and acts as a drought refuge in an urban landscape.	Yes
5. Regularly supports 20,000 or more waterbirds.	Total annual maximum counts from Edithvale-Seaford Wetlands are less than 20,000 (average is approximately 5000).	No
6: Regularly supports 1% of the individuals in a population of one species or subspecies of waterbird.	Counts above 1% of the estimated population of two species are regularly recorded within the site: Australasian Bittern *Botaurus poiciloptilus* and Sharp-tailed Sandpiper *Calidris acuminata*.	Yes

Criteria	Justification	Meets Criterion (Yes/No)
7. Supports a significant proportion of indigenous fish subspecies, species or families, life-history stages, species interactions and/or populations that are representative of wetland benefits and/or values and thereby contributes to global biological diversity.	The site is not considered important for native fish.	No
8: An important source of food for fishes, spawning ground, nursery and/or migration path on which fish stocks, either within the wetland or elsewhere, depend.	The site is not considered important for native fish.	No
9: Regularly supports one percent of the individuals in a population of one species or subspecies of wetland-dependent non-avian animal species.	No evidence to suggest that this criterion is met.	No

2.4.2 Other listings/classifications

Edithvale-Seaford Wetlands are also:

- Considered to be a site of State and International Treaty Zoological Significance in the southeast of Melbourne and Mornington Peninsula by DSE (2004);
- included in the Directory of Important Wetlands (ANCA 1996; KBR 2009);
- subject to a number of migratory bird bilateral agreements and conventions (Section 3.1.2);
- identified as a high value Melbourne Water SoBS (Section 3.4.3);
- part of the Carrum Important Bird Area (IBA) program led by BirdLife Australia (see below).

Seaford Wetlands was also identified as:

- a site of International importance for the Sharp-tailed Sandpiper by Watkins (1993), in that the area supports (or supported) 1% or more of the individuals in the East Asian – Australasian Flyway population.

Carrum Wetlands Important Bird and Biodiversity Area

The Important Bird and Biodiversity Areas (IBAs) program is an international non-governmental conservation scheme lead by BirdLife International Partners, such as BirdLife Australia. IBAs are (BirdLife Australia 2016b):

- sites of international importance for bird conservation; and
- small enough to be practical targets for conservation management, but large enough to meet the global IBA criteria.

The Australian IBA program aims to protect a network of sites critical for the conservation of Australia's birds by:

- promoting IBAs as a tool for biodiversity conservation planning;
- encouraging government to prioritise conservation at IBAs (e.g. in grant-giving schemes); and
- encouraging and facilitating local community-based groups and land-owners to manage land sustainably and conserve key bird species.

Edithvale and Seaford Wetlands, together with Braeside Park Wetlands, Wannarkladdin Wetlands, Boundary Road Wetland, PARCS Wetland and the Eastern Treatment Plant constitute the Carrum Wetlands IBA (Figure 2; BirdLife Australia 2016b). The Carrum Wetlands IBA regularly supports more than 1% of the world populations of Sharp-tailed Sandpiper, Blue-billed Duck and Chestnut Teal and is an important non-breeding refuge for the endangered Australasian Bittern (BirdLife Australia 2016b).

Globally-important bird populations in this IBA identified from monitoring between 1989 and 2008 recorded (BirdLife Australia 2016b):

- Chestnut Teal 0 - 1962 individuals;
- Blue-billed Duck 0 - 510 individuals;
- Australasian Bittern 0 - 14 individuals; and
- Sharp-tailed Sandpiper 0 - 5839 individuals.

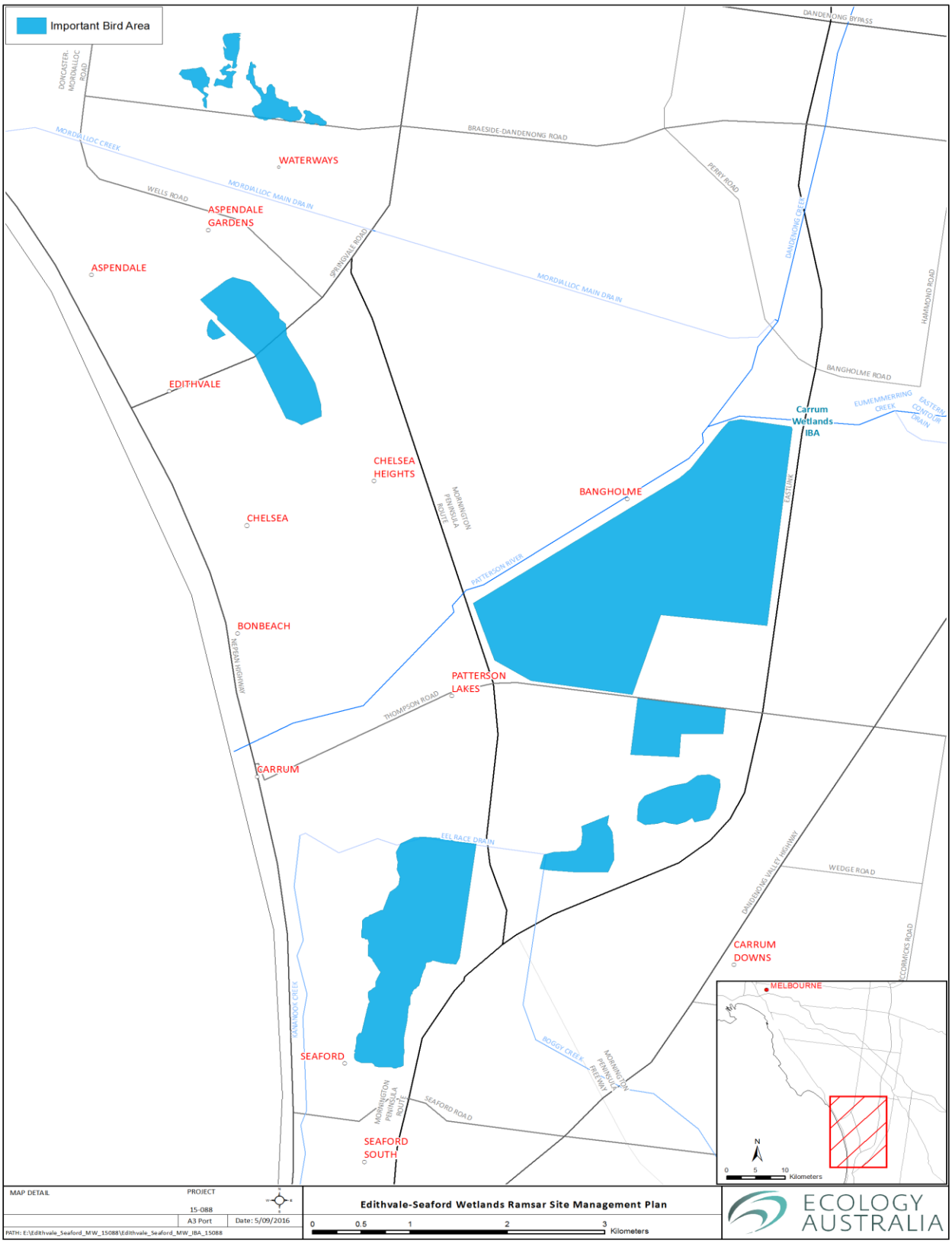


Figure 2 The location of the Carrum Important Bird Area comprising Edithvale Wetlands, Seaford Wetlands, Braeside Park Wetlands, Wannarkladdin Wetlands, Boundary Road Wetland, PARCS Wetland and the Eastern Treatment Plant

2.5 Land Tenure and Management

The Edithvale Wetlands site comprises freehold land parcels (allotments) owned and managed by Melbourne Water (KBR 2009; DSE 2012; DEPI 2013a).

Seaford Wetlands consists of freehold land parcels owned and managed by Melbourne Water and a Crown Land conservation reserve to the east of Seaford Wetlands that is managed by Melbourne Water under a Committee of Management (KBR 2009; DSE 2012). Frankston City Council owns a significant portion of the parcels of land surrounding Seaford Wetlands, particularly the dryland areas (see Figure 3). There is an informal arrangement in terms of management with Melbourne Water notionally managing inside the internal fence and Frankston City Council notionally managing outside the internal fence (see Figure 4; Paul Rees, Melbourne Water, pers. comm.).

Land tenure and management is described in KBR (2009) and DSE (2012) with land parcel/lot numbers updated by DELWP (2016d) provided in Appendix 1.

'Downs Estate' (Lot 93\PP3025), in the northeast of Seaford Wetlands, was acquired by Frankston City Council just prior to the preparation of the last Management Plan for the Ramsar site (KBR 2009). It is freehold land managed by Frankston City Council and is situated outside of the Ramsar boundary. However, Council's Environment and Planning Department and Melbourne Water are interested in including the land within the Ramsar boundary.

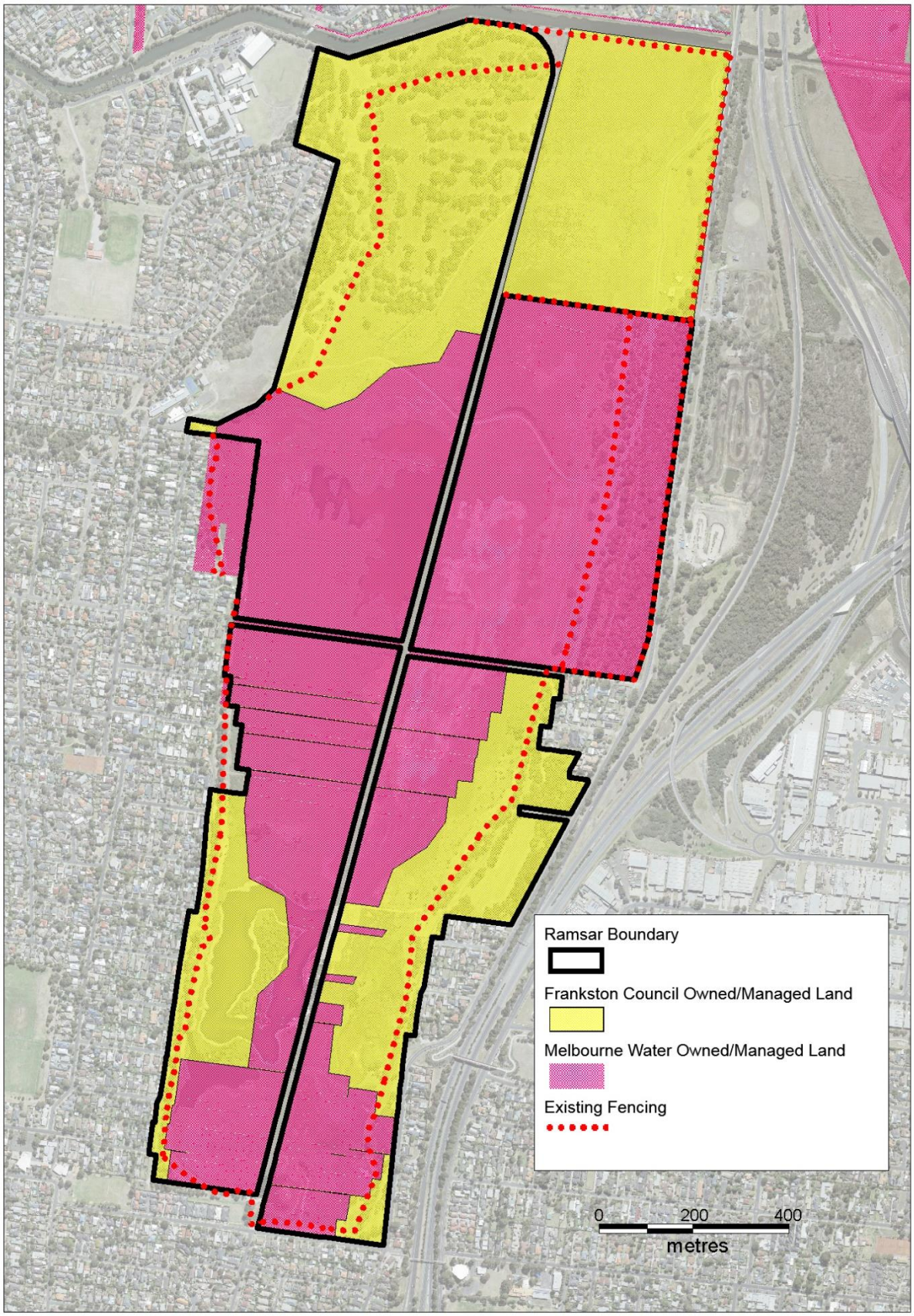


Figure 3 Plan of the Seaford Wetlands section of the Ramsar site, showing the land owned by Melbourne Water and Frankston City Council (figure provided by Melbourne Water).

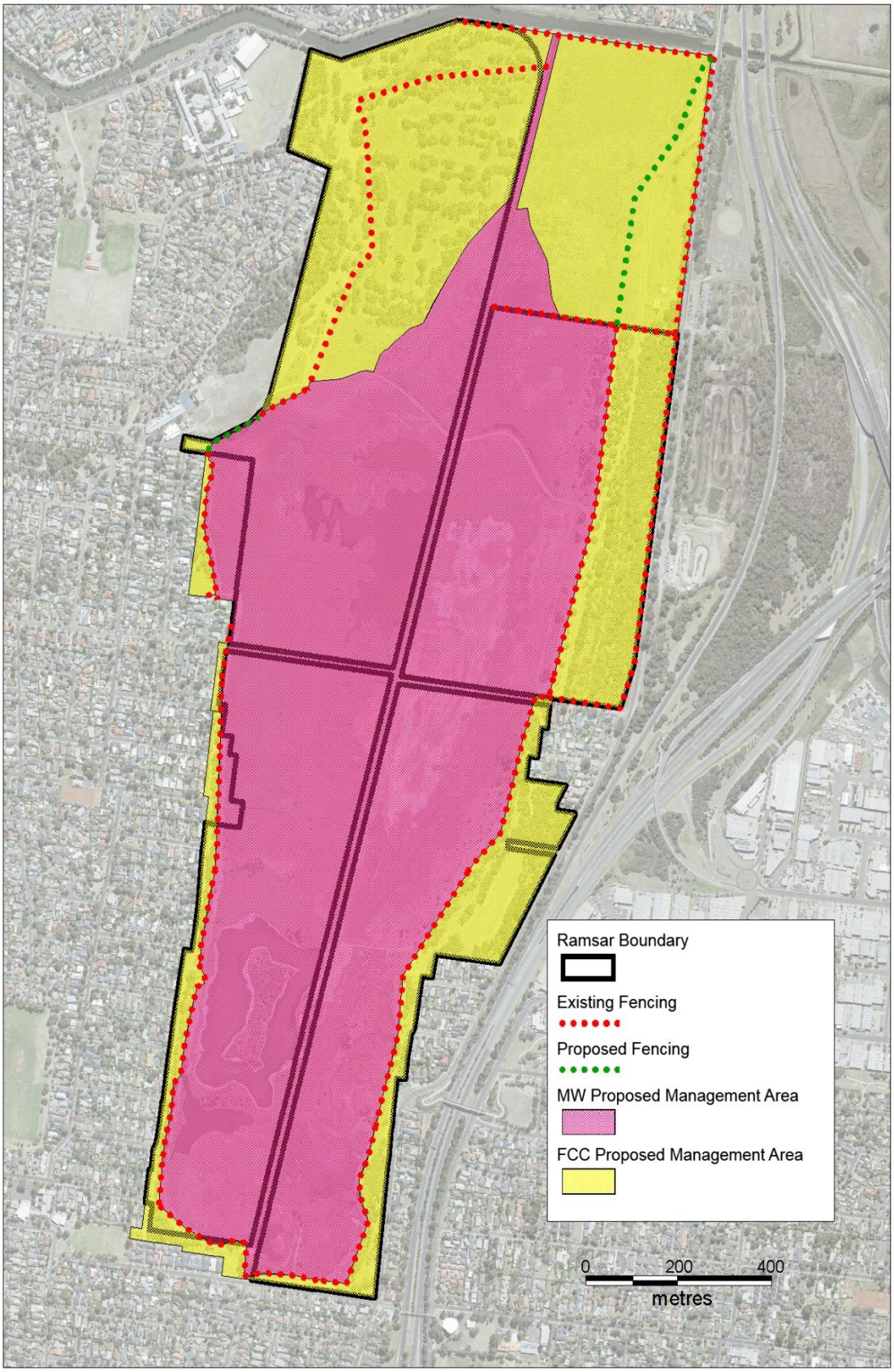


Figure 4 **Plan of the Seaford Wetlands section of the Ramsar site, showing the proposed management areas of Melbourne Water and Frankston City Council (figure provided by Melbourne Water).**

2.6 Landscape Setting

The Edithvale-Seaford Wetlands Ramsar Site is the only Victorian Ramsar site and one of a few Australian Ramsar sites located in an urban landscape and support important areas of open space used by the public for recreation (Ecology Australia 2000; KBR 2009; DSE 2012).

Edithvale Wetlands are surrounded by freehold urban development to the north, east and south that form the suburbs of Aspendale Heights and Chelsea Heights (KBR 2009; DSE 2012). Centre Swamp Drain and an associated drainage reserve occur along the western boundary of the Edithvale Wetlands and runs from north to south between Mordialloc Creek in the north and the Patterson River in the south. A recreation reserve, the Edithvale Common, adjoins the Drain and drainage reserve to the west of Edithvale North Wetlands and supports two wetlands which supported good habitat for waterbirds (e.g. Latham's Snipe and ducks) and frogs on an annual basis prior to alterations/improvements to drainage; it now supports good waterbird and frog habitat only during very wet years (Ecology Australia 2001; KBR 2009; SKM 2011; Section 6.3.2; Paul Rees and Will Steele, Melbourne Water, pers. comm.). Kingston City Council is investigating alterations to the local drainage system to alleviate flooding in nearby streets, by providing water more frequently to the low lying areas in Edithvale Common (Paul Rees, Melbourne Water, pers. comm.). Rossdale Golf Course adjoins the Drain and drainage reserve to the northwest corner of Edithvale North Wetlands, whilst Chelsea Public Golf Course adjoins the northern half of Edithvale South Wetlands. Residential development adjoins the Drain and drainage reserve to the southwest of Edithvale South Wetlands (i.e. south of Chelsea Public Gold Course). The block of land to the south of Edithvale South Wetland and bordering the northern side of First Avenue and the western side of houses along Norman Avenue (c. 4.0 ha in size) may be developed and Melbourne Water will potentially acquire a portion that is covered by the LSIO (Paul Rees, Melbourne Water, pers. comm.).

Eel Race Creek borders the northern end of Seaford Wetlands (Ecology Australia 2000; KBR 2009). Freehold urban development and undeveloped land surrounds Seaford Wetlands, to the west, south, east and northeast, including the Patterson River Secondary College, residential development and Seaford North Primary School in the northwest, residential development to the west, Austin Road to the south, Francis Street and Old Wells Road to the east, and the Frankston City Motorcycle Park to the east in the northern half of the site (Ecology Australia 2000; KBR 2009).

'Downs Estate' in the northeast of Seaford Wetlands, is freehold land managed by Frankston City Council that is situated outside of the Ramsar boundary. However, Council's Environment and Planning Department and Melbourne Water are interested in including the land within the Ramsar boundary (see Sections 2.5 and 4.1.12).

Prohibitive fencing with access gates for maintenance vehicles and pedestrians have been installed to separate sensitive wetland habitats from publically accessible dryland and recreation areas at Edithvale and Seaford Wetlands (KBR 2009; Paul Rees, Melbourne Water pers. comm.).

The surrounding urban landscape poses considerable challenges for management and protection of the significant values of the Ramsar site. Management issues associated with the urban landscape include reduced stormwater quality, disturbance of wildlife, predation of wildlife by domestic animals, weed invasion and litter (e.g. Brett Lane and Associates 2001; Ecology Australia 2000; KBR 2009; DSE 2012).

2.7 Catchment Setting

The Edithvale-Seaford Wetlands are located in the Bunyip River Basin in the Southeast Coast Drainage Division (KBR 2009; DSE 2012). The Southeast Coast Drainage Division extends along the coast of Australia from south-eastern Queensland to south-eastern South Australia. The Bunyip River Basin occupies some 389,033 ha, with land use divided between urban development and agriculture (KBR 2009).

Within the Bunyip River Basin, Edithvale Wetlands and Seaford Wetlands occur in the Dandenong Catchment (c. 85,500 ha). Dandenong Creek is a major waterway within the catchment, with headwaters in the Dandenong Ranges National Park. At the time of European Settlement, Carrum Carrum Swamp received water largely from Dandenong Creek and Eumemmering Creek, with contributions from catchments that drain to Mordialloc Creek and Boggy Creek (GHD 2006). However, the hydrology of the Edithvale-Seaford Wetlands has been significantly altered since European Settlement, such that (GHD 2006; KBR 2009; SKM 2011; DSE 2012; Section 6.3):

- Seaford Wetlands has been disconnected from the Boggy Creek catchment and largely receive inflows from drains and groundwater intrusions; and
- Edithvale Wetlands receive water largely from local stormwater inlets, with groundwater intrusions also occurring.

2.8 Local Government

The Edithvale-Seaford Wetlands Ramsar site intersects both the southern extent of the Kingston City Council and the northern extent of Frankston City Council local government areas (Figures 1, 8 and 9; Brett Lane and Associates 2001; Ecology Australia 2000; KBR 2009; DSE 2012): Edithvale Wetlands are located within the Kingston City Council local government area; and Seaford Wetlands are situated within Frankston City Council local government area.

3 Legislation and Policy Framework

3.1 International Legislation and Policy

3.1.1 The Ramsar Convention

Ecological Character

The Convention on Wetlands of International Importance, otherwise known as the Ramsar Convention, was signed in Ramsar Iran in 1971 and came into force in 1975. It provides the framework for local, regional and national actions, and international cooperation, for the conservation and wise use of wetlands. Wetlands of International Importance are selected on the basis of their international significance in terms of ecology, botany, zoology, limnology and/or hydrology. Australia was one of the first countries to sign the Convention, and there are now 169 Contracting Parties and over 2000 designated wetlands of international importance. The mission of the Ramsar Convention is (Ramsar Convention 2016):

"Conservation and wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world."

In 1997 the Convention identified three pillars for the conservation and protection of wetlands:

i) the wise use of all wetlands through national plans, policies and legislation, management actions and public education;

ii) the designation and sustainable management of suitable wetlands for inclusion on the list of Wetlands of International Importance; and

iii) international cooperation on transboundary wetlands and shared species.

Under the terms of the Convention contracting parties nominate wetlands to be designated as Wetlands of International Importance, with nominated sites required to meet at least one of nine listing criteria. The act of designating a wetland as a Ramsar site carries with it certain obligations, including managing the site to maintain its 'ecological character' and to have procedures in place to detect if any threatening processes are likely to, or have altered, the 'ecological character'. The Ramsar Convention has defined "ecological character" and "change in ecological character" as (Ramsar Convention 2005):

- *"Ecological character is the combination of the ecosystem components, processes and benefits/services [CPS] that characterise the wetlands at a given point in time";* and
- *"…change in ecological character is the human induced adverse alteration of any ecosystem component, process and or ecosystem benefit/service."*

Ramsar documentation

Ramsar site management to maintain ecological character is reliant on a number of key documents and processes as illustrated in Figure 5. The three key documents are:

Ramsar Information Sheet (RIS) - compiled for each site it documents the essential information related to the site and its management. The Administrative Authority of each Contracting Party submits the RIS to the Ramsar Secretariat. In the case of Australia this is the Australian Government Department of the

Environment (DoE). The Parties have committed to providing updated RIS information for their Ramsar sites every six years, or on the occasion of any significant change in a site's ecological character. The most recent RIS for Edithvale-Seaford Wetlands was compiled in 2001 (Brett Lane and Associates 2001) and can be obtained from the DoE website (http://www.environment.gov.au/cgi-bin/wetlands/ramsardetails.pl?refcode=57#). This RIS is currently being updated (Hale, in pre.) with a revised RIS due in mid-2016. Once formally approved this revised RIS will be available from the Ramsar Information Service (https://rsis.ramsar.org/).

Ecological Character Description (ECD) – provides a more detailed and quantitative description of ecological character for a Ramsar site. The ECD for Edithvale-Seaford (DSE 2012) was written in 2008, prior to the development of guidelines for ECDs (DEWHA 2008). It can be accessed from the DoE website (http://www.environment.gov.au/cgibin/wetlands/ramsardetails.pl?refcode=57#).

An update to the ECD is being drafted (Hale 2016), which identifies critical components, processes and services and sets limits for acceptable change.

Management plan – documents the management strategies required to protect and restore the ecological character of a Ramsar site. In Australia, the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) establishes the framework for management of Australian Ramsar sites, and Schedule 6 of Environment Protection and Biodiversity Conservation Regulations 2000 outlines the principles relevant to the preparation of Ramsar site management plans (Text Box 1).

Ramsar Rolling Review – The Department of Environment has developed a three-year Ramsar Rolling Review program for reporting the status of the ecological character of Australia's Ramsar sites. The broad aims of the Ramsar Rolling Review (DELWP 2016e) program are to:

- Review and report on the status of the ecological character of Australia's Ramsar sites.
- Be a tool to assist managing sites in order to maintain their ecological character, improving links between ecological character, site management plans and monitoring programs for critical components, processes and services and associated threats.
- Provide input to a database of baseline and threat data.
- Record updates as knowledge gaps are addressed and refine Limits of Acceptable Change.
- Highlight issues and facilitate assessment of a potential change of character, focussing on proactive management before the situation requires notification.
- Identify broad trends or common threats across site and jurisdiction boundaries.

3.1.2 Migratory Bird Bilateral Agreements and Conventions

Australia is party to a number of bilateral agreements, initiatives and conventions for the conservation of migratory birds, which are relevant to the Edithvale-Seaford Wetlands Ramsar Site. The bilateral agreements are:

- *Japan-Australia Migratory Bird Agreement (JAMBA)* – The agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds in Danger of Extinction and their Environment, 1974;

- *China-Australia Migratory Bird Agreement (CAMBA)* - The Agreement between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment 1986;
- *Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA)* - The Agreement between the Government of Australia and the Republic of Korea for the Protection of Migratory Birds and their Environment, 2006; and
- *The Bonn Convention on Migratory Species (CMS)* - The Bonn Convention adopts a framework in which countries with jurisdiction over any part of the range of a particular species co-operate to prevent migratory species becoming endangered. For Australian purposes, many of the species are migratory birds.

3.1.3 East Asian-Australasian Flyway Partnership

The East Asian-Australasian Flyway Partnership (EAAFP) was launched in November 2006 and is an informal and voluntary initiative that aims to protect migratory waterbirds, their habitat and the livelihoods of people dependent upon them. The partnership covers the East Asia-Australasia flyway which covers 22 countries and extends from the Arctic Circle, through East and South-east Asia, to Australia and New Zealand.

Partners include governments, site managers, academic institutions, UN agencies, development agencies, industrial and private sector, non-government organisations and local people. The partnership provides a platform for dialogue and cooperation, supports the listing and maintenance of internationally recognised wetlands and supports a range of community education programs and activities.

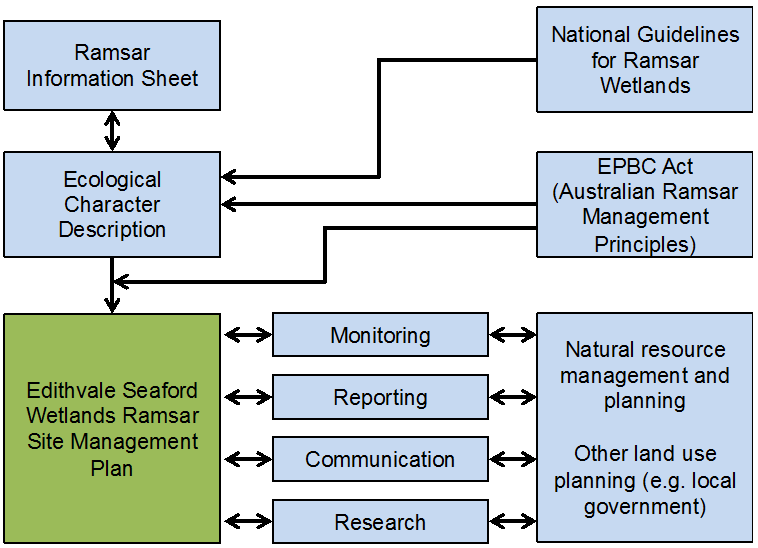


Figure 5 The Edithvale-Seaford Wetlands Ramsar Site Management Plan in context of other requirements for the management of Ramsar sites (adapted from DEWHA 2008).

1 General principles

1.01 The primary purpose of management of a declared Ramsar wetland must be, in accordance with the Ramsar Convention :

(a) to describe and maintain the ecological character of the wetland; and

(b) to formulate and implement planning that promotes:

(i) conservation of the wetland; and

(ii) wise and sustainable use of the wetland for the benefit of humanity in a way that is compatible with maintenance of the natural properties of the ecosystem.

1.02 Wetland management should provide for public consultation on decisions and actions that may have a significant impact on the wetland.

1.03 Wetland management should make special provision, if appropriate, for the involvement of people who:

(a) have a particular interest in the wetland; and

(b) may be affected by the management of the wetland.

1.04 Wetland management should provide for continuing community and technical input.

2 Management planning

2.01 At least one management plan should be prepared for each declared Ramsar wetland.

2.02 A management plan for a declared Ramsar wetland should:

(a) describe its ecological character; and

(b) state the characteristics that make it a wetland of international importance under the Ramsar Convention; and

(c) state what must be done to maintain its ecological character; and

(d) promote its conservation and sustainable use for the benefit of humanity in a way that is compatible with maintenance of the natural properties of the ecosystem; and

(e) state mechanisms to deal with the impacts of actions that individually or cumulatively endanger its ecological character, including risks arising from:

(i) physical loss, modification or encroachment on the wetland; or

(ii) loss of biodiversity; or

(iii) pollution and nutrient input; or

(iv) changes to water regimes; or

(v) utilisation of resources; or

(vi) introduction of invasive species; and

(f) state whether the wetland needs restoration or rehabilitation; and

(g) if restoration or rehabilitation is needed--explain how the plan provides for restoration or rehabilitation; and

(h) provide for continuing monitoring and reporting on the state of its ecological character; and

(i) be based on an integrated catchment management approach; and

(j) include adequate processes for public consultation on the elements of the plan; and

(k) be reviewed at intervals of not more than 7 years.

3 Environmental impact assessment and approval

3.01 This principle applies to the assessment of an action that is likely to have a significant impact on the ecological character of a Ramsar wetland (whether the action is to occur inside the wetland or not).

3.02 Before the action is taken, the likely environmental impact of the action on the wetland's ecological character should be assessed under a statutory environmental impact assessment and approval process.

3.03 The assessment process should:

(a) identify any part of the ecological character of the wetland that is likely to be affected by the action; and

(b) examine how the ecological character of the wetland might be affected; and

(c) provide adequate opportunity for public consultation.

3.04 An action should not be approved if it would be inconsistent with:

(a) maintaining the ecological character of the wetland; or

(b) providing for the conservation and sustainable use of the wetland.

3.05 Approval of the action should be subject to conditions, if necessary, to ensure that the ecological character of the wetland is maintained.

3.06 The action should be monitored by the authority responsible for giving the approval (or another appropriate authority) and, if necessary, enforcement action should be taken to ensure compliance with the conditions.

Text Box 1. Australian Ramsar management principles.

3.2 National Legislation and Policy

3.2.1 *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*

The EPBC Act regulates actions that will have or are likely to have a significant impact on any matter of national environmental significance, which includes the ecological character of a Ramsar wetland (EPBC Act 1999 s16(1)). An action that will have or is likely to have a significant impact on a Ramsar wetland will require an environmental assessment and approval under the EPBC Act. An 'action' includes a project, a development, an undertaking or an activity or series of activities (http://www.environment.gov.au/epbc/index.html).

The EPBC Act establishes a framework for managing Ramsar wetlands, through the Australian Ramsar Management Principles (EPBC Act 1999 s335), which are set out in Schedule 6 of the Environment Protection and Biodiversity Conservation Regulations 2000. These principles are intended to promote national standards of management, planning, environmental impact assessment, community involvement, and monitoring, for all of Australia's Ramsar wetlands in a way that is consistent with Australia's obligations under the Ramsar Convention. Some matters protected under the EPBC Act are not protected under local or state/territory legislation, for example, many migratory birds are not specifically protected under State legislation. Species listed under international treaties JAMBA, CAMBA and CMS have been included in the List of Migratory species under the Act. Threatened species and communities listed under the EPBC Act may also occur, or have habitat in the Ramsar site; some species listed under State legislation as threatened are not listed under the EPBC Act as threatened, usually because they are not threatened at the national (often equivalent to whole-of-population) level. The Regulations also cover matters relevant to the preparation of management plans, environmental assessment of actions that may affect the site, and the community consultation process.

3.2.2 National Strategy for the Management of Coastal Acid Sulfate Soils 2000

National Strategy for the Management of Coastal Acid Sulfate Soils 2000 has four objectives:

- Identify and define coastal acid sulfate soils;
- Avoid disturbance of coastal acid sulfate soils;
- Mitigate impacts when disturbance is unavoidable; and
- Rehabilitate disturbed coastal acid sulfate soils and acid drainage.

3.3 Victorian Legislation and Policy

3.3.1 *Environment Protection Act 1970*

This Act establishes the Environment Protection Authority and makes provision for the Authority's powers, duties and functions. These relate to improving the air, land and water environments by managing waters, acid sulfate soils, control of noise and control of pollution. State Environment Protection Policies (SEPPs) are subordinate legislation made under the provisions of the Act. The SEPP (Waters of Victoria) sets water quality objectives to protect the beneficial uses of waters and covers wetlands in a general nature. Both Edithvale Wetlands and Seaford Wetlands are subject to a Land Subject to Inundation Overlay (LSIO), of which one of its purposes is to protect water quality in

accordance with the provisions of relevant state environment protection policies, particularly in accordance with Clauses 33 and 35 of the SEPP (Waters of Victoria or WoV) (KBR 2009).

Both wetlands are potentially subject to acid sulfate soils. Policy has been established in Victoria to prevent and regulate pollution from acid sulfate soils. These include: the State Environment Protection Policy (Prevention and management of contamination of land); the Industrial Waste Management Policy (Waste acid sulfate soils 1999) which deal with onsite and offset (e.g. disposal) impacts; and the Best Practice Management Guidelines for Dredging which provide broad policy principles for what needs to be considered and a framework for assessing applications for dredging and specifically refer to coastal acid sulfate soils.

Policies emphasise the need to manage land in a manner that avoids adverse impacts from acid sulphate soils, including avoiding any off-site impacts.

3.3.2 *Environment Effects Act 1978*

This Act establishes the processes for assessment of proposed projects (works) that are capable of having a significant effect on the environment. The Act establishes the role of the Minister for Planning to decide whether an Environmental Effects Statement (EES) is required. The roles and responsibilities of the EES process are described in the Ministerial guidelines for Assessment of Environmental Effects under the *Environment Effects Act 1978* (DSE 2006). The guidelines specify the criteria for referring a project to the Minister for decision on the requirement for an EES. These include effects of potential long term change to the ecological character of a Ramsar site and the need to consider coastal acid sulfate soils in assessing proposed developments.

3.3.3 *Flora and Fauna Guarantee Act 1988*

This Act provides a legislative and administrative framework for the conservation of biodiversity in Victoria. The Act provides for the listing of threatened taxa, communities and potentially threatening processes. It requires the preparation of action statements for listed species, communities and potentially threatening processes and sets out the process for implementing interim conservation orders to protect critical habitats. The Act also seeks to provide programs for community education in the conservation of flora and fauna and to encourage co-operative management of flora and fauna. Ramsar sites provide habitat for many of Victoria's threatened species and support threatened communities. The Act and Victorian Biodiversity Strategy are currently under review.

3.3.4 *Water Act 1989*

This Act establishes rights and obligations in relation to water resources and provides mechanisms for the allocation of water resources. This includes the consideration of environmental water needs of rivers and wetlands as well as for human uses, such as urban water supply and irrigation.

The most relevant section of the Act for this Plan is s189 - Functions of Authorities:

- to identify and plan for state and local community needs relating to the use and to the economic, social and environmental values of land and waterways ; and
- to develop and to implement effectively schemes for the use, protection and enhancement of land and waterways;

- to maintain the environmental water reserve in accordance with the environmental water reserve objective;
- to improve the environmental values and health of water ecosystems, including their biodiversity, ecological functions, quality of water and other uses that depend on environmental condition;
- to investigate, promote and research any matter related to its functions, powers and duties in relation to waterway management;
- to educate the public about any aspect of waterway management;
- to identify and plan for State and local community needs relating to the application or use of water in the Water Holdings or other exercise of rights in the Water Holdings within the waterway management district of the Authority;
- to apply or use water in the Water Holdings or otherwise exercise rights in the Water Holdings within the waterway management district of the Authority in accordance with any relevant seasonal watering statement.

(see http://www.austlii.edu.au/au/legis/vic/consol_act/wa198983/s189.html)

3.3.5 *Planning and Environment Act 1986*

The *Planning and Environment Act 1986* sets out procedures for preparing and amending the Victoria Planning Provisions and planning schemes, obtaining permits under schemes, settling disputes, enforcing compliance with planning schemes, and other administrative procedures.

One main function of the Act is to define the roles and responsibilities of the Minister, councils, government departments, the community and other stakeholders in the planning system. This is in addition to setting the broad objectives for planning in Victoria and the main rules, procedures and statutory instruments for how the planning system is to work. The Act uses the planning schemes to set out how land may be used and developed.

The State Planning Policy Framework (SPPF), clause 15.08, stresses the need to avoid disturbing acid sulfate soils. The planning system provides further opportunity at the local level to include more accurate and confident mapping of coastal acid sulfate soils risk areas directly into planning schemes and to identify a planning trigger for implementing a coastal acid sulfate soils risk identification process when considering development proposals.

The SPPF 15.08-2 (gazetted December 2008) states that planning for coastal areas should:

- Avoid development in identified coastal hazard areas susceptible to coastal acid sulfate soils; and
- Ensure that development conserves, protects and seeks to enhance biological diversity and ecological values by avoiding the disturbance of coastal acid sulfate soils.

Zones and Overlays

The majority Edithvale Wetlands is zoned Public Use Zone – Service and Utility, with the exception of the south-western corner which is a Public Park and Recreation Zone. The site is covered by:

- an Environmental Significance Overlay to ensure that development is compatible with identified environmental values; and
- a Land Subject to Inundation Overlay to identify land within the 1 in 100 year flood level, protect water quality and river/wetland/floodplain health, and ensure that development maintains free passage and temporary storage of floodwaters to minimise potential flood damage/impacts.

Similarly, the majority of Seaford Wetlands is a Public Use Zone – Service and Utility, with the exception of the dryland area to the north which is a Public Conservation and Resource Zone. Overlays covering the site include:

- an Environmental Significance Overlay – Schedule 1 (Areas of Botanical or Zoological Significance) to ensure that development is compatible with identified environmental values, botanical and zoological values and protected and enhanced in the long term, and populations and communities of native plants and or fauna are protected;
- a Land Subject to Inundation Overlay to identify land within the 1 in 100 year flood level, protect water quality and river/wetland/floodplain health, and ensure that development maintains free passage and temporary storage of floodwaters to minimise potential flood damage/impacts; and
- Wildfire Management Overlay to ensure that the development of land considers bushfire risk (protection of life and assets) and bushfire protection measures are implemented where warranted.

3.3.6 *Catchment and Land Protection Act 1994*

The *Catchment and Land Protection Act 1994* establishes a framework for the integrated management and protection of catchments. It establishes processes to encourage and support community participation in the management of land and water resources and provides for a system of controls on noxious weeds and pest animals. Section 20 of this Act outlines the duty of land owners to take all reasonable steps to avoid causing or contributing to land degradation which causes or may cause damage to the land of another land owner, as well as to conserve soil and protect water resources.

3.3.7 *Crown Land (Reserves) Act 1978*

The *Crown Land (Reserves) Act 1978* provides for the reservation of Crown lands for public purposes, including: watersheds and gathering grounds for water supply purposes; the supply and distribution of water and works including reservoirs, aqueducts, pipe-lines channels and waterways; the protection of the beds or channels and the banks of waterways; and drainage and sewerage works.

Section 13 of the Act provides for regulating Crown lands for: its care, protection and management; the carrying out of works or improvements; the safety of persons on the land; and for issuing permits and licences and entering into agreements in relation to the land.

Section 14 of the Act provides for the appointment of Committees of Management.

While the Act does not make specific reference to coastal acid sulphate soils, there is scope under these provisions for any coastal acid sulphate soils risk identification process to be triggered or for regulations to be made.

3.3.8 *Coastal Management Act 1995*

Section 37 of the *Coastal Management Act 1995* requires the written consent of the Minister for proposals for use and development on coastal Crown land (Crown land 200 m from high tide). There is opportunity for a coastal acid sulfate soils risk identification process to be triggered under these consent provisions.

3.3.9 *Wildlife Act 1975 and Wildlife Regulations 2002*

The purposes of the *Wildlife Act 1975 and Wildlife Regulations 2002* are to:

- establish procedures in order to promote:
    - the protection and conservation of wildlife;
    - the prevention of taxa of wildlife from becoming extinct; and
    - the sustainable use of and access to wildlife.
- prohibit and regulate the conduct of persons engaged in activities related to wildlife.

The Act covers all wildlife, including all native vertebrate animals, all kinds of deer, non-indigenous quail, pheasants, and partridges, and all terrestrial invertebrate animals listed under the *Flora and Fauna Guarantee Act 1988*. The Act regulates the hunting, trading and taking of wildlife.

Research or Scientific Permits are issued under the Act (and *Flora and Fauna Guarantee Act 1988*) to carry out:

- surveys, research, management, protection, conservation and enhancement of wildlife populations and wildlife habitats;
- public education programmes for promoting and maintaining an appreciation of the value of wildlife;
- scientific or biological research, studies, or investigations in conjunction with other scientific organizations; and
- removal of wildlife from any particular locality.

Management of Eastern Grey Kangaroos at Edithvale South Wetland is covered under a Wildlife Permit issued to Melbourne Water under the *Wildlife Act 1975*. Wildlife licences are also issued under this Act to take or destroy wildlife, which would include removal of introduced species from the wetlands.

3.3.10 *Country Fire Authority Act 1958*

Fire prevention responsibilities are derived from Section 43 of the *Country Fire Authority Act 1958* which delegates fire suppression power and duties to public authorities (see Terramatrix 2013a):

- “in the country area of Victoria it is the duty of every municipal council and public authority to take all practicable steps (including burning) to prevent the occurrence of fires on, and minimise the danger of the spread of fires on and from (a) any land vested in it or under its control or management, and (b) any road under its care and management”.

Section 96A of this Act requires municipal councils to appoint a person to be the fire prevention officer for that council for the purposes of this Act.

Under Sections 20 and 46 of the Act, respectively, and regarding the country area of Victoria (CFA response area), it is the Country Fire Authority's (CFA's) role to superintend and enforce fire prevention and to report any failure by a public authority or municipal council to properly carry out their duties.

Under Sections 54 and 55 of the Act, respectively, the CFA may appoint a Municipal Fire Prevention Committee (MFPC) to undertake a range of functions, including advising Council on the existence and management of hazards, and making recommendations in the preparation of the Municipal Fire Prevention Plan. The key fire management responsibilities for the municipality rest with the (Frankston) Municipal Fire Management Planning Committee (MFMPC), which is a sub-committee of the Municipal Seaford Wetlands – Fire Management Plan (see Terramatrix 2013a).

3.3.11 Victorian Waterway Management Strategy

The 2013 Victorian Waterway Management Strategy (VWMS) provides the framework for government—in partnership with the community—to maintain or improve the condition of rivers, estuaries and wetlands so that they can continue to provide environmental, social, cultural and economic values for all Victorians. The framework is based on regional planning processes and decision-making, within the broader system of integrated catchment management in Victoria.

3.3.12 Victorian Coastal Strategy 2014

Achievements of previous iterations of the Victorian Coastal Strategy (Victorian Coastal Council 2014) have included the establishment of a hierarchy of principles that guides effective coastal planning and decision-making in accordance with the objectives of the *Coastal Management Act 1995*. The first principle of this Strategy is to protect significant environmental and cultural values, based upon a sound understanding of coastal features, vulnerability and risks. This Strategy also emphasises the need to avoid disturbing coastal acid sulfate soils and ensure any development proposed near or on coastal acid sulfate soils demonstrates that it will avoid any disturbance.

3.3.13 Victorian Coastal Acid Sulfate Soils Strategy

The Victorian Coastal Acid Sulfate Soils Strategy (DSE 2009c) aims to protect the environment, humans and infrastructure from the harmful effects of disturbing coastal acid sulfate soils. It aims to build the capacity of land owners and land and water managers to plan and manage activities in coastal acid sulfate soils risk areas. It identifies principles and promotes a risk management approach to guide decision-making. The emphasis of the strategy is on avoiding disturbing coastal acid sulfate soils.

3.3.14 *Public Health and Wellbeing Act 2008*

The *Public Health and Wellbeing Act 2008* received Royal Assent in September 2008 and took effect on 1 January 2010. The Act replaces the previous Victorian *Health Act 1958* and is a key piece of legislation designed to protect the health of Victoria's population, with implications for:

- authorised officers within local councils and the Department of Health and Human Services;
- pest control operators;
- cooling tower operators;
- the governance and management of a range of consultative councils established under the Act;

- the management of infectious diseases, micro-organisms and medical conditions by medical and health practitioners, Victoria's Chief Health Officer and affected individuals; and
- the development of public health policy through providing for municipal public health and wellbeing plans, a State public health and wellbeing plan and in some circumstances, health impact assessments.

The *Public Health and Wellbeing Regulations 2009* were made by the Governor in Council on 15 December 2009 and took effect on 1 January 2010. The regulations replace the previous *Health (Infectious Diseases) Regulations 2001* made under the former *Health Act 1958* which empowered the Victorian Health Department and councils as their agents to direct owners and occupiers of land to undertake measures to reduce the incidence of mosquito breeding to prevent mosquito-borne diseases.

The *Public Health and Wellbeing Regulations 2009 S.R. No. 178/2009 (1)* states for the purposes of Section 235(a) of the Act, in order to prevent breeding of mosquitoes which may be vectors of arboviruses, an authorised officer may give written directions to the owner or occupier of any premises to remove, or take steps to avoid, any condition on those premises conducive to the breeding of mosquitoes. Thus, Melbourne Water has the responsibility to manage mosquitoes within the assets that it owns and maintain as a matter of public health as consistent with other managers of water assets in Victoria (also see DSE 2004; GHD 2015; Melbourne Water 2016, undated[a] and undated[b]).

3.3.15 Framework for Mosquito Management in Victoria (DSE 2004)

The objective of the Framework for Mosquito Management in Victoria (DSE 2004) is to provide a strategic framework to assist councils and State government agencies to implement local mosquito management programs in an effective and environmentally appropriate manner consistent with Victoria's commitments to sustaining and improving community health and protecting the environment. The Framework provides a legislative framework and discusses the potentially conflicting demands of legislation designed to protect human health (i.e. *Public Health and Wellbeing Regulations 2009*) via mosquito control and legislation designed to protect the environment, species and ecological processes that occur naturally, such as breeding sites for mosquitoes being located in high value wetlands (e.g. Ramsar sites and EPBC Act 1999), the role of mosquitoes in the food chain and identifying methods of mosquito control potentially impacting unintentionally and negatively on the environment (e.g. physical, chemical and biological control). The Framework also addresses the potential disturbance to cultural values (both indigenous and post-settlement heritage) associated with mosquito management (e.g. construction of drainage channels and changes to natural water flow) and identifies the relevant legislation which aims to protect cultural values.

The Framework also:

- identifies responsibilities of State Government, councils and community in mosquito management;
- provides a risk assessment framework to health and well-being based on the likelihood of being bitten by arbovirus-carrying or nuisance mosquitoes and the health and social impacts of being bitten (criteria for health risk are based on past outbreaks of diseases - the level of risk from an incidence or high potential of MVE is very high, the level of risk from a high incidence of RRV or BFV is high, the level of risk from an abundance of nuisance mosquitoes and some RRV or BFV in the past is moderate, the level of risk from a low densit6y of nuisance mosquitoes is low); and

- gives a risk assessment framework to the environment from mosquito management intervention based on the environmental sensitivity of the site (criteria for environmental sensitivity are based on land status – Ramsar sites, sites supporting important habitat for nationally threatened species or migratory species have high environmental sensitivity, National, State or Coastal Parks have high sensitivity, etc.) and the environmental risk associated with mosquito management based on the Ramsar Convention Wetland Risk Assessment; and
- provides a framework for mosquito management incorporating an integrated and co-ordinated approach with various methods and delivery of management varying depending on environmental sensitivity of the site and the area to be covered.

Based on the Framework for Mosquito Management in Victoria (DSE 2004), Melbourne Water (undated[a]) has prepared the Mosquito Management Decision Support Tool to guide mosquito management at Melbourne Water assets.

3.4 Regional and Local Plans and Policy

3.4.1 Port Phillip and Western Port Regional Catchment Strategy

The Port Phillip and Western Port Regional Catchment Strategy is a statutory document under the CaLP Act that provides the overarching framework for land, water and biodiversity management in the region.

3.4.2 Better Bays and Waterways

Better Bays and Waterways was developed by the Environment Protection Authority Victoria and Melbourne Water to achieve water quality improvement for the Port Phillip and Western Port region. The plan was aimed at reducing the amount of pollutants entering waterways and bays from rural, urban and coastal areas.

3.4.3 Healthy Waterways Strategy

The *Healthy Waterways Strategy* (Melbourne Water 2013a) outlines Melbourne Water's role in managing rivers, estuaries and wetlands in the Port Phillip and Westernport region. This strategy focuses on investing in areas that the community values and that will protect and improve environmental values and increase liveability.

Melbourne Water's (2013a) *Healthy Waterways Strategy 2013* recognises that Melbourne Water land supports important environment and social values and states that waterways:

- connect diverse and thriving communities of native plants and animals;
- provide amenity to urban and rural areas and engage communities with their environment; and
- are managed sustainably to balance environmental, economic and social values.

Sites on Melbourne Water land that support important biodiversity values may be considered a Site of Biodiversity Significance (SoBS). Under the *Waterways Sites of Biodiversity Significance Plan 2013* (Melbourne Water 2013b), Melbourne Water recognises 36 SoBS all of which are managed by Melbourne Water and support at least one of the following biodiversity values:

1. species or ecological communities protected under the Commonwealth EPBC Act;

2. species or ecological communities listed as threatened under the Victorian FFG Act;
3. Ecological Vegetation Class or Classes (EVCs) which are considered to be vulnerable or endangered within the bioregion;
4. species that are listed under the Advisory List of Rare or Threatened Plants in Victoria – 2014 (DEPI 2014), Advisory List of Threatened Vertebrate Fauna in Victoria – 2013, Advisory List of Threatened Invertebrate Fauna in Victoria – 2009; and
5. connecting habitat for threatened flora and fauna.

In addition to providing the listing criteria for SoBS, the *Waterways Sites of Biodiversity Significance Plan 2013* (Melbourne Water 2013b) gives directions on how SoBS should be managed in accordance with Melbourne Water's obligations under environmental legislation, and to achieve the objectives of the Healthy Waterways Strategy 2013.

Edithvale-Seaford Wetlands were identified as high value SoBS because they fulfilled a number of criteria, including the sites: are greater than 50 ha in size; support substantial vegetation remnants with several threatened Ecological Vegetation Classes; support large populations or representatives of several EPBC Act and FFG Act-listed items (e.g. Australasian Bittern; Ramsar-listed); support other threatened flora and fauna (e.g. VROTs, Advisory Listed fauna); support significant populations of Migratory and/or Marine Overfly bird species (e.g. migratory waders); and demonstrate connectivity for threatened species (Ecology Australia 2013).

4 Ecological Character and Values - Critical Components, Processes and Services

The Australian Government has developed and implemented a framework for describing the ecological character of Ramsar sites (DEWHA 2008). This framework requires the identification and description of critical components, processes and services. These are defined as characteristics of the Ramsar site (DEWHA 2008):

1. that are important determinants of the sites unique character;
2. that are important for supporting the Ramsar criteria under which the site was listed;
3. for which change is reasonably likely to occur over short to medium time scales (less than 100 years); and/or
4. that will cause significant negative consequences if change occurs.

The ECD for the Edithvale-Seaford Ramsar Site (2002) was drafted prior to the release of these national guidelines and so does not describe character in terms of critical components, processes and services. A recent review has developed an addendum to the ECD (Hale 2016) and identified four components, processes and services that are critical to the ecological character of the Ramsar site:

- Waterbird diversity and abundance;
- Waterbird breeding;
- Physical habitat for waterbirds; and
- Threatened wetland species.

4.1 Waterbird Diversity and Abundance

The Edithvale-Seaford Wetlands support a diversity and abundance of waterbirds, with average total annual maximum counts of around 5000. The site supports a diversity of birds and over 75 waterbird species have been recorded at the site (KBR 2009; DSE 2012). Twenty species of waterbirds listed under international migratory agreements have been recorded within the Ramsar site. This number includes species that, in Australia, are residents (e.g. Eastern Great Egret) and a number of migratory species that are only occasionally recorded at the site. There are eight species of international migratory shorebirds that are regularly supported (two thirds of seasons) by the Edithvale-Seaford Wetlands Ramsar site (Table 2).

The site supports a variety of different types of waterbirds, which is illustrated by looking at the functional guilds (Figure 6). In particular, the site is important for waders, which are the most numerous birds at the site. The site, however, also supports numbers of ducks, fish eating species (such as pelicans and cormorants), herbivores (such as swans and coots) and large wading birds (such as ibis and herons).

Table 2 **Palaearctic migratory waders recorded in the Ramsar site and their frequency of occurrence (percentage). The eight species that the site is considered to regularly support are shaded.**

Common name	Species name	JAMBA	CAMBA	ROKAMBA	Percent of years
Australian Painted Snipe	*Rostratula australis*		X		5
Common Greenshank	*Tringa nebularia*	X	X	X	86
Curlew Sandpiper	*Calidris ferruginea*	X	X	X	68
Latham's Snipe	*Gallinago hardwickii*	X	X	X	100
Long-toed Stint	*Calidris subminuta*	X	X	X	14
Marsh Sandpiper	*Tringa stagnatilis*	X	X	X	68
Pectoral Sandpiper	*Calidris melanotos*	X	X	X	68
Red Knot	*Calidris canutus*	X	X	X	5
Red-necked Stint	*Calidris ruficollis*	X	X	X	73
Sharp-tailed Sandpiper	*Calidris acuminata*	X	X	X	100
Wood Sandpiper	*Tringa glareola*	X	X	X	68

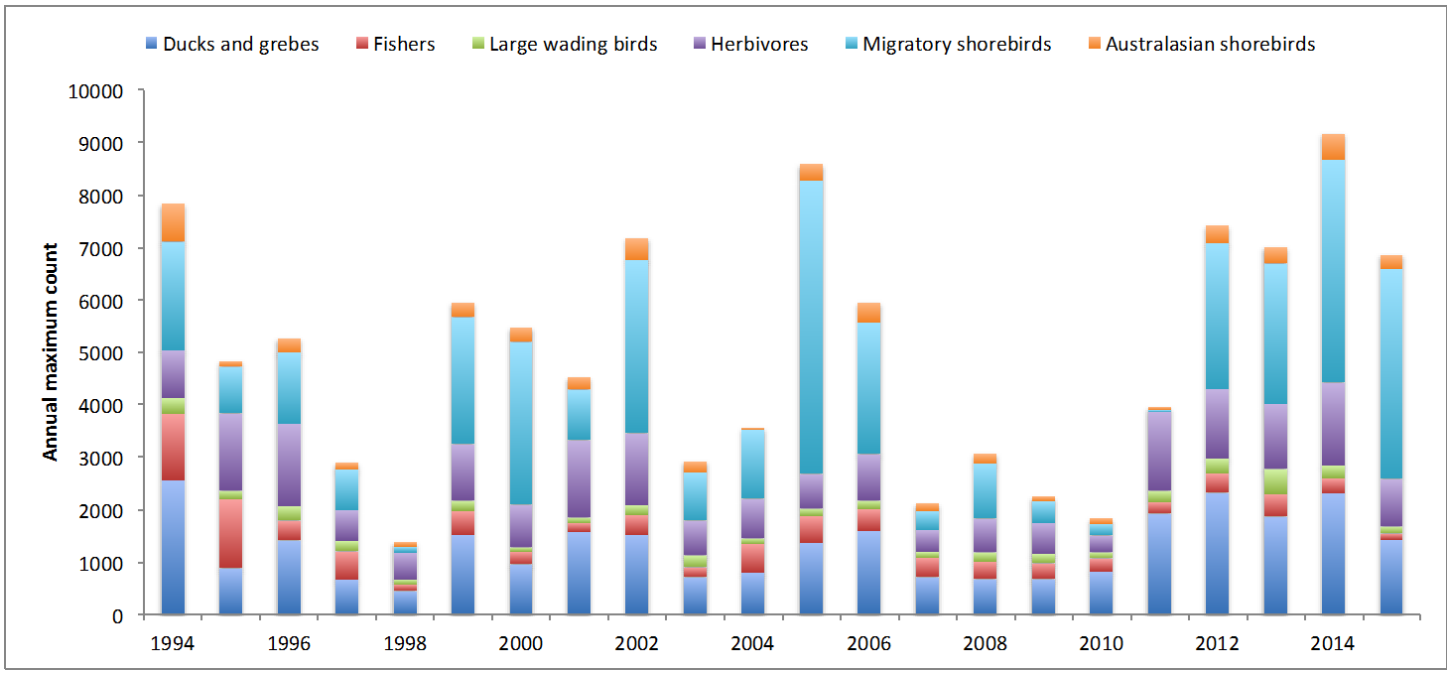


Figure 6 **Maximum annual abundance of waterbird guilds at Edithvale-Seaford Wetlands 1994 to 2015 (data from BirdLife Australia). Guild membership as defined by Kingsford et al. (2012).**

4.2 Waterbird Breeding

There are records of over 20 species of waterbird breeding within the Ramsar site (RAOU 2001; Birds Australia 2006, 2007, 2008, 2010, 2012; BirdLife Australia 2013a, 2013b, 2015b and 2016a). The most common breeding species are Black Swan *Cygnus atratus* and a range of duck species, such as Chestnut Teal *Anas castanea* and Blue-billed Duck *Oxyura australis* (FFG Act-listed, 10 breeding records at Edithvale Wetlands since 1998 and they occasionally breed at Seaford). There are also records of wetland dependent raptors (Swamp Harrier *Circus approximans*) and other wetland dependent birds (e.g. Australian Reed-Warbler *Acrocephalus australis*) breeding at the site (e.g. BirdLife Australia 2016a).

4.3 Physical Habitat for Waterbirds

Hydrology and vegetation type have been identified as the most important habitat components for supporting waterbirds at the Ramsar site (Birds Australia 2004). The mosaic nature of the habitat is what supports the broad range of species. The wetlands have been divided into habitat zones and two zones in each portion of the Ramsar site are considered most important for waterbirds (Birds Australia 2004):

- Edithvale (Figure 12):
    - Edithvale North (EN1) - deeper water for a number of duck species, surrounded by tall reeds; and
    - Edithvale South (ES1) - shallow wetlands that seasonally dry providing foraging habitat for shorebirds, grading to tall marsh at the fringes, providing cover for species, such as Australasian Bittern and Latham's Snipe.
- Seaford (Figure 13):
    - Downs Estate (Cell SN) - pasture which provides foraging habitat for large wading species, such as ibis; and
    - Seaford North 2 Pool, Seaford Central West 1 (SCW1) and Seaford East 2 - mosaic of deeper water, tall marsh, deeper saline ponds important for all wetland bird species.

4.4 Threatened Wetland Species

The Edithvale-Seaford Wetlands regularly support two waterbird species listed as threatened species under the Commonwealth EPBC Act 1999.

Curlew Sandpiper *Calidris ferruginea* is a small bird weighing just 60 grams (Higgins and Davies 1996). It is an international migratory species that spends the non-breeding season in the southern hemisphere. They arrive in late spring, spend the summer feeding on invertebrates in intertidal mudflats and depart for the northern hemisphere in February to March. Juveniles who arrive in the Ramsar site spend their first one or two winters at the site before heading to the northern hemisphere to breed.

Curlew Sandpiper is listed as Critically Endangered under the EPBC Act due to declines in their global populations. There have been a large number of investigations into the decline of shorebirds in the East Asian-Australasian Flyway, with habitat declines particularly at staging areas in the Yellow Sea

recognized as the most significant impact factors (MacKinnon et al. 2012, Murray et al. 2015, Hua et al. 2015).

Australasian bittern *Botaurus poiciloptilus* is a shy and cryptic wading species of waterbird. Habitat preferences are for permanent, densely vegetated freshwater wetlands (Menkhorst 2012). It forages mainly at night in shallow water up to 30 cm deep and feeds on frogs, fish and invertebrates as well as occasional plant material (Marchant and Higgins 1990). Within the Ramsar site the species inhabits emergent vegetation, but there is a balance between having sufficient cover and the vegetation being too dense for effective foraging. Control of emergent vegetation such as Common Reed *Phragmites australis* is important for this species at the site. The bitterns require reed beds and edges, but they benefit from mosaic reed control, as the re-growth Tall Marsh is less dense and therefore more suitable for foraging and habitat (Andrew Silcocks, BirdLife Australia, pers. comm.; Paul Rees, Melbourne Water, pers. comm.).

The site provides important winter feeding habitat for the species, which travels north to breed. Within the site, there have been declines in the species (Figure 7), but this may reflect more widespread population changes than characteristics of the Ramsar site (Andrew Silcocks, BirdLife Australia, pers. comm.).

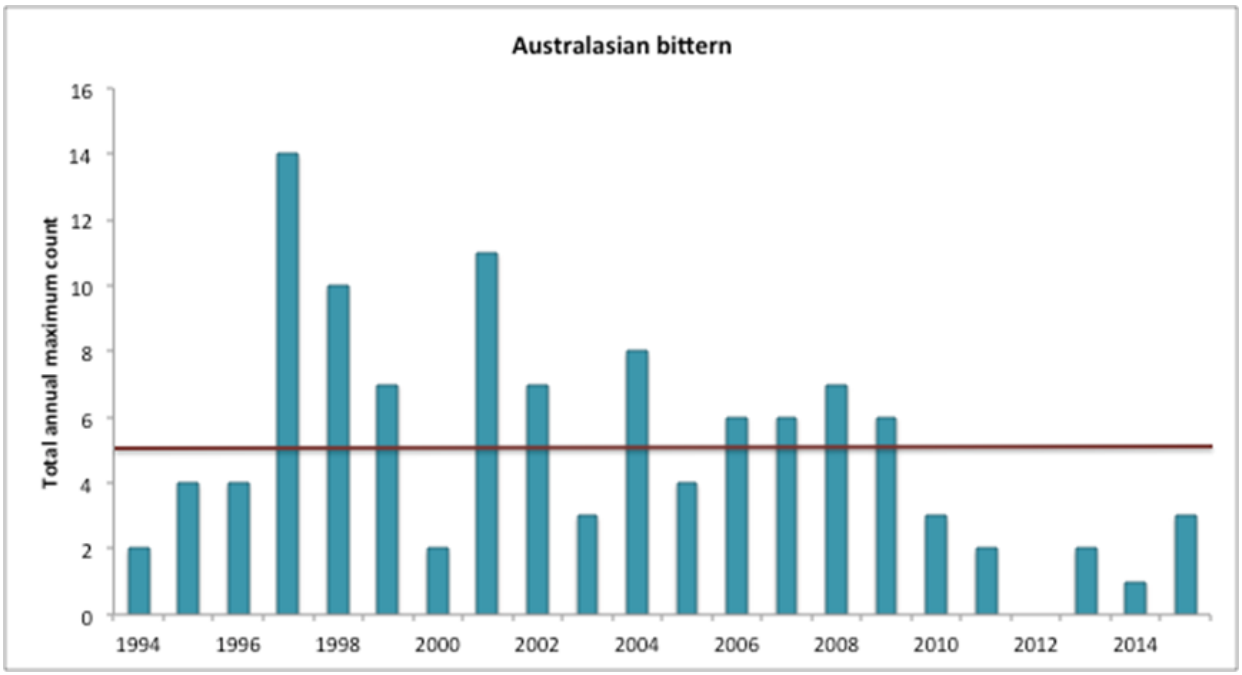


Figure 7 Maximum annual abundance of Australasian Bitterns at Edithvale-Seaford Wetlands 1994 to 2015 (data from BirdLife Australia).

4.5 Flora

4.5.1 Vegetation

The large Carrum Carrum Swamp that formerly encompassed both Edithvale and Seaford Wetlands was dramatically altered when the Patterson Cut was constructed in the 1870's to drain the Swamp. Edithvale and Seaford Wetlands both occur in what would have been the deeper parts of the former Carrum Carrum Swamp. The drainage of the wetland irreversibly changed the hydrology and hence the

vegetation communities present within these two sites, whereby the current vegetation now more closely resembles what would have surrounded the edges of the Carrum Carrum Swamp prior to drainage.

Eight Ecological Vegetation Classes (EVCs) were identified at Edithvale and Seaford Wetlands in Australian Ecosystems' latest survey (Australian Ecosystems 2015): Brackish Wetland Aggregate, Brackish Aquatic Herbland, Brackish Herbland, Aquatic Herbland, Plains Sedge Wetland, Tall Marsh, Swamp Scrub and Damp Sands Herb-rich Woodland. The distribution and occurrence of these EVCs as mapped by Australian Ecosystems (2011a, 2015; TBLD and Australian Ecosystems 2005) is in a constant state of flux primarily responding to seasons, water levels and salinity. These vegetation communities and distributional changes are discussed below based on field observations and previous reports (TBLD and Australian Ecosystems 2005; Australian Ecosystems 2011a, 2015). Maps illustrating the distribution of EVCs at each site are provided in Figures 8 and 9.

Note: an asterisk (*) denotes exotic species while a hash (#) denotes native species that are not considered indigenous at the site.

Damp Sands Herb-rich Woodland (EVC 3) – Vulnerable in the Gippsland Plain Bioregion

According to Australian Ecosystems (2015), Damp Sands Herb-rich Woodland occurred at Seaford Wetlands in areas that had primarily been revegetated, or previously identified as Plains Grassy Woodland (Australian Ecosystems 2011a). This vegetation community occurs on the quaternary dunes that surrounded the Carrum Carrum Swamp. The dominant canopy species observed comprised River Red-gum *Eucalyptus camaldulensis* and Coast Manna Gum *Eucalyptus viminalis* subsp. *pryoriana*, along with Black Wattle *Acacia mearnsii* and Coast Banksia *Banksia integrifolia* in the sub-canopy. Understorey shrubs were sometimes included in the revegetation and some areas have been heavily invaded by Coast Tea-tree #*Leptospermum laevigatum*, a large shrub species that is only considered indigenous to the coastal dunes and headlands (Thompson 1989). The observed understorey was generally dominated by exotic vegetation, primarily mown or unmown grasses, with some areas of Bracken *Pteridium esculentum* or revegetated indigenous species.

Swamp Scrub (EVC 53) – Endangered in the Gippsland Plain Bioregion

Swamp Scrub was identified in small disjunct patches across Seaford Wetlands (including an artificial island) and three small islands in the north of Edithvale Wetlands. This EVC had previously been identified as Estuarine Scrub in 2010 (Australia Ecosystems 2011a) based on the understorey composition of species more tolerant of salt that were uncommon during the current field surveys. Swamp Paperbark *Melaleuca ericifolia* dominated this EVC which is situated in slightly more elevated areas than the aquatic wetland and marsh EVCs. Scattered Swamp Gums *Eucalyptus ovata* were also occasionally present. Understorey species included Water Ribbons *Cycnogeton procerum* and Common Reed *Phragmites australis* in wetter areas and Blackberry **Rubus fruticosus* spp. agg. and exotic grasses such as Paspalum **Paspalum dilatatum*, Kikuyu **Cenchrus clandestinum*, Couch **Cynodon dactylon* var. *dactylon* in drier areas. In some places the understorey has been revegetated to introduce diversity.

Tall Marsh (EVC 821) – not assigned a bioregional conservation status for the Gippsland Plain

Tall Marsh vegetation was dominated by thick swards of Common Reed *Phragmites australis* and occasionally Cumbungi (*Typha domingensis* and/or *Typha orientalis*). Other plant species, such as Water

Ribbons *Cycnogeton procerum*, Salt Club-sedge *Bolboschoenus caldwellii*, Common Duckweed *Lemna disperma*, Common Blown-grass *Lachnagrostis filiformis*, Hastate Orache **Atriplex prostrata*, Aster-weed **Symphyotrichum subulatum*, Spiny Rush **Juncus acutus*, Couch, Kikuyu and Toowoomba Canary-grass **Phalaris aquatica*, were present though uncommon amongst the Common Reed and Cumbungi.

In many locations at the wetlands, this EVC has been expanding into the other wetland EVCs, which reduces floristic diversity and changes the structure of the vegetation from an open wetland to a dense, tall sward (sometimes to 3.5 m tall) of Common Reed or Cumbungi. Given the scarcity of the more open and diverse wetland communities, and the reduced fauna habitat suitability of the Tall Marsh, grooming of Common Reed has been trialled to limit the expansion of this EVC (Plate 1). The results have shown to be quite successful, as discussed further in Section 9.4.1.

Plate 1 Ungroomed (left) and groomed (right) Common Reed *Phragmites australis* at Edithvale North Wetland.

Brackish Wetland Aggregate (EVC 656) – Endangered in the Gippsland Plain Bioregion

The Brackish Wetland was variously dominated by Sea Rush *Juncus kraussii* subsp. *australiensis*, Salt Club-sedge *Bolboschoenus caldwellii*, Fine Twig-sedge *Baumea arthrophylla*, Common Spike-sedge *Eleocharis acuta*, Shiny Swamp-mat *Selliera radicans* and Creeping Monkey-flower *Mimulus repens* among others. Some areas have also been invaded by Spiny Rush **Juncus acutus* subsp. *acutus*. It is common at both wetlands, however since 2010, large areas of this EVC has been displaced by the encroachment of Common Reed which has resulted in a changed vegetation structure, reduced floristic diversity and reduced fauna habitat diversity. Particularly at Edithvale Wetlands, this EVC commonly appears as Unvegetated open water/bare soil/mud (EVC 990) for around six months of the year.

Brackish Aquatic Herbland (EVC 537) – not assigned a bioregional conservation status for the Gippsland Plain

Brackish Aquatic Herbland occurred in deeper water with aquatic herbs and filamentous algae dominating. Common species included Water Ribbons, Lake Water-milfoil *Myriophyllum salsugineum*,

and Fennel Pond-weed *Potamogeton pectinatus* in the deeper water, through to Slender Knotweed *Persicaria decipiens* and Swamp Crassula *Crassula helmsii* in the drier margins.

This EVC has contracted in extent at both Edithvale and Seaford Wetlands over the past decade where it was once abundant in both the northern and southern Edithvale Wetlands, and scattered in the south of Seaford Wetlands (TBLD and Australian Ecosystems 2005). This EVC now only occurs in the constructed northern wetlands at Edithvale (Australian Ecosystems 2011a, 2015) and is no longer represented at Seaford (seeming due to encroaching Tall Marsh).

Plains Sedgy Wetland (EVC 647) – not assigned a bioregional conservation status for the Gippsland Plain

Plains Sedgy Wetland occurs at both sites. The occurrence at Seaford was restricted to the perimeter of two small Aquatic Herbland dominated waterbodies in the south east of the site that are separated from the main Brackish Wetland dominated waterbody by an artificial levee. At Edithvale, it occurred in the lower lying areas of the large wetland just north of Edithvale Road. Plains Sedgy Wetland was dominated by Common Spike-sedge *Eleocharis acuta* and Fine Twig-sedge, Water Ribbons, Common Blown-grass *Lachnagrostis filiformis* and a variety of amphibious forbs. Common Reed and Cumbungi surround or are interspersed through all patches identified and their encroachment threaten the floristic diversity.

Aquatic Herbland (EVC 653) – not assigned a bioregional conservation status for the Gippsland Plain

Small discrete pockets of Aquatic Herbland exist at Seaford Wetlands, while at Edithvale the areas of Aquatic Herbland are replaced with Tall Marsh and Brackish Wetland Aggregate/Unvegetated (open water/bare soil/mud) as the water draws down in spring. Dominant species commonly included Water Ribbons, Water-milfoil *Myriophyllum* spp., Small River Buttercup *Ranunculus amphitrichus*, Streaked Arrowgrass *Triglochin striata*, Common Duckweed, Tall Spike-sedge *Eleocharis sphacelata*, and to a lesser extent Common Reed (Greet 2015; Australian Ecosystems 2011b).

Brackish Herbland (EVC 538) – not assigned a bioregional conservation status for the Gippsland Plain

Brackish Herbland occurred in two discrete areas on the outskirts of the Edithvale South wetland. It had previously also been identified as occurring in the middle of this wetland (Australian Ecosystems 2016), though was not identified there in the current survey. Instead, this area was dominated by open water, mudflat or Common Reed (resembling Brackish Wetland Aggregate), with occasional herbs tolerant of brackish conditions such as Beaded Glasswort *Sarcocornia quinqueflora* subsp. *quinqueflora* and Creeping Monkey-flower *Mimulus repens*. As per Aquatic Herbland, it is likely that this EVC will continue to fluctuate in distribution depending on the season and annual rainfall each year.

Wet Saltmarsh Herbland (Coastal Saltmarsh Aggregate, EVC 9) – Least Concern in the Gippsland Plain Bioregion, Vulnerable under the EPBC Act 1999

A small area of vegetation resembling Wet Saltmarsh Herbland has established in Seaford Wetland where the Tall Marsh has died back (possibly as a result of high salinity; Paul Rees, Melbourne Water, pers. comm.). This area was dominated by Beaded Glasswort *Sarcocornia quinqueflora* subsp. *quinqueflora* with a small scattering of other typical saltmarsh species such as Shiny Swamp-mat *Selliera radicans* and Creeping Monkey-flower *Mimulus repens*. Spiny Rush *Juncus acutus* subsp. *acutus* was present, though most plants had been killed as a result of management. The small extent of this EVC

within the site disqualifies it as part of the EPBC Act listed community *Subtropical and Temperate Coastal Saltmarsh*.

4.5.2 Significant Flora Species

Seven Victorian rare or threatened (VROT) plant species have been identified as having a moderate likelihood of occurrence within Edithvale Wetlands, and five VROT species have been identified for Seaford Wetland. Further information on this can be found in Appendix 2.

Figure 8 Ecological Vegetation Class mapping for Edithvale Wetlands.

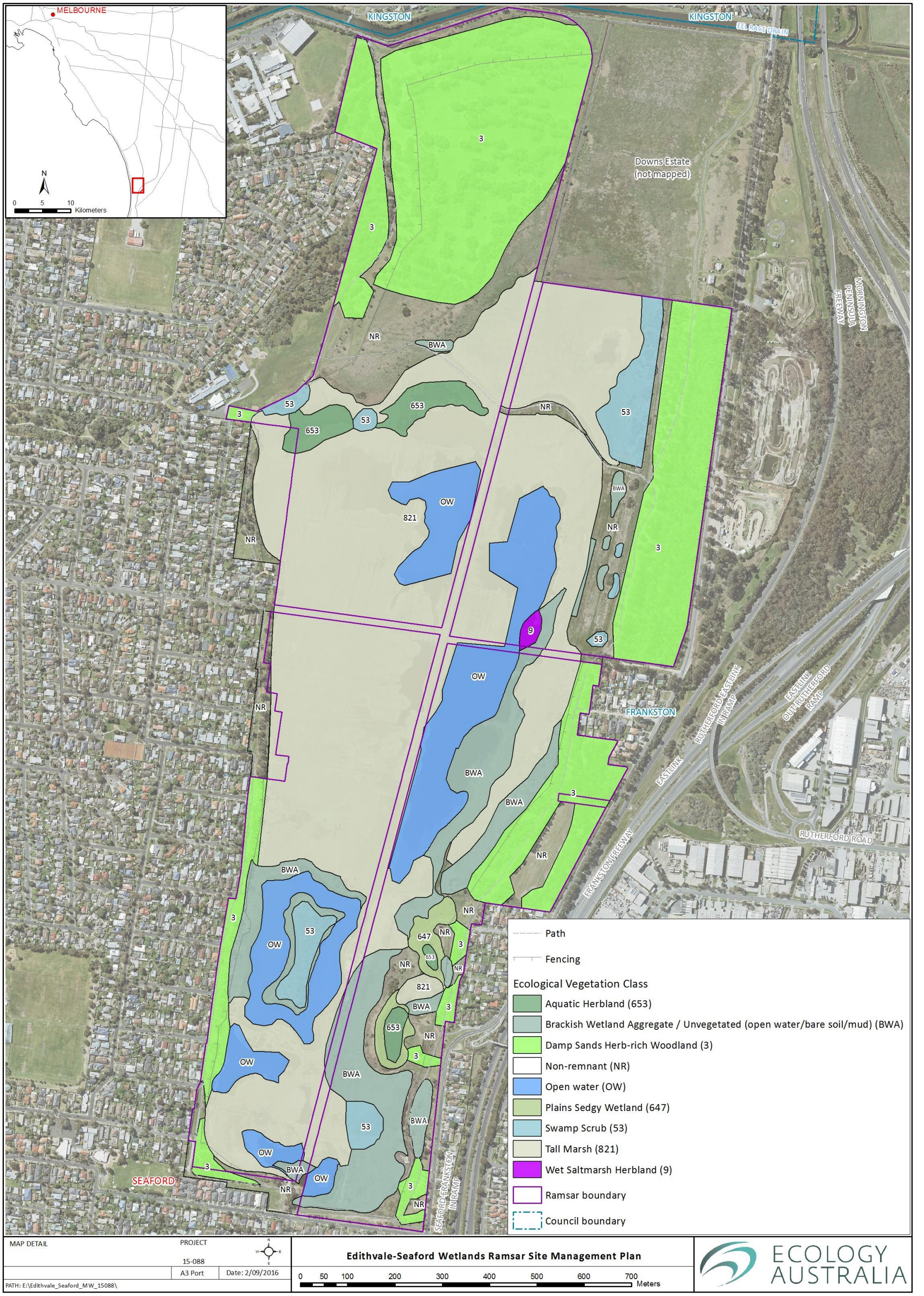


Figure 9 Ecological Vegetation Class mapping for Seaford Wetland.

4.6 Other Fauna

4.6.1 Threatened Bird Species

Monthly surveys undertaken since 1989 at Edithvale Wetlands have recorded totals of:

- 157 species at Edithvale North wetlands (including 11 exotic species, and the Cockatiel *Nymphicus hollandicus* is probably an aviary escapee);
- 166 species at Edithvale South wetlands (including 14 exotic species); and
- 177 species over both wetlands (BirdLife Australia 2016a; BirdLife Atlas database; Appendix 3).

Monthly surveys undertaken since 1994 at Seaford Wetlands have recorded a total of 174 species (including 13 exotic species, and the Cockatiel *Nymphicus hollandicus* and Scaly-breasted Lorikeet *Trichoglossus chlorolepidotus*, both probably represent aviary escapees and the Pacific Black Duck – Mallard hybrid *Anas superciliosa - Anas platyrhynchos*) (BirdLife Australia 2016a; BirdLife Atlas database; Appendix 3).

Overall, 197 species have been recorded at Edithvale-Seaford Wetlands (Appendices 3 and 4).

A number of threatened or migratory species have been recorded at the wetlands (Appendices 3 and 4) and the totals are given in Table 3.

Table 3 Numbers of species recorded at Edithvale and Seaford Wetlands and listed as threatened or migratory/marine-overfly species under the Commonwealth Environment Protection and Biodiversity Act 1999 (EPBC Act) and/ or threatened under the Victorian Flora and Fauna Guarantee Act 1988 (FFG Act) and/or classified as threatened in Victoria by DSE (2013).

Wetlands	EPBC Act-listed threatened species	EPBC Act Migratory or Marine-overfly species	FFG Act listed threatened species	DSE (2013) classified threatened species
Edithvale North	1	48	10	28
Edithvale South	2	59	13	30
Seaford	2	58	12	28
Edithvale and Seaford combined	**4**	**68**	**14**	**34**

The wetlands support a high number of threatened bird species, including (from ANCA 1996; Ecology Australia 2000; RAOU 2001; Birds Australia 2004, 2006, 2007, 2008, 2010 and 2011; BirdLife Australia 2013a, 2013b, 2015a, 2015b and 2016a; KBR 2009; SKM 2011; Andrew Silcocks, Birds Australia, pers. comm.):

- populations of diving duck species which are threatened in Victoria, such as the Blue-billed Duck *Oxyura australis* (FFG and endangered under DSE 2013) and Hardhead *Aythya australis*

(vulnerable under DSE 2013) which are known to breed at the wetlands, and Musk Duck *Biziura lobata* (vulnerable under DSE 2013), which favour areas of deeper water;

- Australasian Shoveler *Anas rhynchotis* (vulnerable under DSE 2013), a dabbling duck which strains insects and seeds from water (e.g. in the marshy areas);
- Little Bittern *Ixobrychus minutus dubius* (FFG and endangered under DSE 2013) is a summer visitor to Victoria from northern Australia which bred at Edithvale Wetlands over several seasons;
- populations of crakes and rails occur regularly at ESW, including Lewin's Rail *Rallus pectoralis* and Baillon's Crake *Porzana pusilla palustris* (both FFG and vulnerable under DSE 2013) which prefer dense vegetation (e.g. reed beds) for shelter and nesting and nearby mudflat edges for foraging;
- non-breeding individuals of FFG Act-listed Eastern Great Egret *Ardea modesta*, Little Egret *Egrettea garzetta nigripes* and Intermediate Egret *Ardea intermedia*;
- A suite of other threatened species have been recorded less regularly at ESW, such as the Australian Painted Snipe *Rostratula australis* (EPBC and FFG), Freckled Duck *Stictinetta naevosa* (FFG and endangered under DSE 2013), Caspian Tern *Sterna caspia* (FFG and near threatened under DSE 2013) and Wood Sandpiper *Tringa glareola* (vulnerable under DSE 2013).
- Latham's Snipe *Gallinago hardwickii* is a medium-sized wader which breeds on Hokkaido in northern Japan and far eastern Russian Islands in the Japanese Archipelago during the boreal summer, and migrates to south-eastern Australia where it spends the austral summer. It arrives in Victoria from late August and leaves by late March or early April (Higgins and Davies 1996). Latham's Snipe is listed as a migratory species under the EPBC Act and is classified as near threatened in Victoria (DSE 2013). It used to occur in large numbers of up to 400 snipe at Seaford Wetlands in the 1970's and 1980's (Sean Dooley, BirdLife Australia, pers. comm.; ANCA 1996), but has more recently been recorded in smaller numbers during regular counts (up to 20–30 snipe, Table 4). DEWHA (2009) developed the EPBC Act Policy Statement 3.21 outlining the Significant Impact Assessment Guidelines for 36 Migratory Shorebird species. DEWHA (2009), with advice from experts, define 'important habitat' for Latham's Snipe as those sites that support at least 18 individuals of the species. Edithvale Wetlands have exceeded/equalled the 18 Snipe threshold during 17 months of the monthly surveys undertaken since 1989 (Table 4). Seaford Wetlands have exceeded/equalled 18 Snipe during six months since 1994. Together, the Edithvale-Seaford Wetlands Ramsar Site has exceeded the threshold on 21 occasions. Thus, Edithvale and Seaford Wetlands supports 'important habitat' for Latham's Snipe as defined under the EPBC Act.
- Pied Cormorant *Phalacrocorax varius* and Royal Spoonbill *Platalea regia* (near threatened), generally forage in small numbers at the wetlands (a pair of Royal Spoonbills bred in the southern section of Seaford Wetlands over the 2010/2011 season; this was the first and only breeding record for this species at the Ramsar site).
- For the terrestrial species, there are also records of Swift Parrot *Lathamus discolour* (EPBC and FFG) from Seaford Wetlands, the latest record being from March 2015 (Appendices 3 and 4).

- The Orange-bellied Parrot *Neophema chrysogaster* (EPBC and FFG) was last recorded in the area in 1980's, at Seaford Swamp in 1986 and 2 km south of Edithvale and at Wells Road in 1988 (VBA, DELWP 2016).
- A Powerful Owl *Ninox strenua* (FFG and vulnerable under DSE 2013) was recorded at Edithvale South Wetland over a two week period in November 2015 (Paul Rees, Melbourne Water, pers. comm.).
- Marshland Passerines (e.g. Australian Reed-warbler *Acrocephalus australis*, Little Grassbird *Megalurus garmineus*, Golden-headed Cisticola *Cisticola exilis*, White-fronted Chat *Epithanura albifrons*, Striated Fieldwren *Calamanthus fuliginosus*, White-browed Scrubwren *Sericornis frontalis*, Superb Fairy-wren *Malurus cyaneus* and Brown Thornbill *Acanthiza pusilla*) represent an important component of the margins of wetlands that support tall reedbeds (BirdLife Australia 2015b). Higher numbers occur at the wetlands during wet years, suggesting that lower invertebrate prey supplies during droughts force marshland passerines to seek wetter environments (Andrew Silcocks, BirdLife Australia, pers. comm.).
- A diversity of raptor species occur at the wetlands. Those commonly recorded include the Swamp Harrier *Circus approximans*, Black-shouldered Kite *Elanus axillaris*, Whistling Kite *Haliastur sphenurus*, Brown Goshawk *Accipiter fasciatus*, Peregrine Falcon *Falco peregrinus*, Brown Falcon *Falco berigora*, Australian Hobby *Falco longipennis*, Nankeen Kestrel *Falco cenchroides* and Eastern Barn Owl *Tyto javanica*. Little Eagle *Hieraaetus morphnoides* and White-bellied Sea-Eagle *Haliaeetus leucogaster* (FFG) also occasionally visit the wetlands. The mosaic of open wetlands, Short Marsh, Tall Marsh, Swamp Scrub, Woodland, indigenous and non-indigenous plantings and grassland provide a diversity of habitats for raptor species. Most species have been recorded foraging over all habitats at Edithvale Wetlands. At Seaford Wetlands, the habitats most used are Red Gum Woodland and associated wetlands and adjoining terrestrial areas in the east. The dependency of each species on the wetlands will vary (e.g. two pairs of Swamp Harriers occur and breed in and forage over wetlands at Edithvale and Seaford Wetlands: whereas Australian Hobbies breed in trees but forage over wetlands and both Black-shouldered Kites and Nankeen Kestrels may opportunistically take prey from reedbeds or adjacent habitats).

Table 4 Number of months during which BirdLife Australia surveys at Edithvale Wetlands from September 1989 to September 2015 and Seaford Wetlands from June 1994 to September 2015 have recorded 18 Latham's Snipe or more (number of snipe recorded are given), Edithvale–Seaford Wetlands.

Month and Year	Edithvale-Seaford (highest count)	Edithvale North	Edithvale South	Seaford
November 1991	18	<18	18	No counts
December 1991	25	<18	25	No counts
January 1992	30	<18	30	No counts
November 1999	18	<18	18	<18
December 1999	30	30	25	<18
January 2000	54	54	<18	<18
February 2000	20	<18	20	<18
December 2000	24	<18	24	<18
January 2001	22	<18	22	<18
January 2002	22	22	<18	<18
February 2006	22	22	<18	22
December 2012	24	<18	<18	24
January 2013	22	<18	<18	22
November 2013	22	22	<18	<18
December 2013	27	27	<18	21
January 2014	22	<18	<18	22
February 2014	21	21	<18	<18
November 2014	22	22	<18	20
December 2014	28	28	<18	<18
February 2015	24	24	<18	<18
Total months	**20 months out of a possible *209 survey months**	**10 months out of a possible *209 survey months**	**8 months out of a possible *209 survey months**	**6 months out of a possible *170 survey months**

*Possible survey months for potentially detecting Latham's Snipe at Edithvale-Seaford Wetlands August, September, October, November, December, January, February and March based on the species known occurrence in southern Australia.

4.6.2 Mammals

A total of 28 species of mammal has been recorded at the Ramsar site as listed in databases (Ecology Australia 2001; KBR 2009; Appendix 5). The Bush Rat *Rattus fuscipes* was also reported to occur at Seaford Wetlands during a Monash University study in the mid-1980's, but hasn't been recorded since then (Ecology Australia 2001). The Southern Freetail Bat *Mormopterus sp. 4* was definitively recorded at both Edithvale and Seaford Wetlands in 2009 by Parsons Brinckerhoff (2009) bringing the total number of mammals recorded to 29 (Appendices 5 and 6; see below).

There have been no records of the EPBC Act- and FFG Act-listed Southern Brown Bandicoot *Isoodon obesulus obesulus* from the area since 1980 (DELWP 2016).

The EPBC Act- and FFG Act-listed Grey-headed Flying-fox *Pteropus poliocephalus* has been recorded in the region more recently and is likely to occur at the wetlands (see below). The Swamp Rat *Rattus lutreolus* was last recorded at Seaford Wetlands in 2005 (DELWP 2016; Will Steele, Melbourne Water, pers. comm.) and still potentially occurs there.

The Rakali or native Water Rat *Hydromys chrysogaster* has recently been identified from footprints as being present at the wetlands in early-2016 (Paul Rees, Melbourne Water, pers. comm.).

The Swamp Wallaby *Wallabia bicolor* has also recently been identified from footprints as being present at the wetlands in early-2016 (Paul Rees, Melbourne Water, pers. comm.).

Feral animals that occur include the Fox *Vulpes vulpes*, Cat *Felis catus*, Domestic Dog *Canis familiaris* and European Rabbit *Oryctolagus cuniculus* (Appendix 5). Domestic pigs *Sus scrofa domesticus* were recently illegally released at Seaford Wetlands, but have since been removed (Paul Rees, Melbourne Water, pers. comm.).

Eastern Grey Kangaroo

In 1985, seven Eastern Grey Kangaroos *Macropus giganteus* and three pouch young from Healesville Sanctuary were introduced to the Edithvale South Wetlands under permit to control grass growth and minimise fire risk and promote conservation and enjoyment of wildlife in an urban environment (Ecology Australia 2001; KBR 2009; Ecoplan Australia 2015). Edithvale South Wetland is enclosed by a 2.1 m high fence and the population is therefore enclosed (Ecoplan Australia 2015). Growth of the isolated population is initially thought to have been relatively slow as a result of environmental factors, such as Fox (*Vulpes vulpes*) predation (KBR 2009). In 2001, Ecology Australia (2001) noted that the population comprised 25–30 kangaroos. In 2005, the population was estimated to be 53 kangaroos (KBR 2009; Ecoplan Australia 2015). Melbourne Water installed drinking troughs and shelters for the kangaroos in 2009, as the organisation is obliged to ensure adequate resources for the population (KBR 2009). In March 2016, the captive population was estimated to be 52 kangaroos inside the enclosure, which exceeds the sustainable carrying capacity of 16–27 animals as recommended in the current Kangaroo Management Plan (Paul Rees, Melbourne Water, pers. comm.).

Historical management of the population included vasectomy of three males in 1995, and vasectomy of three males and treatment of 19 females with levonorgestrel contraceptive implants in 2009 (Ecoplan Australia 2015; VWSA 2016).

To reduce the population to the sustainable level, Melbourne Water commissioned Strathbogie Wildlife [including VWSA (VWSA 2016)] to remove a number of animals from the population and supply the females with medium- to long-term contraception. The work undertaken in April resulted in the removal of 32 kangaroos from the population, and implantation of nine females with contraception. This left 20 kangaroos at Edithvale comprising the nine implanted females and 11 kangaroos which were not captured, three of which are females that received contraceptive implants in 2009 (VWSA 2016). VWSA (2016) used population and sex ratio data to estimate that there may only be two to three female kangaroos capable of breeding.

Bat species

Microbat surveys have been undertaken at both Edithvale and Seaford Wetlands using Anabat call detectors (Parsons Brinckerhoff 2009) and follow-up targeted harp trapping at Edithvale Wetlands (Parsons Brinckerhoff 2010) (Appendix 6). These surveys recorded the following results:

- Eight species were positively identified at Edithvale Wetlands (Chocolate Wattled Bat *Chalinolobus morio*, Gould's Wattled Bat *Chalinolobus gouldii*, Southern Freetail Bat, Large Forest Bat *Vespadelus darlingtoni*, Southern Forest Bat *V. regulus*, Little Forest Bat V. *vulturnus*, White-striped Freetail Bat *Tadarida australis* and Lesser Long-eared Bat *Nyctophilus geoffroyi*);
- Five species were positively identified at Seaford Wetlands (Gould's Wattled Bat, Southern Freetail-Bat, Large Forest Bat, Southern Forest Bat and White-striped Freetail Bat);
- Species groups/complexes recorded at the Wetlands for which calls are indistinguishable and cannot be identified to species levels include:
    - Eastern Freetail Bat/Southern Freetail Bat *Mormopterus* sp. 2 and *Mormopterus* sp. 4, Forest Bat *Vespadelus* species and Long-eared Bat *Nyctophilus* species at both Edithvale and Seaford Wetlands; and
    - Gould's Wattled Bat/*Mormopterus* species and Large Forest Bat/Eastern Bent-wing Bat *Miniopterus schreibersii oceanensis* at Seaford Wetlands.
- 'Potential' calls of three other bat species were obtained during the Anabat surveys, including:
    - The Eastern Bent-wing Bat, listed under the FFG Act 1988, and Eastern Broad-nosed Bat *Scotorepens orion* (not threatened) at both Edithvale and Seaford Wetlands; and
    - Yellow-bellied Sheathtail Bat *Saccolaimus flaviventris*, listed under the FFG Act, at Seaford Wetlands.

Of these three species, Eastern Broad-nosed Bat and Yellow-bellied Sheathtail Bat could be expected to occur at the wetlands (Rob Gration, EcoAerial, pers. comm.). The Yellow-bellied Sheathtail Bat is only vagrant to southern Victoria so wouldn't occur regularly (Rob Gration, EcoAerial, pers. comm.). The Eastern Bent-wing Bat has a low likelihood of occurrence due to the lack of suitable roosting habitat i.e. caves, mines, aqueducts (Rob Gration, EcoAerial, pers. comm.).

The Grey-headed Flying-fox *Pteropus poliocephalus* (EPBC Act and FGG Act) and Eastern Freetail Bat *Mormopterus* sp. 2 (not threatened) were recorded at the Eastern Treatment Plant, and both species probably also occur at Edithvale-Seaford Wetlands (Parsons Brinckerhoff 2009, 2010; Rob Gration, EcoAerial, pers. comm.).

Therefore, 11 bat species potentially occur at the Edithvale-Seaford Wetlands, including two threatened species: Grey-headed Flying-fox (EPBC, FGG) and Yellow-bellied Sheathtail Bat (FFG).

4.6.3 Frogs

Ten species of frog have been recorded at the wetlands (Ecology Australia 2001; KBR 2009; Appendix 5). Threatened species recorded include the Growling Grass Frog *Litoria raniformis (*EPBC Act- and FFG Act), which was last recorded in 1988 to the south of Edithvale (DELWP 2016). The closest records of Southern Toadlet *Pseudophryne semimarmorata* (vulnerable under DSE 2013) occur at Braeside Park (in 1987 and 1990). There are more recent records (2013) from Langwarrin Flora and Fauna Reserve

(DELWP 2016). The Southern Toadlet is very cryptic and difficult to detect, but could still occur at Edithvale or Seaford Wetlands; particularly Edithvale Wetlands. Haswell's Froglet *Paracrinia haswelli* is not considered to be threatened, but it would be considered notable if it still occurred at the wetlands. It is an uncommon frog species that prefers dense, wet, heathy habitat near waterbodies such as swamps, ponds, dams and creeks but may also occur in forest, woodland and shrubland near waterbodies (Wildlife Profiles 1999, Ecology Australia 2005c, Ecology Partners 2007; DSE 2004, DELWP 2016).

Species recorded in recent times at the wetlands during the monthly bird surveys are the frog species that have persisted in urban development and commonly occur in Greater Melbourne: Common Froglet, Spotted Marsh Frog, Striped Marsh Frog, Southern Bullfrog and Southern Brown Tree Frog (see Birds Australia 2006, 2007, 2008, 2010 and 2011; BirdLife Australia 2013a, 2013b 2015 and 2016).

The most favourable habitats for frogs at the wetlands are (see e.g. BridLife Australia 2016; and Andrew Silcocks, BirdLife Australia, pers. comm.):

- Most of Edithvale South (i.e. Zone 1 of BirdLife Australia or Cell ES1 of GHD 2006);
- BirdLife Australia Zones 5 and 7 of Edithvale North (Cells EN1 and EN3a of GHD 2006);
- The freshwater swamp on the eastern side (i.e. wetland in south-east of Zone 1of BirdLife Australia, and Cell SSE2 of GHD 2006); and
- The wetland near Seaford North Primary School (wetland in northwest of Zone 1 of BirdLife Australia and northwest of Cell SCW1 of GHD 2006); and
- The wetland in northeast of Zone 1 of BirdLife Australia and east of Cell SN1 of GHD (2006).

Edithvale Common was reported to regularly support good frog habitat prior to drainage improvements. It still provides good habitat for frogs, but only during very wet periods (Paul Rees, Melbourne Water, pers. comm.).

4.6.4 Reptiles

There are no known reptile surveys undertaken at Edithvale-Seaford Wetlands Ramsar Site (no survey results are listed in the VBA, DSE 2016).

A total of 21 reptile species has been recorded in the region (Appendix 5). None of these species are considered to be threatened. The Eastern Long-necked Turtle is classified as data deficient in Victoria by DSE (2013) and is widespread in wetlands of Greater Melbourne.

SKM (2011) considered that potential habitat was available for the Swamp Skink *Lissolepis coventryi* (FFG Act and classified as vulnerable in Victoria by DSE 2013). Surveys using Elliott trapping, remote-sensing camera and artificial shelters would be needed to confirm the presence or otherwise of this species.

4.6.5 Fish

No fish surveys are known to have been undertaken at Edithvale-Seaford Wetlands Ramsar Site (no survey results are listed in the VBA, DSE 2016).

Four native fish species and one exotic species have been recorded in the region (Appendix 5). None of the native fish species are considered to be threatened. Common Galaxias and Short-finned Eels were

reported to be abundant in Seaford Wetlands in 1985 (see Ecology Australia 2001), and Short-finned Eels are still regularly seen at Seaford Wetlands (Paul Rees, Melbourne Water, pers. comm.). The introduced Mosquitofish or Plague Minnow/Eastern Gambusia *Gambusia holbrooki* is present in the wetlands and is highly invasive and capable of tolerating a wide range of environmental conditions. It is an aggressive competitor that potentially out-competes native fish species. It also preys on frog eggs and tadpoles and appears to differentially affect frog species (Morgan and Buttemer 1996; Pyke and White 1996 and 2000; Komak and Crossland 2000; Ecology Australia 2001; Pyke 2005).

SKM (2011) considered that further survey work was required to confirm the presence or otherwise of the Dwarf Galaxias *Galaxiella pusilla*, listed as Vulnerable under the EPBC Act 1999 and as a threatened taxon under the FFG Act 1988 and classified as endangered in Victoria by DSE (2013), which is known from the Boggy Creek catchment. We consider that due to the disconnection of the wetlands from their natural catchments, and factors, such as salinity in some wetlands (e.g. particularly Seaford), this species has a low likelihood of occurrence, but reiterate the point above that no survey data is available for the wetlands to enable a more confident assessment.

4.6.6 Invertebrates

Very limited information is available on the aquatic macro-invertebrate communities of the wetlands. Ecology Australia (2001) reported on benthos and plankton sampling undertaken by Monash University at Seaford Wetlands in 1985, which recorded Polychaete and Oligochaete worms and zooplankton; the latter comprising mostly copepods and cladocerans. A saline water tolerant species of mosquito *Aedes camphotrincus* is known from Seaford Wetlands (GHD 2006). There are no invertebrate species records listed in the VBA within a 5 km radius of the wetlands (DELWP 2016).

Mosquitoes occur in moderate abundance and require management at Seaford Wetland (see Section 9.4.8) as some species can transmit disease causing pathogens (GHD 2015; Melbourne Water 2016). In Victoria, there are three main mosquito-borne diseases: Ross River Virus (RRV), Murray Valley Encephalitis (MVV) and Barmah Forest Virus (BFV). Currently, Seaford Wetlands is the only high risk asset for mosquito outbreaks (DSE 2004; ALS 2010; GHD 2015; Melbourne Water undated[b]) due to:

- A moderate average abundance of mosquitoes (based on median abundances of c. 80 adult mosquitoes collected in one light trap in 2010);
- Frequent mosquito control action;
- A very high abundance event of adults collected from the wetland;
- A high percentage composition of vector/pest species (*Aedes camptorhynchus* will bite during the day, night and after sunset and is considered to be a principal vector if RRV and BFV and is known to carry MVE in laboratory conditions, *Culex australicus* is thought to be an amplifier of arboviruses because it carries many arboviruses for different hosts although it does not preferentially bite humans and other species which were collected are potential vectors but in extremely low abundance);
- Numerous complaints from residents;
- RRV was detected in one tested mosquito; and
- A high average of vector larvae species have been found in the Wetland.

4.7 Function

Edithvale-Seaford Wetlands (Brett Lane and Associates 2001; GHD 2006; Ecology Australia 2001; KBR 2009; SKM 2011; DSE 2012):

- support a diversity of habitats for a diverse range of flora and fauna species;
- are an essential component of the regional drainage system, receiving, retaining and diverting stormwater and other surface run-off;
- have a critical flood storage capacity that protects surrounding and downstream properties from flooding; and
- contribute to protecting the water quality of Port Phillip Bay by retaining and treating stormwater and other run-off.

4.8 Cultural Heritage

Heritage Insight (2016a and 2016b) has completed a desktop cultural heritage assessment for both Edithvale and Seaford Wetlands (Appendix 14). Their findings are summarised below.

4.8.1 Edithvale Wetlands

A search of the Victorian Aboriginal Heritage Register identified 13 registered Aboriginal Places within a 2 km radius of the study area, comprising a total of 19 components. Of these 13 sites, four were located within 200 m of the study area. The majority of sites in the area are small deposits of stone artefacts located in both surface and sub-surface contexts. Artefact raw material in these sites is primarily quartz and quartzite, with some silcrete. These sites have all been located on the lowland plain on the former swamp landform and likely represent transitory use of the landscape rather than substantial long term campsites. It should also be noted that contour mapping shows all of these sites are located at a higher elevation than the study area.

Aboriginal sites are commonly found around the margins of the Currum Currum Swamp and on elevated ground within the area. However, recent archaeological work has also located sites underneath swamp deposits. A Cultural Heritage Management Plan by Kennedy, Wheeler and Foley (2012) challenged the assumption that Aboriginal sites will not be found within the former swamp, as they identified archaeological deposits within a sandy dune layer located underneath the swamp deposits which is believed to predate the inundation of Carrum Swamp, dating the finds to at least 7000 years old. However, this sandy layer has not been identified in other CHMPs conducted nearby. More broadly however, archaeological work conducted in Edithvale and surrounds has shown that Aboriginal archaeological sites located within the margins of the former Carrum Swamp are extremely rare.

The site prediction model developed concluded that there is an extremely low likelihood that Aboriginal cultural material will be present in the northern section of the study area, and a low likelihood in the southern section. If Aboriginal cultural heritage material is present it will most likely be in the form of low density stone artefact deposits.

4.8.2 Seaford Wetlands

A search of the Victorian Aboriginal Heritage Register identified that there are 33 registered Aboriginal Places within a 2 km radius of the study area, comprising a total of 34 components. These sites comprise artefact scatters (n=21), object collections (n=2), shell middens (n=4) and scarred trees (n=7). There are two sites located within the activity area and two sites within 200 m of the activity area.

It should be noted that historically, if it was unclear whether a scarred tree was cultural or not, it was still practice to register them as potential scarred trees. Five of the seven scarred trees are potentially culturally scarred trees. Two of the potentially scarred trees are located within 200 m of the study area.

Artefact scatters are the most common site type in the local region, and these sites are generally located around the margins of the former Carrum Swamp within sandy dune deposits and Cranbourne Sands deposits. These sites are located in both surface and sub-surface contexts. Quartz is the most common raw material identified however quartzite, silcrete, chert, basalt and glass artefacts have all been recovered.

One artefact scatter is located within the study area itself which is a scatter of stone artefacts located on a ridgeline around the edge of a swampy low-lying area. The recording archaeologist noted that it was likely that this site represented the remnants of a much larger scatter that had likely been collected previously.

There are four registered shell middens within the search region. Two of these shell middens are located on the foreshore dunes on Seaford Beach, one is associated with Kananook Creek and one is located within the study area which comprises three dense exposures of mussel and pipi shell deposits eroding from the side of an access track.

Within the wider Seaford/Frankston area, shell middens are commonly located along the coastal shoreline and deposits of stone artefacts are frequently located within sandy dune landforms and in deposits of Cranbourne Sands, on elevated ridge lines and in areas associated with the margins of Carrum Swamp. This archaeological record demonstrates that both Carrum Swamp and the coastal area were highly important resources for Aboriginal people and were frequently utilised.

The presence of two Aboriginal sites within the study area also show that despite the Seaford Swamp having previously been part of Carrum Swamp and frequently inundated, fluctuating water levels would have provided access both around and through the swamp. Registered Aboriginal places within the study area are evidence of previous Aboriginal activity within the area

The site prediction model developed concludes that there is potential for further deposits of Aboriginal cultural material within the study area. Areas at higher elevations, such as land along the eastern boundary and in the north western corner should be considered to contain moderate to high Aboriginal archaeological potential. Lower-lying areas should be considered to contain lower archaeological potential. The archaeological potential will also be dependent on the level of ground disturbance which has occurred within any given area.

A field survey of the study area would be able to provide a more detailed archaeological assessment and identify areas of archaeological potential along with any surface Aboriginal sites within the study area.

4.9 Social and Amenity Values

Edithvale and Seaford Wetlands are well renowned for bird watching given the abundance and diversity of species, and regular occurrence of many threatened species. At Edithvale, the state of the art Education Centre (built in 2011) and bird hide (which reopened in August 2016 after being refurbished) offer excellent facilities for the general public, particularly bird watchers and school students of all ages. At the Education Centre, school students, special interest groups and the general community can learn about wetland function, plants and animals that live in a wetland, indigenous and European history of the area and sustainable building design.

Both Edithvale and Seaford Wetlands provide open space with natural values amongst the residential land. Walking tracks traverse the reserves, and visitors can also utilise areas of mown lawn. These facilities provide access for casual walking, birdwatching and dog walking for nearby residents and visitors. There is also increasing pressure from the Down's Estate Community Working Group to utilise Seaford Wetland for running events and exercise, although this may have impacts on wildlife. In an effort to reduce disturbance of wildlife across Edithvale Wetland, some of the ponds in the northern section have been designated for dogs to swim and play in and are fenced out of the main wetland area.

The Friends of Edithvale-Seaford Wetlands volunteer community group holds regular working bees, field days and lectures at both wetlands. The group is involved in the promotion of public appreciation and awareness of the wetlands, ecological education, revegetation and general management of the sites.

4.10 Scientific Research and Long-term Monitoring

The Edithvale-Seaford Wetlands Ramsar site has provided significant opportunities for scientific research and long-term monitoring (Brett Lane and Associates 2001; Ecology Australia 2001; KBR 2009). The diversity of flora and fauna, in particular, has provided opportunities for ecological studies. Edithvale and Seaford Wetlands have been used by Birds Australia and BirdLife Australia for long-term monitoring of bird populations since 1989 and 1994 respectively (Birds Australia 2004, 2006, 2007, 2008, 2010 and 2011; BirdLife Australia 2013a, 2013b, 2015a and 2016a). A mist-netting and bird-banding project commenced at Edithvale Wetlands in 2006 (BirdLife Australia 2015b). Monitoring of frog populations has also been undertaken in association with the long-term bird monitoring.

For flora, research and long-term monitoring into the success of control of Common Reed has been undertaken at the wetlands using vegetation mapping, quadrat monitoring and photo-point monitoring (e.g. see Greet and Rees 2015). Monitoring of vegetation condition (i.e. 'Habitat Hectares' methodology) and weed mapping investigations have also been undertaken. (e.g. see Australian Ecosystems 2011a, 2011b and 2016).

The function of the wetlands in flood mitigation and water quality remediation has provided opportunities for research related to the water industry and hydrology (Ecology Australia 2001; KBR 2009; SKM 2011).

Personnel from Monash University have been using the site for blue carbon assessments for research.

Personnel from Chisholm Tafe have been conducting acid sulfate soil assessments for research.

Long-term monitoring and control of a saline water tolerant species of mosquito (*Aedes camphotrincus*) has been undertaken by Melbourne Water.

Water level monitoring has been undertaken at the wetlands since 2008.

Water quality monitoring has been undertaken at Seaford Wetlands since 2003 and at Edithvale Wetlands since 2009 (see SKM 2011; Section 6.2).

Groundwater monitoring commenced in 2014 with the installation of groundwater bores to monitor groundwater dependent ecosystems (GHD 2014).

4.11 Buffer Opportunities

Inside the Ramsar boundary, the wetlands at the Edithvale site are bounded on their eastern side by dryland habitats that offer a number of opportunities. The largest area of interest is an area of c. 8 ha on the north-eastern side of Edithvale South Wetlands, running from the rear of properties along Amaroo Drive in the south to Edithvale Road in the north and bordered in the east by the rear of properties along Enterprize Avenue and Isabella Close. The dryland area supports managed grassland with scattered non-indigenous plantings (e.g. eucalypts and *Melaleuca* sp.). Considerable opportunities exist to make use of this land to complement the wetland values by the installation of treatment wetlands that would treat water from urban drains prior to entering the Edithvale South Wetlands, plus provide additional habitat for waterbirds and frogs. Another opportunity would be to revegetate this area with appropriate woodland species that originally grew in the area.

As discussed in Section 2.6, the Edithvale Common—which formerly supported good waterbird (e.g. Latham's Snipe) and frog habitat during most years, but now supports these habitat values intermittently during very wet years—adjoins the Ramsar boundary to the west of Centre Road Drain and the Edithvale North wetlands. It supports open space which is complementary to the Ramsar wetlands. The potential for inclusion of the Edithvale Common into the Ramsar boundary should be investigated. The City of Kingston is currently investigating whether it can re-flood the area to provide the habitat it formerly did prior to drainage works (Paul Rees, Melbourne Water, pers. comm.).

Should Melbourne Water acquire land associated with the Rossdale Golf Course and First Avenue developments, opportunities to include this land in the Ramsar boundary, or use of this land in a fashion that complements/buffers the Ramsar site, should be investigated (see Section 9).

4.12 'Downs Estate'

'Downs Estate' in the northeast of Seaford Wetlands, is freehold land managed by Frankston City Council that is situated outside of the Ramsar boundary. However, Council's Planning and Environment Department and Melbourne Water are interested in including the land within the Ramsar boundary (see Sections 2.5 and 2.6).

Downs Estate (c. 20.8 ha) was acquired by Frankston City Council in 2006 prior to the preparation of the last Management Plan (KBR 2009). The dominant habitat type is introduced pasture. The land supports seasonal wetlands in a series of old watercourses, and these periodic wetlands fill only during a wet winter. When the site was grazed, it was favoured by flocks of Flame Robins *Petroica phoenicea* (30–40 robins) during their annual winter migration from their breeding areas at higher altitudes to the lowlands. It also favoured the internationally migrant Latham's Snipe during the spring. Both of these

species prefer the short grass for foraging (Birds Australia 2004; TBLD and Australian Ecosystems 2005; Andrew Silcocks, BirdLife Australia, pers. comm.). Flocks of Straw-necked Ibis and Australian White Ibis also foraged in this area as they prefer foraging in an open habitat.

Planning zones over the property include (DELWP 2016c):

- A Green Wedge Zone (GWZ); and
- An Urban Floodway Zone (UFZ)

Planning overlays:

- An Environmental Significance Overlay (ESO);
- Land Subject to Inundation Overlay (LSIO); and
- Wildfire Management Overlay (WMO).

Small areas (<0.2 ha) of Aquatic Herbland EVC (EVC 653) were identified in the northwest, northeast and southeast of the property. A larger area (c. 0.8 ha) of Brackish Aquatic Herbland EVC (EVC 537) and a smaller area (<0.10 ha) of Tall Marsh EVC (EVC 821) occur in the southwest corner of the property (Aspect Studios 2012).

The Ephemeral wetlands have potential to be managed for late-winter and early-spring habitat for waders, by pumping water from Wadsley's Drain Pump Station into the ‘old watercourse’ which runs southwest across the land, including inundation of the adjoining low-lying areas (Paul Rees, Melbourne Water, pers. comm.). The land immediately adjoining the Seaford Wetlands (to the west of the walking trail) is undoubtedly the most important part of the ‘Downs Estate’, and flooding the low-lying areas would provide habitat for waders and open grassy areas for other bird species.

Frankston Council Officers support the notion to incorporate Downs Estate into the Ramsar boundary. However, the notion would need to be passed at a Council meeting. The area east of shared trail is likely to continue to have some community use, and therefore, it is appropriate for land west of the trail to be included in the Ramsar boundary as is discussed in Section 9.5.1. A recent Council resolution supported some community activities east of the shared trail. While these activities will be carefully controlled under a licence issued by Council, there may be potential for impacts on migratory and other birds due to some activities. This could put additional pressure on the wetlands, particularly if water is returned to western portion of Down Estate and birds start to utilise it more frequently.

5 Status of Ecological Character and Limits of Acceptable Change (LAC)

The mechanism against which change in ecological character is assessed is via comparison with Limits of Acceptable Change (LAC). LAC are defined by Phillips (2006) as:

"…the variation that is considered acceptable in a particular measure or feature of the ecological character of the wetland. This may include population measures, hectares covered by a particular wetland type, the range of certain water quality parameter, etc. The inference is that if the particular measure or parameter moves outside the 'limits of acceptable change' this may indicate a change in ecological character that could lead to a reduction or loss of the values for which the site was Ramsar listed. In most cases, change is considered in a negative context, leading to a reduction in the values for which a site was listed".

The following should be considered when developing and assessing LAC:

- LAC are a tool by which ecological change can be measured. However, LAC do not constitute a management regime for the Ramsar site.
- Exceeding or not meeting LAC does not necessarily indicate that there has been a change in ecological character within the meaning of the Ramsar Convention. However, exceeding or not meeting LAC may require investigation to determine whether there has been a change in ecological character.
- While the best available information was used to prepare the ECD and define LAC for the site, a comprehensive understanding of site character may not be possible as in many cases only limited information and data are available for these purposes. The LAC may not accurately represent the variability of the critical components, processes, benefits or services under the management regime and natural conditions that prevailed at the time the site was listed as a Ramsar wetland.
- LAC can be updated as new information becomes available to ensure they more accurately reflect the natural variability (or normal range for artificial sites) of critical components, processes, benefits or services of the Ramsar wetland. The formal process for this is via the Ramsar Rolling Review, which is a three yearly assessment of ecological character at each Ramsar site (Butcher et al. 2011).

The LAC for the Edithvale-Seaford Wetlands Ramsar Site were developed in the recent ECD addendum (Hale 2016). The Ramsar Rolling Review (DELWP 2016e) provides the most recent assessment of current conditions against LAC, the 2016 assessment is provided in (Table 5). This assessment indicates that the site is currently within the LAC.

Table 5 Summary of assessment against Limits of Acceptable Change for the Edithvale-Seaford Wetlands Ramsar Site.

Key: CPS Critical ecosystem components, processes and services/benefits

Critical CPS	Limit of Acceptable Change	2016 Assessment
Waterbird diversity and abundance	Abundance of waterbirds will not decline below the following (calculated as a rolling five year average of maximum annual count): • Total waterbirds – 2500 • Migratory waders – 900 • Australasian waders – 125 • Ducks – 650 • Fishers – 200 • Large wading birds – 100 • Herbivores – 450	Abundance of waterbirds (2011 – 2015) from Edithvale-Seaford Wetlands was as follows (BirdLife Australia unpublished data): • Total waterbirds – 7250 • Migratory waders – 2700 • Australasian waders – 300 • Ducks – 1960 • Fishers – 280 • Large wading birds – 275 • Herbivores – 1300 **The site is currently within the LAC.**
	Abundance of Sharp-tailed Sandpiper will not decline below 1% of the population as stated in the most recent Wetlands International Population estimate (based on a five year rolling average of annual maximum counts).	Abundance of Sharp-tailed Sandpipers (2011 – 2015) from Edithvale-Seaford Wetlands was 3300 (1.8% of the population) (BirdLife Australia, unpublished data). **The site is currently within the LAC.**
Waterbird breeding	Breeding of the following species at least once every five years: Black Swan Blue-billed Duck Chestnut Teal Dusky Moorhen Purple Swamphen Swamp Harrier	All species were recorded breeding more than once in the past five years (2011-2015) (Birds Australia 2006, 2007, 2008, 2010, 2012; BirdLife Australia 2013a, 2013b, 2015 and 2016). **The site is currently within the LAC.**
Physical habitat for waterbirds	Habitat that comprises open water, emergent native vegetation (sedges, rushes and reeds) and exposed mudflats, with no habitat comprising more than 70 percent of the total wetland area for more than five successive years.	The extent of tall marsh dominated by Common Reed *Phragmites australis* has increased at the Ramsar site over the past two decades from 34 hectares in 1994 to 57 hectares in 2013 (Melbourne Water unpublished data). However, this is not greater than 70% of the wetland area and a mosaic of open water (deep and shallow) exposed mudflats and emergent vegetation is maintained. **The site is currently within the LAC.**
Threatened species: birds	Presence of Australasian Bittern and Curlew Sandpiper in at least three out of every five years.	Data from BirdLife Australia (2011–2015) indicate: • Australasian Bittern = four out of the past five years. • Curlew Sandpiper = four out of the past five years. **The site is currently within the LAC.**

6 Site Condition

This section addresses the current condition of the vegetation, water quality and hydrology of Edithvale-Seaford Wetlands.

6.1 Vegetation

Edithvale-Seaford Wetlands have undergone much disturbance since pre-European settlement, formerly being part of the much larger Currum Currum Swamp that has now largely been drained and turned into residential land. The existing wetland remnants that comprise the deeper areas of the former Currum Currum Swamp are highly modified from their previous form with changed hydrology, water quality and salinity. Despite these modifications, the existing wetlands appear to be in quite good condition due to the large diversity of flora and fauna species and vegetation communities present that represent many aspects of the former swamp on a smaller scale.

The quality of the vegetation was assessed and mapped by Australian Ecosystems in 2010 and 2015 (Australian Ecosystems 2011a, 2015) following either the Vegetation Quality Assessment (VQA) or Index of Wetland Condition (IWC) assessment methodology. These assessments indicate that the vegetation quality at both sites is generally quite good, with the majority of vegetation containing moderate diversity and moderate to low levels of weed invasion. In general the higher dryland and ephemeral areas of vegetation contain more weeds than the lower permanently wet or longer inundated areas.

To compare the change in vegetation condition over time, Melbourne Water has commenced condition assessment surveys every five years. However, the 2015 survey primarily used the Index of Wetland Condition assessment methodology rather than the Vegetation Quality Assessment (Habitat Hectare) method. This makes comparison of the vegetation quality over time very difficult as the two assessment methods used are not readily comparable. The conclusions drawn in Australian Ecosystems (2015) regarding the overall change in Habitat Hectares present at the site between 2010 and 2015 is not valid as both assessments assigned all zones assessed using the IWC method a default VQA scores of 0.45. This is more pertinent in the 2015 assessment where the majority of the vegetation was assessed using the IWC method.

6.2 Water Quality

Water quality in the Edithvale-Seaford Wetlands is likely to be significantly influenced by saline water intrusion from groundwater, exposure of coastal acid sulphate soils, backflows of saline water in drains during high tides[1] and the quality of stormwater run-off from adjoining urban areas. The presence of sediment, nutrients and toxicants potentially affects the diversity and productivity of the wetlands (Ecology Australia 2001; GHD 2006; KBR 2009; SKM 2011; DSE 2012). Rising salinity is an issue and is likely to result in shifts from freshwater flora and fauna communities to those tolerant of more saline conditions. Furthermore, good water quality is important for sustaining aquatic flora and fauna (SKM 2011; Jacobs 2016).

[1] There are flood flaps to prevent backflows, however, rubbish can jam them open allowing water to backflow.

6.2.1 Water Quality Sampling 2009/2010

Occasional surface water quality sampling was undertaken at Edithvale Wetlands in 2009/2010 by the Waterwatch group (SKM 2011; Jacobs 2016). Water quality varied between wetland cells, but was overall poor with many indicators exceeding SEPP (Waters of Victoria or WoV) objectives due to the source of the water. Cells with wetlands that received direct inputs of stormwater exhibited high turbidity and nutrients, but lower salinity (EN3a and ES1), than other cells. Cell EN2 had particularly high salinity, and receives groundwater as a result of excavation into the groundwater layer in the 1980's; this cell was also suspected to have low pH from potential acid sulfate soils, but no evidence was obtained in water quality samples (SKM 2011; Jacobs 2016).

At Seaford Wetlands, occasional water quality sampling was undertaken by the Waterwatch group from 2003. Overall, water quality was also poor with many indicators exceeding SEPP objectives due to the sources of water (SKM 2011; Jacobs 2016). Low pH (<6), due to exposure of acid sulphate soils, was recorded in most cells. Nutrient concentrations were highest in the northern cells where inflows from Wadleys Road Drain occur (e.g. SN1 and SCW1), and declined as water flows through the system (from north to south). Seaford Wetlands were brackish and salinity increased through the system with the most brackish cells being SSW1, SSW3 and SSE4 in the south. Elevated salinity is due to saline groundwater intrusion, and tidal intrusion from Eel Race Creek and Kananook Creek (GHD 2006; KBR 2009; SKM 2011; Jacobs 2016).

6.2.2 Water Quality Monitoring 2009 Onwards

From September 2009–2015, more continuous records of water quality parameters were collected.

Salinity

Water quality monitoring from September 2009–2015 demonstrated that salinity levels in Seaford Wetland s are highly variable over time and between cells. Despite this spatial and temporal variation, salinity levels within a cell typically peak in mid-to-late summer and decrease through the year (Jacobs 2016).

As a coastal wetland, potentially subject to seawater incursions and with likely interactions with saline groundwater, SEPP (WoV) objectives were unlikely to be met (Table 6). The dissolved solids associated with catchment run-off are also a potential contributing factor to the increased conductivity seen in both sites on Wadsleys Drain, which supplies Seaford Wetland northern pool (Cell SN1).

Conductivity measurements recorded may reveal excessive fluctuations over short periods of time, and unexpectedly freshwater recorded at times. As the pools at Seaford evaporate (i.e. there is no outflow), the salt becomes highly concentrated in the remaining water and then leaves a thick salt crust when it has dried out completely. Wadsleys Drain receives backflows occasionally from the Patterson Lakes pumps, which pump sea water from Patterson Lakes into Eel Race Creek (Paul Rees, Melbourne Water, pers. comm.).

Freshwater typically has a conductivity of less than 1000 µS/cm, while seawater measurements are typically greater than 50,000 µS/cm. The conductivity in the Wadsleys Drain sites ranged from 340 (freshwater) to 20,000 µS/cm. Similarly, Edithvale Wetlands sites ranged from 450 to 20,000 µS/cm. The observations for Seaford Wetlands ranged from 7.1 (levels associated with mountain streams) to 49,500 µS/cm; very nearly seawater (Table 6).

pH

The pH objectives for this region (SEPP WoV) require that the 25th and 75th percentile range should fall between 6.4 and 7.7. Between one and 27 snapshot surveys were conducted from 2009–2015. Limited numbers of surveys at some sites mean that an accurate calculation of percentiles is compromised.

All sites fall within or close to the SEPP (WoV) objectives for pH levels, with median levels for all wetland cells within a suitable neutral range of 7.0-7.5. There are occasional low readings of pH of below 6.0, in cells SSE4, SCW1, SSW3 and SCE2 and in Centre Drain (Jacobs 2016). This is potentially an indicator of Acid Sulfate Soils (ASS), which are present in areas that are influenced by sulphate-rich saline groundwater intrusion (Jacobs 2016). Low pH occurs when ASS is exposed to air and is then rewet. ASS has been identified in cells SSE4 and SSW1; low pH observations are typically recorded between August and November during the wetting cycle of Seaford wetlands (SKM 2011; Jacobs 2016).

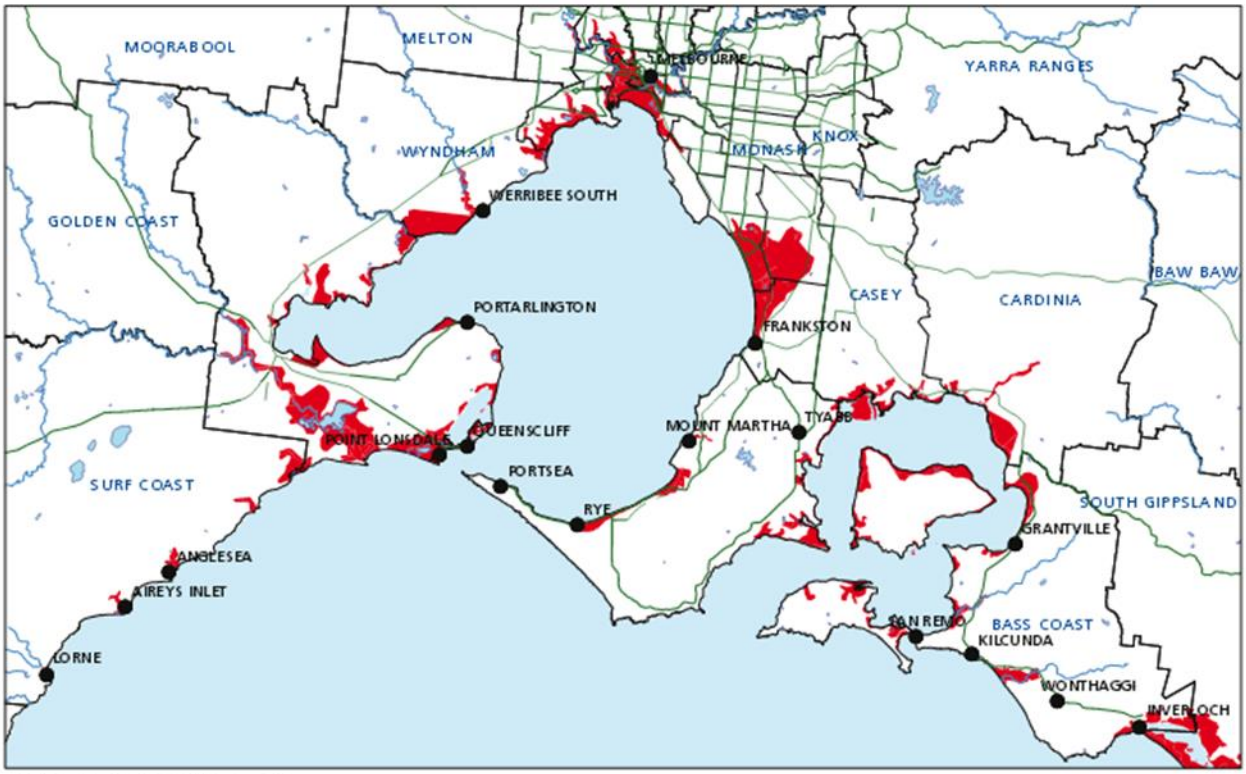
The wetlands fall within an area that has been mapped as potentially impacted by ASS (DSE 2010; Figure 10). Measurements of pH ranged from 2.92 to 9.2. These are extreme fluctuations, and may be a result of waxing and waning inputs from catchment run-off (increasing the alkalinity) and coastal acid sulfate soils (increasing the acidity).

Typically, the Wadsleys Road Drain and Edithvale Wetland sites exhibited pH levels that ranged from acceptable to increased alkalinity, while the Seaford Wetland sites exhibited massive fluctuations, with one site ranging between 2.92 and 9.12 over the course of 17 snapshot surveys.

Table 6 Water quality monitoring data summary for salinity, 2009–2015, Edithvale-Seaford Wetlands.

	Wetland Cells	Monitoring Site	Count of EC (µS/cm)	Min of EC (µS/cm)	Average of EC (µS/cm)	Max of EC (µS/cm)
Wadsleys Drain	SN1	DER100	1	4100	4100	4100
		DSE500	2	7400	12700	18000
		DWA100	5	570	10134	20000
		DWA200	7	1270	7081	19600
		DWA300	2	340	435	530
Edithvale Wetlands	EN3	EV1	22	1655	3029	4600
	EN3a	EV2	9	450	2213	4110
	ES1	EV3	8	965	1839	3700
	EN2	EV4	2	20000	20000	20000
Seaford Wetlands	SN1	SF1	15	463	6389	37300
	SSW1	SF10	4	6250	15280	28000
	SCW1	SF2	28	1010	14048	42900
	SCE2	SF3	20	1490	16643	49500
	SSE2	SF4	9	108	1802	4380
	SSE4	SF5	17	7.1	10202	41300
	SCW1	SF6	13	19.7	7797	22500
	*SN1	SF7	14	23.9	13666	39000
	SSW3	SF8	9	41.3	7641	32800
	SCW1	SF9	9	425	8418	32600

*=Centre Drain



Map 3 Central Coast

Prospective Land: land that has the potential to contain Coastal Acid Sulfate Soils

Figure 10Map of land that has the potential to contain coastal acid sulfate soils from DSE (2010).

Dissolved Oxygen

Dissolved Oxygen (DO) levels recorded at Edithvale and Seaford Wetlands have been highly variable (Jacobs 2016). Stormwater inputs support high biochemical oxygen demand and can rapidly deplete DO levels. The wetlands are rich in organic plant biomass and decomposition during the die-back period would draw DO levels down. DO levels above 10 mg/L may indicate algal blooms or macrophyte growth in wetland cells (Jacobs 2016).

Turbidity

Median turbidity levels have generally not exceeded 50 NTU, with occasional recordings above 50 NTU in Seaford Wetland cells SCW1 and SCE2 (Jacobs 2016).

Reactive Phosphorous

The Waterwatch group collected Reactive Phosphorous data from April 2009 to November 2011 (Jacobs (2016). Phosphorous levels were found to be highest at the inlets to wetlands, such as in Wadleys Drain (SN1) and Centre Drain (SN1) at Seaford Wetlands and in stormwater receiving wetlands at Edithvale (EN3a and ES1). This reflects significant nutrient removal and stormwater treatment by the wetlands as water moves through the cells, and the important ecosystem service prior to water entering Port Phillip Bay (SKM 2011; Jacobs 2016).

Heavy metals in sediment

Eight heavy metals (arsenic, cadmium, chromium, copper, mercury, nickel, lead and zinc) were tested in sediment across eight sites (EV1–3, SF1–5) between 2012 and 2014. The only two metals to exceed the recommended levels for 95% protection of species (ANZECC and ARMCANZ 2000) were copper and zinc.

Edithvale Wetlands sites passed all copper assessments, while one quarter of assessments of Seaford Wetlands sites failed. Edithvale Wetlands sites failed two out of 10 zinc assessments, and Seaford Wetlands failed seven out of 20 assessments (Table 7).

A number of nutrients were also sampled, however, there are no default trigger values for wetlands to compare against. When comparing the results against the most conservative levels (freshwater lakes and reservoirs), none of the sites tested passed default trigger values for total phosphorus, while comparisons against the least conservative levels (lowland rivers) had a number of sites passing: EV1 (4 out of 4 surveys), EV2 (1 out of 3) and SF4 (3 out of 4). All sites failed tests for Total Nitrogen when compared against any default trigger values, ranging from marine to upland river sites, while all sites but one (SF2 on one occasion) passed the 95% level of protection of species for NH3. While difficult to compare against relevant trigger values, and noting the small number of replicates for each site (three or four), these results suggest that there is a fairly high nutrient load across all sites.

Table 7 Water quality monitoring data summary for copper and zinc, 2009–2015, Edithvale-Seaford Wetlands.

		Number of times exceeding recommended levels	
Cell (Site)	Number of surveys	Copper	Zinc
EN3 (EV1)	4		
EN3a (EV2)	3		1
ES1 (EV3)	3		1
SN1 (SF1)	4	3	3
SCW1 (SF2)	4	2	1
SCE2 (SF3)	4		1
SSE2 (SF4)	4		
SSE4 (SF5)	4		2

6.3 Hydrology

The Hydrology of the Edithvale-Seaford Wetlands Ramsar Site is described in detail in GHD (2006) and summarised in KBR (2009), SKM (2011), DSE (2012) and Jacobs (2016a).

The Carrum Carrum Swamp is part of a geological trough bounded on the north side by a monoclinal fold near Beaumaris and on the south side by Selwyn's Fault, near Frankston (GHD 2006). Along with many of the coastal lagoons and wetlands in south-eastern Australia, the wetlands were formed as a result of the end of the last Ice Age and sea level rise c. 5,000 to 7,000 years ago (GHD 2006; SKM 2011; Heritage Insight 2016). A significant portion of the Carrum Carrum Swamp was drowned. Characteristics of the former coastal shoreline include former coastal dune systems behind which lay a series of inter-dunal lagoons. Drier and cooler conditions resulted in retreat of the sea establishing the current dune system and a more recent set of inter-dunal lagoons that filled with a mixture of eroded dunal sands and more recent alluvial deposits from the catchments of Dandenong Creek, Eumemmerring Creek, Boggy Creek and smaller creeks to the north (GHD 2006).

When the area was first surveyed in 1866, water from the Carrum Carrum Swamp drained either to the north into Mordialloc Creek or to the south to Kananook Creek. Five wetland-lagoonal complexes were evident, including (GHD 2006; SKM 2011; see Figure 11):

- Carrum Swamp – the main series of lagoons that existed and form the current suburb of Chelsea Heights, and Wannarkladdin and Carrum wetlands. Dandenong and Eumemmerring Creeks discharged into the Carrum Swamp. The Swamp formed the main seasonal pond and header pool that fed Kananook Creek that broke through the parallel dune systems of the semi-tidal creek. Construction of the Pattersons Cut in 1878–9 divided this swamp, resulting in a loss of connection to the major catchment flows;
- Seaford Swamp: a secondary swamp that extended from near the current alignment of Eel Race Drain to a sand dune ridge near the current alignment of Hummerstone Road. The swamp was an off-stream wetland and only filled seasonally with sufficient water flow from Boggy Creek. Interconnection with Carrum Swamp occurred under flood conditions. Outflow was via a small channel along the current alignment of Eel Race Drain;
- Edithvale Swamp: a backwater swamp from the Carrum Swamp with only seasonal connection to both the north and south cells of the wetland. A natural sill divided the cells from Carrum Swamp at the southern end of Edithvale Wetlands (near the current location of Thames Boulevarde, Chelsea Heights);
- Mordialloc/Braeside Swamp: was an area of the former inter-coastal swamps where drainages from the north terminated that extended from higher elevations of Mordialloc through to the lowlands of Braeside and Keysborough; it was contained on the north side by higher ground. It was seasonally connected to all other swamps and drained to the old Mordialloc Creek which was a sand barrier estuary that was only breached in flood season. The Swamp was mostly drained by the Dandenong Roads Board in the 1880s with the construction of a drain along a similar alignment to that of the current Mordialloc Main Drain. Small vestiges of the Swamp still exist at Braeside Park and to the south of Woodlands.

- Boggy Creek Swamp: a smaller swamp that encompassed the lower floodplain of Boggy Creek (included Rossiters Road Swamp). The Boggy Creek alignment lay further to the east than its current alignment.

At the time of European Settlement, the Carrum Carrum Swamp was an extensive freshwater wetland that occupied c. 5,260 ha and extended along the eastern shoreline of Port Phillip Bay, from Mordialloc in the north, to Frankston in the south, and as far east as Bangholme. The water source of the Carrum Carrum Swamp came mostly from Dandenong Creek (headwaters in the Dandenong Ranges) and Eumemmering Creek (headwaters at Narre Warren), with smaller contributions from the catchments that currently drain to Mordialloc Creek and Boggy Creek catchment (GHD 2006; KBR 2009; SKM 2011).

Drainage of the Carrum Carrum Swamp commenced in 1868, when channels were constructed across the Swamp to carry water to Mordialloc Creek and Kananook Creek, in order to claim land for grazing and cultivation (GHD 2006).

In 1879, the Patterson Cut, now known as the "Patterson River", was cut through the Swamp by the Dandenong Roads Board and coastal dunes to Port Phillip Bay to provide further drainage, with the focus on providing agricultural land. The "new river" commenced at the confluence of Dandenong and Eumemmering Creeks, near Bangholme (GHD 2006; SKM 2011).

Extensive flooding in 1889 resulted in the capacities of the small channels and Patterson Cut being exceeded. The Carrum Drainage Trust was formed with a major focus to increase the capacity of the system (GHD 2006).

By early twentieth century, most of the original wetlands area had been drained and land was being used for market gardens and dairy farming (Heritage Insight 2016a and 2016b).

Following extensive flooding in 1923 and 1924, drains were further increased in size by the State Rivers and Water Supply Commission (GHD 2006).

Major floods in 1934 resulted in works on the levee system to increase the capacity and further develop the drainage system (GHD 2006).

By the 1960's, the former Swamp area had been largely urbanised (Heritage Insight 2016a and 2016b).

Aerial photograph history and contour mapping demonstrates that (Heritage Insight 2016a and 2016b):

- the areas encompassing Edithvale and Seaford Wetlands would have regularly been waterlogged and occasionally inundated (0–1 m above sea level);
- rapid residential development and subdivision during the 1940s for Edithvale Wetlands and 1950s for Seaford Wetlands; and
- significant modifications to drainage, including construction of pools, drains and weirs after 1980 at Edithvale Wetlands and since 1989 at Seaford Wetlands.

In late 1991, Melbourne Water was formed by the amalgamation of the Dandenong Valley Authority and Board of Works and took over management of drainage and floodplain systems.

As result of historic drainage, Edithvale and Seaford Wetlands have been largely isolated from their natural sources of water and most surface inflow is via drains, many of which are controlled (GHD 2006; KBR 2009; SKM 2011; DSE 2012; Jacobs 2016).

6.3.1 Edithvale South Wetlands

Edithvale South Wetlands comprises a natural depression on the south side of Edithvale Road with the lowest point being 0.3 m below sea level (GHD 2006). Despite being farmed for dairy cattle as late as 1969, the morphology of the basin and the peat layer on which it lies is intact, preserving the last and deepest remnant of the original Carrum Carrum Swamp (GHD 2006; KBR 2009; SKM 2011; DSE 2012).

Edithvale South Wetlands are predominantly fed by three drains from catchments to the east which initially entered sediment ponds at the edge of the macrophyte zone (Figure 12). The winter and spring standing water level generally sits at around 0.00 m Australia Height Datum (AHD), but rises up to 0.78 m AHD during rain events and discharges to Edithvale North Wetlands at Centre Swamp Drain; the invert level of the weir is -0.02m AHD, and therefore, any water above that level discharges to Edithvale North Wetlands (Appendix 7). Reduced rainfall during summer and autumn will result in evaporation and water levels drop below 0.00 m AHD, the drawdown creating the critical mudflat foraging habitat for waders (GHD 2006).

The system comprises one main shallow pool (ES1) and three smaller, deeper pools (ES1a, ES1b and ES1c). The invert of the main pool is -0.47 m AHD. It starts to overflow into Centre Swamp Drain above the invert level of the weir (-0.02 m AHD), and is generally c. 45 cm deep, but has been recorded at depths of up to 125 cm deep (i.e. 0.78 m AHD) (Paul Rees, Melbourne Water, pers. comm.).

The system dries-up over late-summer and autumn, facilitating a lush growth of Salt Club-rush (*Bolboschoenus caldwellii*) in late-summer and autumn, the species that sustains the peats and nutrient cycling. Natural drying of the wetland facilitates the control Common Reed *Phragmites australis* invasion.

A manually operated pump on Centre Swamp Drain can pump water when the drain holds water into the northern pool during dry periods (Appendix 7; GHD 2006; KBR 2009; DSE 2012).

6.3.2 Edithvale North Wetlands

Edithvale North Wetland predominantly comprises a series of constructed wetlands within the former floodplain on the north side of Edithvale Road (Appendix 7; Figure 12; GHD 2006; KBR 2009; DSE 2012). Construction commenced in 1987. Immediately north of Edithvale Road, EN1 was constructed as a shallow pool within the peat layers that established a similar morphology and depth to Edithvale South Wetlands and subsequently remains fresh-brackish (GHD 2006; KBR 2009; DSE 2012). EN1 is connected to Edithvale South via a pipe under Edithvale Road which supplies water at around 0.00m AHD.

A number of other pools further north (i.e. EN2, EN3 and EN3a) generally reach deep into the peat layer and sandy substrate and have varying inputs of groundwater. Water levels in EN3 and EN3a are generally responsive to the groundwater table, which varies in height, but can draw down to -1.95 m AHD during drought years. Salinity is therefore a problem in EN3 and EN3a e.g. 10,000 to 12,000 us/cm (GHD 2006). In wetter seasons, the standing water can reach 0.00 to 0.15 m AHD and salinity is lower e.g. 4,000 to 5,000 us/cm (GHD 2006).

The invert level of the northwest wetland (EN3) is -1.9 m AHD, while the invert level of the L-shaped lake (EN2) is -1.95 m AHD. Data for EN3 suggest that it ranges from 0.42 (-1.48 m AHD) to 2.00 (-0.1 m AHD) m deep. Data for EN2 suggest that it ranges from 0.00 m (i.e. empty) (-1.95 m AHD) recorded in Feb 2016, to more than 2.00 m (gauge under water) (>0.15 m AHD) (Paul Rees, Melbourne Water, pers. comm.).

In the west of the system, the water level in the Dog Pond (another constructed wetland), which is open to the public as a swimming hole for dogs, is also controlled by the groundwater table, but can receive water from cell EN2 via an overflow channel at -0.4 m AHD. Inadequate water retention and salinity are considered to be problems in this pond.

Stormwater drains enter the wetlands via sediment ponds EN4 and EN5. EN4 is a deep pool that generally supports freshwater and provides good foraging habitat for Blue-billed Duck *Oxyura australis*, Musk Duck *Biziura lobata* and Australasian Bittern (GHD 2006; KBR 2009; DSE 2012; Jacobs 2016).

A series of weirs control flow of water between EN1, EN2, EN3 and EN3a and limit total drawdown during prolonged dry or drought conditions. Stormwater supplies these cells from a series of drains and overland flow (GHD 2006; KBR 2009; SKM 2011; Jacobs 2016).

6.3.3 Seaford Wetlands

Seaford Wetlands was disconnected from its natural catchment (Boggy Creek) in the 1880's associated with the construction of the Patterson Cut. The wetlands were subsequently drained for agriculture and much of the land surrounding the core wetland area was still being farmed into the 1970's, with some excavation to facilitate drainage by the landowners (GHD 2006; KBR 2009; SKM 2011).

In addition to its disconnection from Boggy Creek, the system no longer receives water from the Carrum Swamp (now Patterson Lakes) and receives increased groundwater from the local drainage system (GHD 2006; SKM 2011).

Saline water can enter the system from three sources (Appendix 7; Figure 13; GHD 2006; KBR 2009; DSE 2012; Jacobs 2016):

1. In 1988, excavation occurred in the south of the swamp to create lakes (GHD 2006; KBR 2009; SKM 2011; DSE 2012). The excavation broke through peat layer resulting in saline water and acid sulphate groundwater entering this section of the wetland;
2. Ground seepage into stormwater drains to the west of the wetlands; and
3. Backflows from marine waters of Kananook Creek via connectivity to the Bardia Avenue drain and Weatherstone Road drainage system.

The hydrology is highly modified and regulated, and surface flows are almost all from stormwater drains (Appendix 7). A central drain, constructed after World War 1, receives pumped low flows from Wadsleys Road Drain into the northern cell (SN1). This central drain delivers water to varying degrees into cells further south. The levee crossing the central drain, and the central and southern flood gates on this drain were upgraded in 2013 (Paul Rees, Melbourne Water, pers. comm.). The wetlands also receive water during very large events (i.e. 1-in-100 year) from the Boggy Creek catchment i.e. overtops the levee (SKM 2011).

To control salinity at Seaford Wetlands, previous management interventions aimed to provide a freshwater supply during winter, spring and summer through a series of cascading pools which run from north to south through the system that constantly dilute and export the salts from the site. Other works included (GHD 2006; SKM 2011; DSE 2012):

- In 1989–1990, the inlet from Eel Race Drain was modified to prevent intrusion of saline water and permit freshwater to enter the wetlands;

- In 1991–1992, construction of a low embankment to enable ponding of freshwater over groundwater and isolate the northern cell (SN1) from saline areas and promote a fresh-brackish system (SKM 2011);
- Interventions to reduce saline intrusion from the drainage system and to intercept the local drains from the west, between Shirley Avenue and Mackenzie Street;
- There are pumps and flood flaps at Bardia Avenue and Weatherston Road to prevent water back-flowing from Kananook Creek; and
- In addition there is a pump system at James Street, which directs saline groundwater intercepted by the local drainage system and directs it around the wetland to the Austin Road Pit.

Seaford Wetlands support (GHD 2006; KBR 2009; SKM 2011; Jacobs 2016): semi-permanent brackish pools in the south which receive stormwater input; a deep, permanent and strongly saline pool in the southwest which has been excavated into the peat layer and exposed acid-sulphate soils; intermittent shallow brackish herb/sedgeland areas in the south; and small marshes fed by stormwater in the east and north.

Melbourne Water is currently investigating whether there is an opportunity to pump water from Boggy Creek into Seaford Wetlands (Paul Rees, Melbourne Water, pers. comm.).

SCE2 has an invert level of 0.19 m AHD, with a range of 0.00 m (0.19 m AHD) to 0.60 m (0.79m AHD) and generally dries out in summer. SCW1 has an invert level of 0.14 m AHD, with a range of 0.00 m (0.14 m AHD) to 0.70 m (0.84 m AHD). The SCE2 and SCW1 operate independently below 0.14 m AHD, but are connected above this point as essentially one large pool, as the levee on either side of the main drain has low points of 0.28 m AHD on the west and 0.31 m AHD on the east. Thus, in an average year, the cells will be disconnected initially in autumn, they will slowly fill until they reach 0.31 m AHD (0.12 to 0.14 m deep), at which point they will be connected over most of winter and spring, until in late-spring and early summer, they draw down below 0.31 m AHD and are no longer connected.

SSW1 has an invert level of 0.08 m AHD and ranges from 0.00 m (0.08 m AHD) to 0.68 m (0.76 m AHD). SSW3 has an invert level of 0.21 m AHD and ranges from 0.00 m (0.21 m AHD) to 0.66 m (0.87 m AHD).

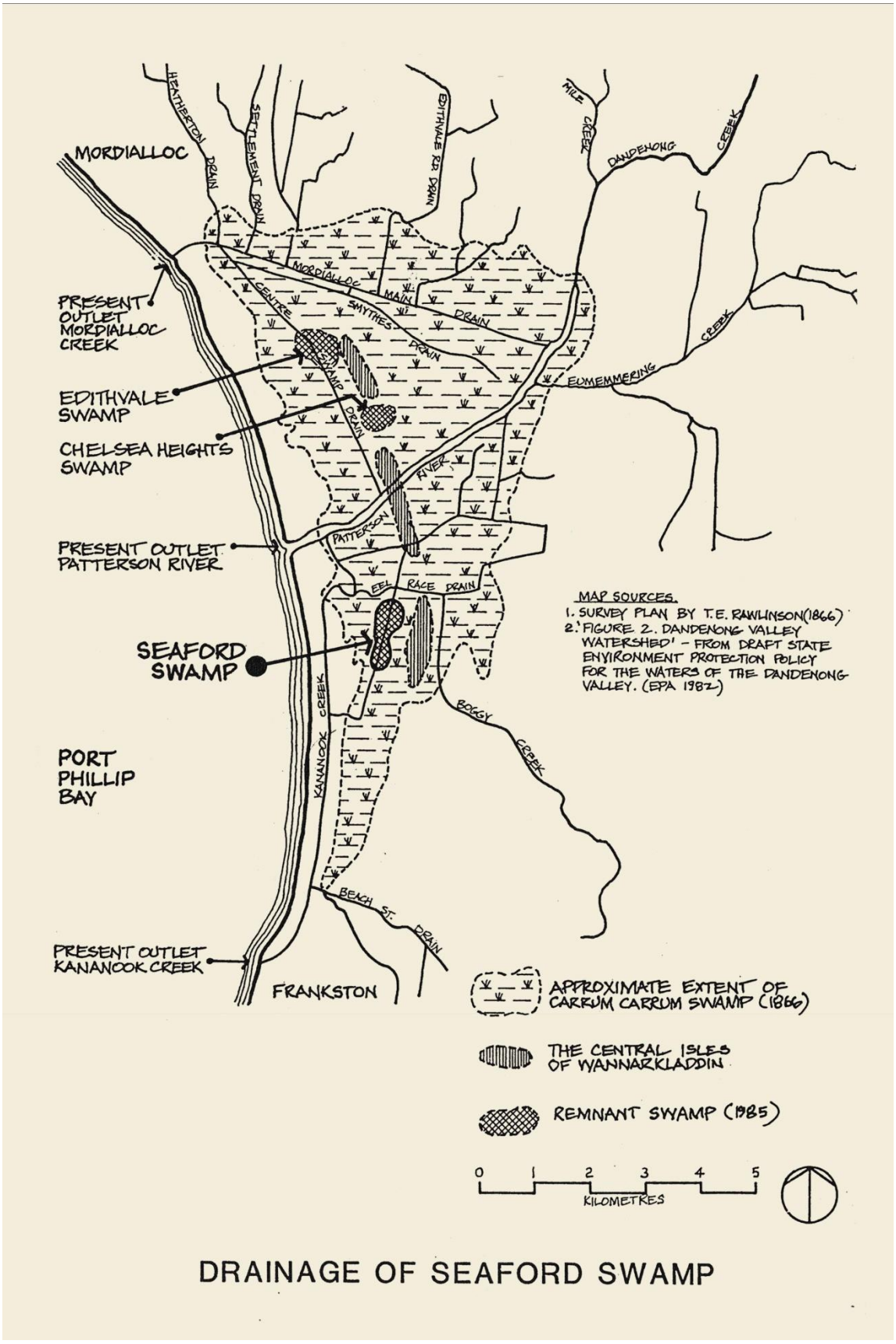


Figure 11Former Carrum Carrum Swamp, including remnant cells (from GHD 2006).

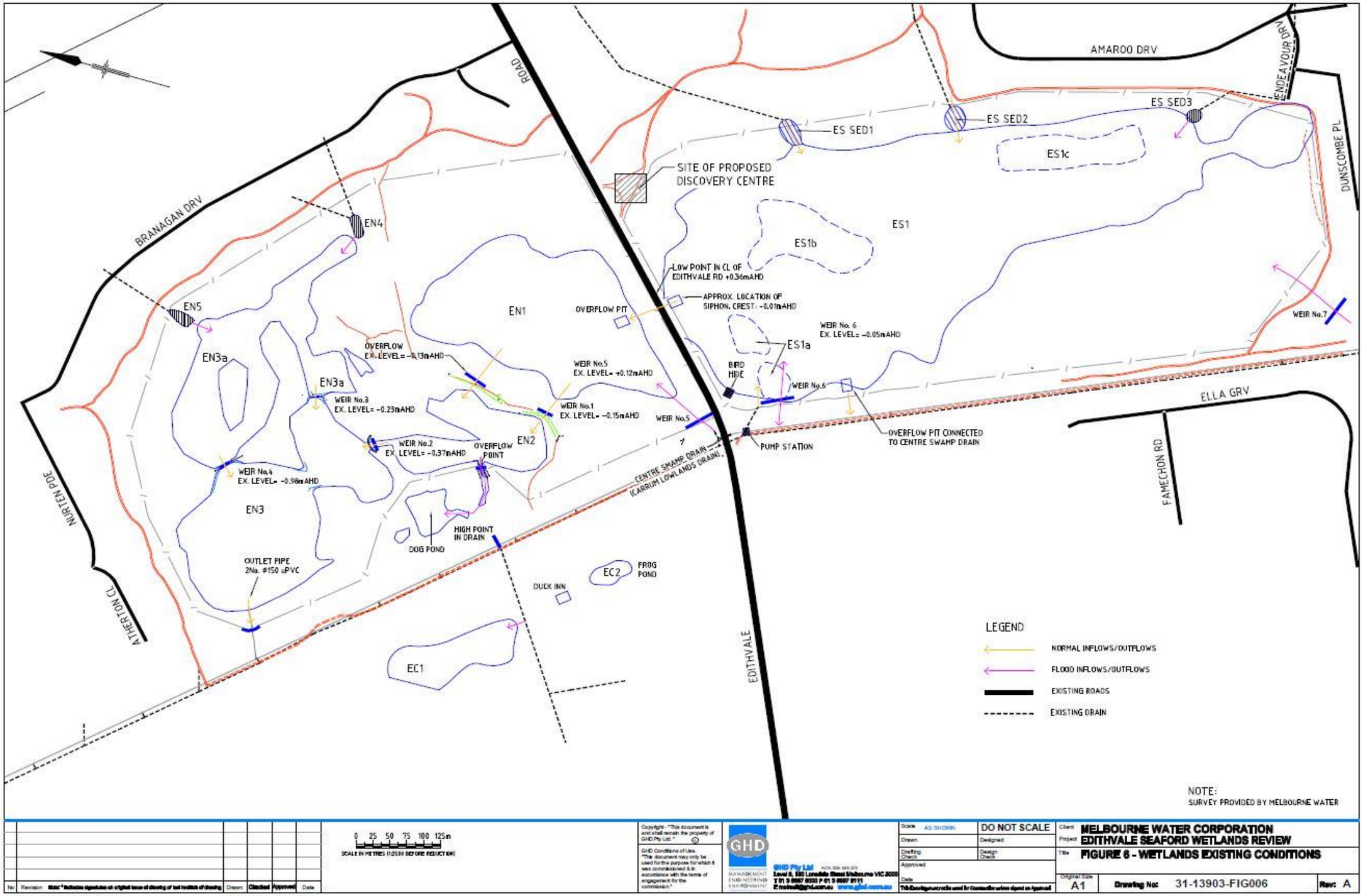


Figure 12Location of hydrological cells, drains, weirs and sedimentation ponds and direction of flows for Edithvale Wetlands (reproduced from GHD 2006).

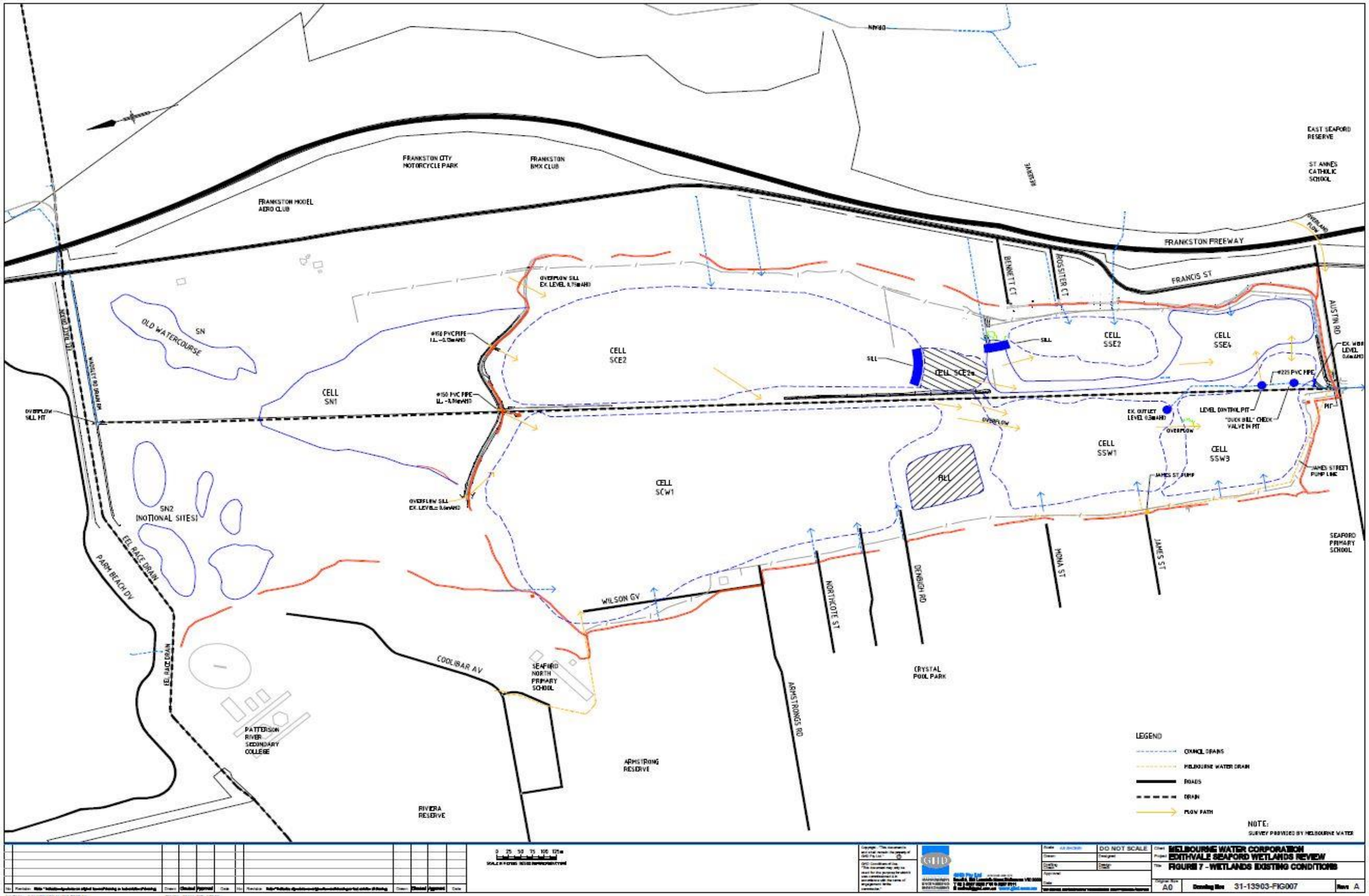


Figure 13Location of hydrological cells, drains, pipes and weirs and direction of flows for Seaford Wetlands (reproduced from GHD 2006).

7 Risk Assessment

A risk assessment has been undertaken to evaluate the threats identified and their potential impacts to the Ramsar sites values. The risk assessment approach follows a structured and iterative process, with the following steps:

1. Establish the context – existing values and environmental conditions;
2. Identify risks – threats and associated potential impacts; and
3. Analyse risks – assign likelihoods and consequences to determine level of risk.

The methods and detailed results are presented in Appendix 8.

Table 8 summarises the results of the risk assessment for each threat.

These results feed into the Management Plan in Section 9.

Table 8 Summary of risk assessment for the Edithvale-Seaford Wetlands Ramsar Site.

Pressures	Stressors	Risk (highest risk for all potential impacts)
Pollution: urban stormwater	Increased nutrients and sediments	Low
Pollution: urban stormwater	Toxicants	Low
Water management: urban stormwater	Altered water regimes	Medium
Water management: urban stormwater	Increased salinity	High
Urban development and recreation	Litter	Medium
Disturbance of Acid Sulfate Soils (ASS)	Acidity and liberation of heavy metals	Medium
Invasive species	Invasive native plant species: Common Reed *Phragmites australis* and Cumbungi *Typha* spp.	High
Invasive species	Invasive native exotic species: Spiny rush **Juncus acutus*	Medium
Invasive species	Predators (foxes, cats and rats)	Extreme
Invasive species	Native species: kangaroos	Medium
Invasive species	Grazing animals (pigs, rabbits)	Medium
Recreational activities	Human disturbance (noise)	Medium
Climate change	Increased frequency / intensity of fire	High
Climate change	Sea level rise	Extreme
Climate change	Increased frequency & intensity of storms	High

8 Threatening Processes

8.1 Water Management: Urban Stormwater – Altered Water Regimes

An important water-related threat to waterbirds and waterbird habitats is inadequate water levels in the wetlands cells to provide habitat at critical times to support life history requirements (e.g. ANCA 1996; Brett Lane and Associates 2001; Ecology Australia 2001; Birds Australia 2008; DSE 2012; BirdLife Australia 2016a). Adequate water levels are required for the duration of the migratory wader species visitation. If wetlands dry out too quickly over summer (e.g. by December), waders disperse from Edithvale-Seaford Wetlands. Adequate water levels are also important for the duration of the diving ducks breeding season to complete the breeding cycle (e.g. Blue-billed Duck, Hardhead).

The Edithvale South Wetland dries out over most summers. If this occurs early in summer, it predisposes young Black Swans, which are incapable of flying, to predation by foxes (e.g. BirdLife Australia 2016a). Maintaining adequate water levels is also an issue at Seaford Wetlands, with the wader pool (SCE2) drying out by November or December during drought conditions (SKM 2011).

An important water-related threat is the dominance of emergent vegetation (i.e. Common Reed and to a lesser extent Cumbungi) in response to shallow, stable water levels during the critical growing summer period, reducing the occurrence of other aquatic vegetation and habitat types (e.g. open mudflats for waders) (SKM 2011). Ideally, a natural pattern of wetting and drying that facilitates the maintenance of a mosaic of vegetation types (e.g. shallow open water with submerged or weakly emergent macrophytes to areas of dense emergent macrophytes, is desired (Ecology Australia 2001; SKM 2011).

The priority objective is to provide an inundation regime which inundates the wetlands over winter and early-spring and is then slowly drawn down from September to December to provide habitat for migratory waders, whilst maintaining the deeper pools/wetland cells as permanent wetlands for waterfowl (Ecology Australia 2001; KBR 2009; SKM 2011; DSE 2012).

Ecology Australia (2001), GHD (2006) and SKM (2011) also suggested that insufficient high level freshwater flows into Seaford Wetlands may lead to gradual accumulation of salt, which becomes concentrated especially during drought years. Maintaining the freshwater herbfield was considered to be dependent on seasonal freshwater flushing to avoid a further transition from freshwater to saline vegetation (also see DNRE 2002).

8.2 Water Management: Urban Stormwater – Increased Salinity

Saline water enters Edithvale North Wetland and Seaford Wetlands via excavations made in 1987 and 1988 which broke through the peat layer resulting in saline water and acid sulphate groundwater intrusions. In Seaford Wetlands, saline water also enters via groundwater seepage into stormwater drains to the west of the wetlands, occasional backflows from marine waters of Kananook Creek and saltwater inflow from Eel Race Drain during higher tides (GHD 2006 and 2015; KBR 2009; SKM 2011; DSE 2012). Both Edithvale and Seaford Wetlands will also become more saline with eustatic sea level rise exacerbating tidal intrusions. Increasing salinity will result in a further shift from flora and fauna communities that favour freshwater, to those that can tolerate brackish or saline water (Ecology

Australia 2001; GHD 2006; SKM 2011). Rising salinity is therefore a threat to waterbirds, frogs and vegetation diversity, resulting in an overall decline in habitat diversity (also see DNRE 2002).

Combined, there appears to be an inexorable trend to more saline conditions, with rising sea levels either directly or indirectly through groundwater intrusion, being the major driver (see also Section 6.2.1).

8.3 Pollution: Urban Stormwater – Increased Nutrients, Sediments and Toxicants

Stormwater inflows potentially carry pollutants, nutrients and sediments into the wetlands from urban areas. Sedimentation can result in smothering of aquatic biota and the creation of sites for weed establishment and favour the introduction of exotic or invasive native weed species (e.g. *Phragmites australis* and *Typha* spp.) and reduce the flood carrying capacity of the wetlands by making the wetlands shallower over time. Nutrients can favour conditions suitable for eutrophication and algal blooms of wetlands. Toxicants can be delivered into wetlands which may adversely impact fauna through bioaccumulation (Ecology Australia 2001; DNRE 2002; KBR 2009; SKM 2011; DSE 2012; DEPI 2014b).

8.4 Urban Development and Recreation – Litter

Litter not only harms the appearance of a wetland, but it can also be harmful to aquatic wildlife through entanglement or ingestion (Ecology Australia 2001; DNRE 2002; KBR 2009; SKM 2011; DSE 2012; DEPI 2014b). Litter can also affect functioning of drains and pipes (e.g. through blockages), ultimately affecting the water regime and drainage function of a wetland.

In order to assist with removal of rubbish from Council drains entering the wetlands, Melbourne Water would like to improve the treatment of some of the council stormwater pipes by installing 'daylight' pipes with treatment swales (Paul Rees, Melbourne Water, pers. comm.).

8.5 Disturbance of Potential Acid Sulfate Soils – Acidity and Liberation of Heavy Metals

Potential acid sulfate soils occur naturally in coastal and inland settings. These soils contain metal sulfide minerals, which, if drained, excavated or exposed to air, can react with oxygen and water to form sulfuric acid (H_2SO_4). This can result in the acidification of surrounding soils, groundwater and surface water, which can destroy soil structure and cause severe acidification of waterways. If exposed, actual acid sulfate soils can lead to the release of other contaminants, such as heavy metals, which, when combined with acid, can harm plants and animals, and contaminate drinking water (DSE 2010).

Actual acid sulfate soils can also have health, engineering, social and economic impacts as well as devastating effects on alkaline building foundations and infrastructure and the formation of acid can corrode concrete and steel (DSE 2010; Eco-tainable 2013).

Soil sulfide levels are elevated in unconsolidated saturated Holocene sediments present in the Seaford Wetlands (Eco-tainable 2013). Consequently, careful management of these sediments is required during

any earth works that need to be undertaken and an Acid Sulfate Soil Management Plan will be required for the management of excavated acid sulfate sediments (DSE 2010; Eco-tainable 2013).

8.6 Invasive Species – Exotic Plants

A number of previous ecological studies for the two wetlands have identified weed species occurring within each site. These include reports by Ecology Australia (2001), TBLD and Australian Ecosystems (2005), Australian Ecosystems (2011a, b, 2015). A large proportion of these are weeds of management concern for the protection of biodiversity values. They include 16 noxious weed species in Edithvale and 19 noxious weed species in Seaford, as listed under the *Catchment and Land Protection Act 1994* for the Port Phillip and Westernport Catchment Management Authority region. In addition, seven species in Edithvale and nine species in Seaford are Weeds of National Significance (WONS).

Many other weed species are present within the site as ubiquitous herbaceous species which are not prioritised for management as they are not particularly invasive or have reached the extent of their invasion potential.

The weeds of management concern listed in Section 9.4.6 (Tables 13 and 14) include highly invasive species as well as less invasive species requiring management for other reasons (e.g. species with easily eradicated populations, species with high visual impact). These weed species have been categorised into two management threat categories (high and medium), reflecting the level of invasiveness and impact posed by the species within the reserve. While it is imperative that the focus of weed management is on high threat species, it is important that populations of medium threat species are not allowed to expand in the short term. This is particularly pertinent in the groomed areas where weeds may be more likely to invade.

An important consideration for managing high threat weed species within the reserve is the ongoing seed input from source infestations within and adjoining the reserve. If source populations are identified, the land owners should be engaged to eradicate these infestations.

8.7 Invasive Species – Exotic Grazing Animals (European Rabbit and Hares)

European Rabbits *Oryctolagus cuniculus* occur at Seaford Wetlands, as evident from faeces observed across the site. Although rabbits can degrade biodiversity values by grazing on plants and disturbing the soil profile, their impacts were not observed to be excessive during site visits. Rabbit impacts can contribute to erosion and dispersal of seeds in faeces and on fur, and if unmanaged, can lead to the loss of plant populations, resulting in floristic changes, degraded fauna habitats and weed spread. Previous assessments (Australian Ecosystems 2011, 2015) noted grazing by introduced animals as a threat to Seaford Wetlands and recommended rabbit control programs be implemented at the site. European Hares *Lepus europaeus* have not been confirmed at Edithvale or Seaford Wetlands, however they should be managed alongside rabbits if found to occur at either site.

8.8 Invasive Species – Exotic Terrestrial Predators (foxes, cats and rats)

The impacts of other pest animals are less readily quantified. Domestic and feral cats *Felis catus* undoubtedly use Edithvale-Seaford Wetlands, as cats have been at Edithvale North and South and

Seaford Wetlands; cats will have some impacts to native fauna. Foxes *Vulpes vulpes* are also regularly seen at the wetlands, and fox control using soft-jaw trapping at Seaford Wetland resulted in the capture of 20 foxes over a two-week period in April/May of 2015 (Paul Rees, Melbourne Water, pers. comm.). The Red Fox is prevalent within Melbourne and surrounds and integrated control using baiting in residential areas is difficult at best and unfeasible in an area frequented by domestic dogs. Both cats and foxes can prey on birds, small mammals (e.g. if Swamp Rats are still extant) and frogs, which may impact detrimentally on local populations at the Wetlands.

8.9 Invasive Species – Exotic Predatory Fish

The Mosquitofish is a small freshwater fish introduced from USA and capable of tolerating a wide range of environmental conditions. Mosquitofish prey upon frog eggs and tadpoles and are considered a serious threat to frogs in the Melbourne region (reviewed in Ecology Australia 2014). It has been suggested that Mosquitofish may be associated with the decline of the threatened Growling Grass Frog *Litoria raniformis* in Victoria (Tyler 1997). The EPBC Act-listed Dwarf Galaxias *Galaxias pusilla* has not been recorded at either site, but if present, may also be threatened by predation and/or competition with Mosquitofish (DELWP 2015).

8.10 Out of Balance/Invasive Native Species

8.10.1 Common Reed and Cumbungi

Common Reed *Phragmites australis* Narrow-leaf Cumbungi *Typha domingensis* and Broad-leaf Cumbungi *Typha orientalis* are robust graminoids that grow to 3 m or more in height. These species now cover large areas of both Edithvale and Seaford Wetlands and are expanding in these sites. Common Reed is by far and away the most abundant of these species at Edithvale and Seaford Wetlands, but all are capable of shading out the smaller herbaceous species, reducing diversity and simplifying habitat structure as they expand in distribution. The thick reed beds provide limited fauna habitat, instead restricting the diversity of habitats, particularly open wetlands and mud-flats, available to wetland birds that might otherwise utilise the site.

A grooming regime commenced in 2013 which aims to reduce the density and distribution of Common Reed and recreate more habitat diversity. This is included in a study by Greet and Rees (2015) at Seaford Wetlands.

Consideration has been given to potential implications of the grooming regime. The potential promotion of weeds (now that the dominant vegetation structure has been temporarily removed and as a result of soil disturbance) are managed effectively now that the groomed areas are more accessible. In addition, the resultant mass of organic litter created is raked into piles as it can limit or inhibit natural recruitment of native species (and weeds), potentially deoxygenate the water as the litter decomposes and clog drains after large rainfall events.

8.10.2 Coast Tea-tree and Coast Wattle

Coast Tea-tree #*Leptospermum laevigatum* and Coast Wattle #*Acacia longifolia* subsp. *Sophorae* naturally occur on the dune systems and headlands along the coast (Curtis 1956, Pedley et al. 1983,

Thompson 1989, Morrison and Davies 1991, Whibley and Symon 1992, Entwisle et al. 1996, Court 2001, Bachmann 2009). Neither of these species are considered indigenous at Edithvale or Seaford Wetlands where they can form dense stands effectively outcompeting and limiting the recruitment of indigenous species.

As #Coast Tea-tree is fire sensitive, a reduction in fire frequency has been suggested by many authors as a precursor to invasion by this species (Burrell 1981, Ecology Australia 1987, Molnar et al. 1989). Fire is an essential management tool for eliminating this species as it does not resprout (instead releasing seed en-masse) and many indigenous species respond positively with enhanced post-fire recruitment. Fire has been used very effectively in many nearby regions where heathy and woodland vegetation communities are threatened by #Coast Tea-tree, e.g. by Kingston City Council and Bayside City Council at many of their inland reserves, by Parks Victoria at Wonthaggi Flora and Fauna Reserve and at 'The Pines' in Frankston. In other coastal heaths, e.g. in the Greater Otway National Park near Anglesea, fire is similarly employed to control #Coast Tea-tree and #Coast Wattle invasion (Katrina Lovett, Parks Victoria, pers. comm.). Follow up management post-fire is vital to manage the resultant crop of #Coast Tea-tree and #Coast Wattle seedlings.

8.10.3 Eastern Grey Kangaroo

The Eastern Grey Kangaroo population at Edithvale South Wetland has been slowly rising to 52 kangaroos estimated in March 2016. This is well above the density of 0.6 – 1.0 kangaroos per hectare recommended by DELWP, or 16 – 27 animals (see EcoPlan Australia 2015; VWSA 2016). Prior to management intervention in March 2016, numbers were considered to be at an unsustainable level.

Following the implementation of kangaroo management in March 2016, 20 Eastern Grey Kangaroos remained on-site (VWSA 2016), which is within the sustainable population limits of 0.6 – 1.0 kangaroos per hectare recommend by DELWP (see EcoPlan Australia 2015; VWSA 2016). Of the 20 kangaroos remaining, nine females were implanted with levonorgestrel implants in March 2016, while 11 animals were not darted, including three females implanted in 2009 (see VWSA 2016). For the 11 animals that were not darted, VWSA (2016) assumed a 1:1 sex ratio to conclude that five or six of these animals were females, including three reproductively inactive animals (i.e. implanted) and two or three females capable of breeding. The three inactive females will eventually return to reproductive activity during their life span. VWSA (2016) also noted that 13 females implanted in 2009 and darted in 2016 had not returned to reproductive condition in March 2016, providing confidence in the approach used in 2009 and 2016.

Based on the results outlined above, a life expectancy in the wild of about 15 years, and the fact that seven recently implanted females were over seven years of age and therefore unlikely to return to reproductive activity within their life span, VWSA (2016) concluded that the population should remain relatively stable for the next decade with natural mortality balancing recruitment.

8.11 Recreational Activities – Human Disturbance to Native Wildlife

Recreational activities pose a potential disturbance threat to waterbirds at Edithvale-Seaford Wetlands Ramsar site. Recreational activities undertaken on and adjoining the site include dog walking on- and off-leash, walking, jogging and trail-bike riding. Although Melbourne Water has a dogs-on-leash policy at the wetlands, this is not always obeyed by reserve users.

There is a substantial body of literature on the effects of noise and visual disturbance to waterbirds from human recreational activities and the potential implications of disturbance (e.g. Dowling and Weston 1999; Paton et al. 2000; Weston 2003; Weston and Elgar 2005 and 2007; Antos et al. 2007; Maguire 2008; DSE 2011; Glover et al. 2011, Weston et al. 2012, Taylor 2006; Weston et al. 2009 and 2012; McLeod et al. 2013; Martin 2015). Recreational disturbance has been identified as a significant risk and management issue at a number of coastal Ramsar sites, including at Cheetham Wetlands [part of the Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar Site), Western Port Ramsar Site and Edithvale-Seaford Ramsar Site (DNRE 2002; Antos et al. 2007; KBR 2009; DSE 2011). The consequences include:

- increased energy expenditure when roosting or foraging birds are forced to fly for varying periods or distances until the disturbance has ceased. Increased movement and decreased foraging time is particularly important for migratory shorebirds which need to gain weight prior to long-distance return flights to their breeding grounds;
- Increased risks of mortality to young of breeding birds due to distraction of breeding adults from protecting nests, eggs and chicks from predators and weather (e.g. heat and cold). Decreased breeding success can result from decreased parental attention to young;
- Disturbance of roosting and foraging birds can result in reductions in breeding success and survival of adults, young and hatchlings having cumulative effects on the population;
- Avoidance of important foraging habitats resulting in a reduction in the area of available foraging habitat for waterbirds;
- Increased levels of competition between birds and mortality associated with a reduction in the area of available foraging habitat if there is a lack of other foraging habitat nearby;
- Sensitive species may be driven out of an area totally.

Of particular relevance is the study of Antos et al. (2007) who investigated the issue of disturbance to shorebirds in relation to urban development and the adjacent Cheetham Wetlands in the south-west of Melbourne. Their study focussed on unauthorised human use, including dogs-off-leash, and concluded that 'buffer creep' was a significant issue for these significant wetlands, with shorebirds effectively avoiding areas of the perimeter of wetlands where human access and associated disturbance occurred, resulting in a significant reduction in the area of available foraging habitat.

Melbourne Water is receiving an increasing number of applications for group active recreation, including running events and other activities, potentially resulting in an increased level of disturbance to waterbirds, including migratory shorebirds.

At Seaford Wetland, Frankston City Council restricts the scale and frequency of public events to minimise disturbance impacts on migratory shorebirds.

Clearly, any event application to Melbourne Water or Council would need to consider the timing of the event in relation to ecological values (e.g. in relation to the period of visitation of migratory shorebirds at Edithvale-Seaford Wetlands or in relation to the period of breeding waterbirds at the wetlands), the location of the event in relation to the ecological values, the number of people involved and level of disturbance, the duration of the event and disturbance factor, and means of reducing or minimising the event and intensity of disturbance.

At Edithvale-Seaford Wetlands, Melbourne Water has intentionally retained stands of Tall Marsh around wetlands, such as along both sides of Edithvale Road and between areas of open space and wetlands, which effectively offer some protection/buffers from busy roads and other recreational activities.

Installation of signage regarding dogs needing to be on-leash inside the Ramsar site and information programs via leaflets forwarded in the mail to residents adjoining the wetlands, should help enforce the dogs-on-leash policy.

There is scope for track, fence and revegetation works to direct users around, rather than through core conservation areas (see Sections 9.5.8 and 9.5.9).

8.12 Climate Change

Melbourne Water have recently requested Jacobs to provided site specific scenarios for Edithvale and Seaford as part of a state-wide assessment of climate change impacts to coastal wetlands (DELWP 2015).

These assessments are based on CSIRO / BOM (2015) modelling of moderate (RCP 4.5) and worse case (RCP 8.5) responses to climate change. Under both scenarios Edithvale and Seaford are highly exposed to the key components including:

- increased eustatic sea level;
- increased storm surge activity;
- higher temperatures;
- lower average rainfall;
- changes in seasonal rainfall with strong declines in winter and spring; and
- overall, more variable rainfall.

Sea level rise modelling shows increasing levels of inundation over the course of this century, with almost total inundation of both wetlands by 2100 (DELWP 2015). Melbourne Water's current thinking is that some mitigation of sea level rise should be possible at Edithvale, but the numerous connections via Kananook Creek and Eel Race Creek would make this very difficult at Seaford.

These assessments suggest that the impact of climate change is the pre-eminent issue for these wetlands. While this current plan has only a seven year timeframe, important decisions are required within this period as to how to manage the transition to increasingly saline conditions. The DELWP (2015) report confirms that the adaptive capacity of these systems is low, so key questions appear to relate to the cost-benefit of mitigation, opposed for example to facilitating or managing change.

8.13 Fire and Fuel Management

Inappropriate fire regimes are a potential threat to local flora and fauna, the underlying peat layer of Seaford Wetlands, cultural heritage sites, Melbourne Water infrastructure, local residents, visitors to the reserve and adjoining residential and commercial assets (KBR 2009; Terramatrix 2013a). Furthermore, significant areas of fuel occur in the reserve, including high grass cover and the extensive stands of

Common Reed *Phragmites australis* which form the dominant EVC at the site, Tall Marsh EVC (Terramatrix 2013a). The most significant fire that occurred in Seaford Wetlands was an unplanned fire in January 2004 that burnt c. 5 ha and ignited the underlying peat layer and could not be extinguished for six months (Terramatrix 2013a).

Current ground-based suppression methods used to extinguish peat fires are highly invasive and likely to penetrate the underlying peat layer and expose acid sulphate soils (Terramatrix 2013a).

Fire management and planning and prevention at Seaford Wetlands are the responsibility of both Melbourne Water and Frankston City Council and is directed by the *Country Fire Authority Act 1958* and a number of documents, including the Carrum Lowlands Fire Protection Plan (Melbourne Water 2007), the Frankston City Council Bushfire Management Strategy (Terramatrix 2013b) and Seaford Wetlands Fire Management Plan (Terramatrix 2013a).

Terramatrix (2013a) found that the existing extent of fuel management works around the perimeter of the reserve was generally of sufficient width to provide the necessary separation distance between housing and/or other assets and flammable vegetation within the reserve. They advised that additional fire protection measures should be undertaken at four key areas at Seaford Wetlands to protect assets such as dwellings. This includes managing these areas as 'Asset Protection Zones' that low fuel loads by ensuring:

- Grass will be no more than 50 mm in height;
- Trees must not over-hang or touch dwellings or assets;
- Shrubs under trees must be separated by at least 1.5 times their mature height;
- Tree canopy separation of at least 2 m; tree canopy cover of no more than 15%; and
- Tree branches pruned to a height of 2 m above ground level.

These recommendations do not pose a significant risk to the ecological values present on-site. However, the associated vegetation removal may require offsetting under Victoria's Native Vegetation Permitted Clearing Regulations. A number of fire protection exemptions may apply under the applicable Environmental Significance Overlay's and under Clause 52.48 of the *Planning and Environment Act 1987*. All fire suppression works are to be undertaken in accordance with *Victorian Best Practice Guidelines for Assessing and Managing Coastal Acid Sulfate Soils* (DSE 2010).

9 Management

This section provides a summary of the management undertaken at the wetlands since the production of the previous Management Plan and the management actions required to maintain or enhance biodiversity values within Edithvale – Seaford Wetlands.

The works undertaken by Melbourne Water at the Edithvale-Seaford Wetlands Ramsar site since the preparation of the last Management Plan (KBR 2009) are provided in Appendix 9. These are summarised as follows:

- The key difference to the last Management Plan with respect to works undertaken to enhancing/maintaining the Ramsar ecological values is the extensive grooming of Tall Marsh to provide more open areas of mudflat for waders, and associated works (e.g. Tall Marsh mapping and vegetation quadrat monitoring, e.g. Greet 2015; Greet and Rees 2015).
- Significant work has also been undertaken on the hydrology of the wetlands, including identification of the optimal flow regimes for the different wetland cells and capital works required to enhance/maintain habitat for waterbirds, and associated upgrades to infrastructure have been undertaken to deliver the water requirements (SKM 2011).
- Groundwater monitoring has been undertaken since 2014 (Figures 14 and 15; GHD 2014).
- Water level gauges have been monitored on a monthly basis.
- Water quality monitoring commenced at Edithvale Wetlands in 2009 (Figures 14 and 15).
- In relation to community education and recreation, the Edithvale Education Centre was constructed at Edithvale South Wetlands in 2011, and the Edithvale South Bird Hide which is now open (as at August 2016) (Paul Rees, Melbourne Water, pers. comm.).
- Monthly bird surveys have continued to be undertaken by BirdLife Australia.
- Weed control is an on-going monthly commitment.
- To assist with predator control at Edithvale North wetlands, a predator-proof fence that is buried 300 mm into the ground was installed.

With regard to this Management Plan, additional items that have been recommended include managing impacts from visitors and their dogs and revegetation. The following management recommendations build upon those detailed in previous reports for the reserve (e.g. TBLD and Australian Ecosystems 2005; KBR 2009; Australian Ecosystems 2011a, b, 2016, Terramatrix 2013, GHD 2006, 2015, SKM 2011, BirdLife Australia 2015 and 2016a) that were reviewed during field inspections.

These issues are to be addressed in a way that will avoid or minimise the risk of triggering sulfuric acid release from the potential acid sulfate soils.

Given that the site is a Ramsar-listed wetland of international significance, protection and enhancement of habitat for a suite of waterbirds is a primary focus of the management actions recommended. Potentially disruptive works (e.g. grooming of Common Reed) are generally undertaken between March and August when many of the migratory shorebird species are absent and the wetlands are driest (allowing easier access). Only maintenance and sampling (e.g. water quality) are undertaken outside of this.

9.1 Management Categories

Management actions are divided amongst Program Maintenance, Capital/Grants Programs and Monitoring and Assessment:

Program Maintenance

- Management actions that will be undertaken on a regular basis and will be implemented by Melbourne Water at Edithvale Wetlands and Melbourne Water and/or Frankston City Council at Seaford Wetland.

Capital/Grants Programs

- Management actions that will involve a large one-off investment of funds or grants.

Monitoring and Assessment

- Biodiversity monitoring and assessment works that are required in accordance with the Ramsar and SoBS Plan, and will be coordinated by a biodiversity specialist from Melbourne Water.

Investigation

- One-off investigations to determine the most appropriate management action(s).

Each management action recommended has been assigned to one of these categories.

9.2 Management Zones and Objectives

Edithvale Wetlands has been divided into three Management Zones, while Seaford Wetlands comprises five. The delineation of Management Zones reflects the differing values, threats and associated management prescriptions required across the reserves. They are mapped in Figure 14 and 15 and described in Tables 9 and 10 along with an outline of the management objectives.

Table 9 Management zones and objectives for Edithvale Wetlands.

Management Zone (MZ)	Management Objective
MZ 1 (wetland vegetation where Common Reed *Phragmites australis* should not increase in cover) Management Zone 1 covers the wetland vegetation generally in the lower depressions and constructed wetlands. Major threats include overabundance of Common Reed reducing flora and fauna diversity, weeds and potential acid sulfate soils.	• Grooming and maintaining the current hydrology regime to suppress Common Reed growth • Control high-priority weed species to maintain biodiversity values • Control foxes and other pest animals, including those that may be using nest boxes
MZ 2 (higher drier Common Reed dominated Tall Marsh) Elevated in the slightly higher and drier areas of Common Reed dominated Tall Marsh vegetation is Management Zone 2. Common Reed dominates these areas with very few other indigenous plant species occurring, but provides crake, rail and bittern habitat. Threats include overabundance of Common Reed reducing flora and fauna diversity, weeds, pet dogs and other pest animals, potential acid sulfate soils and dumping of hard-rubbish.	• Rotational grooming of Common Reed to promote regrowth that provides more suitable for crakes, rails and bitterns. • Control high-priority weed species to maintain biodiversity values • Control foxes and other pest animals, including those that may be using nest boxes
MZ 3 (scrub, woodland and lawn areas) Management Zone 3 includes the Swamp Scrub, Damp Sands Herb-rich Woodland and exotic lawn that generally surround the perimeter of the wetlands. For the most part, the understorey of these areas comprises slashed exotic grasses, with a few pockets that comprise indigenous groundstorey species or have been revegetated. Some serious weed species occur in these areas either as naturalised or planted individuals (e.g. Swamp Oak *Casuarina cunninghamiana*, Giant Honey-myrtle *Melaleuca armillaris*; see Appendix 10 for mapping).	• Control high-priority weed species to maintain biodiversity values • Revegetation and supplementary plantings to increase floristic and habitat diversity • Control foxes and other pest animals, including those that may be using nest boxes

Table 10 Management zones and objectives for Seaford Wetlands.

Management Zone (MZ)	Management Objective
MZ 1 (wetland vegetation where Common Reed *Phragmites australis* should not increase in cover) The lower elevation wetlands that generally are not or previously were not dominated by Common Reed comprise Management Zone 1. Encroachment by Common Reed is the predominant threat to flora and fauna habitat values. Other threats include pest plants and animals (particularly foxes).	• Grooming and maintaining the current hydrology regime to suppress Common Reed growth • Control high-priority weed species to maintain biodiversity values • Control foxes and other pest animals, including those that may be using nest boxes
MZ 2 (Common Reed dominated Tall Marsh) Management Zone 2 includes the slightly more elevated and hence drier areas dominated by Common Reed. Common Reed dominates these areas with very few other indigenous plant species occurring and for the most part provides less suitable fauna habitat values. Threats include overabundance of Common Reed reducing flora and fauna diversity, weeds, pest animals, and potential acid sulfate soils.	• Rotational grooming of Common Reed to promote regrowth that provides more suitable for crakes, rails and bitterns. • Control high-priority weed species to maintain biodiversity values • Control foxes and other pest animals, including those that may be using nest boxes
MZ 3 (Woodland and scrub vegetation) Management Zone 3 comprises the remnant and revegetated Damp Sands Herb-rich Woodland and Swamp Scrub vegetation to the north and east of the site. Major threats include weed invasion and pest animals.	• Control high-priority weed species to maintain biodiversity values • Control foxes and other pest animals, including those that may be using nest boxes • Undertaken revegetation to supplement diversity and rehabilitate disturbed areas after pest plant and animal control
MZ 4 (Non-remnant areas to be slashed and/or revegetated) These areas primarily consist of non-remnant vegetation with scattered indigenous plantings that are recommended for revegetation to provide additional habitat structure and buffer.	• Control high-priority weed species to maintain biodiversity values • Undertake revegetation to provide additional habitat structure and diversity
MZ 5 (adjoining Council owned property outside the Ramsar Boundary) The Council owned Down's Estate (to the north east of the study area) primarily comprises wetland vegetation and pasture. It is recommended that this block be incorporated into the Ramsar Site.	• Incorporate Management Zone 5 into the Seaford section of the Edithvale-Seaford Wetlands Ramsar site • If successfully incorporated, prepare a management plan to improve the quality of the vegetation and habitat values

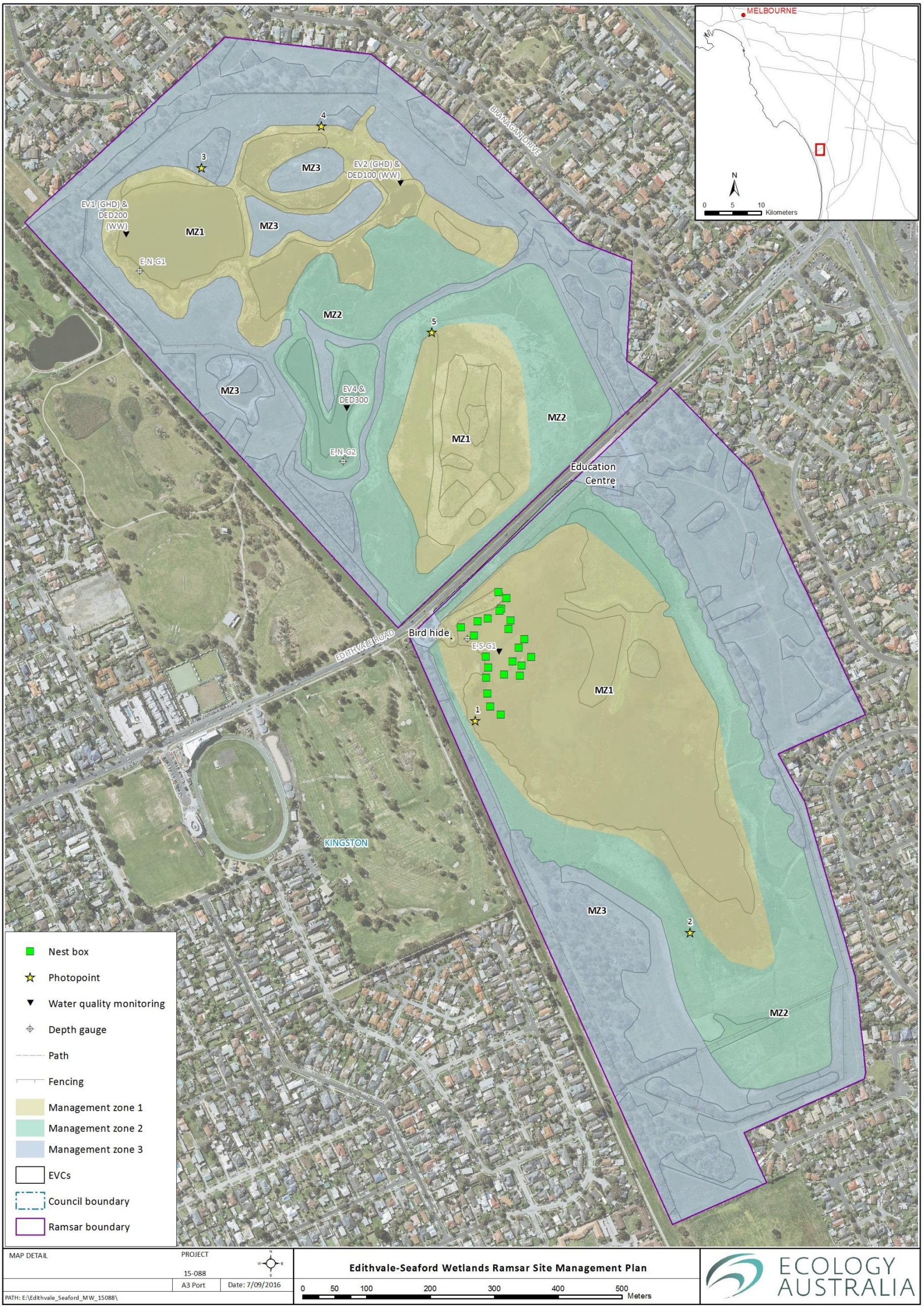


Figure 14The location of management zones and key monitoring features at Edithvale Wetlands. Refer to Figure 5 for detail of Ecological Vegetation Class (EVC) mapping.

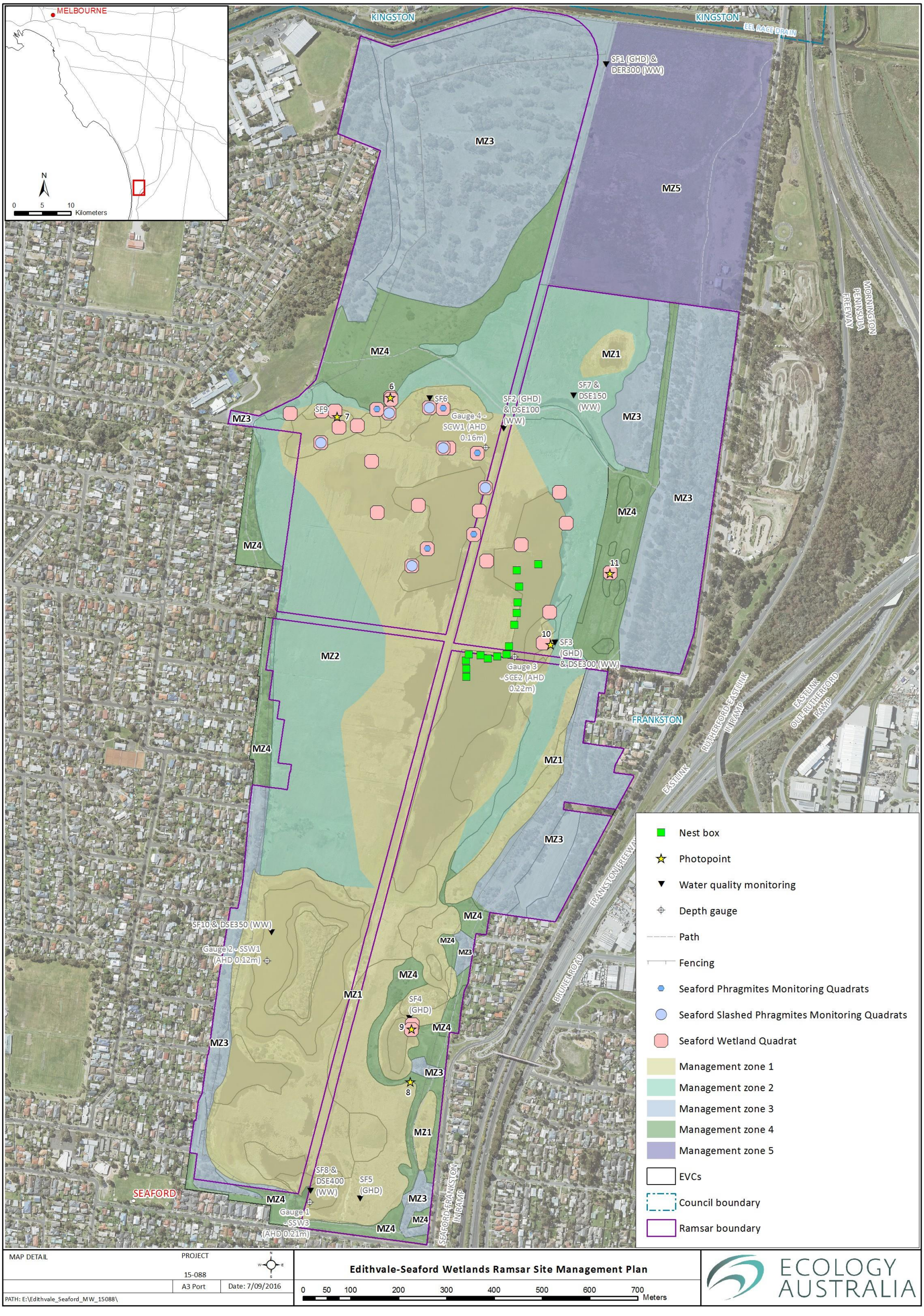


Figure 15The location of management zones and key monitoring features at Seaford Wetlands. Refer to Figure 6 for detail of Ecological Vegetation Class (EVC) mapping.

9.3 Management Priorities

Priority levels have been assigned to each management action, based on Melbourne Water's (2013b) *Waterways Sites of Biodiversity Significance Strategy – 2013*.

Priority 1 (legislative obligations)

- Actions that are a legal obligation under the *Environment Protection and Biodiversity Conservation Act 1999* (this includes Ramsar obligations), the *Flora and Fauna Guarantee Act 1988* or *Catchment and Land Protection Act 1994*;
- Actions to control threats to the Ecological Character of the Ramsar-listed wetlands and are therefore required actions to avoid breeches under the EPBC Act.
- It is expected that funding will be available to achieve all of these actions.

Priority 2 (best practice management)

- Actions that are not a legal obligation but would be considered best practice management, including:
    - the protection and enhancement of habitat for threatened species
    - actions that are relatively easy to achieve as part of ongoing maintenance
    - actions that provide direct benefit to biodiversity values
    - actions that are in line with community's expectation
    - ongoing monitoring of known biodiversity values
- Actions will be undertaken if funding and resources are available after completing all P1 actions.

Priority 3 (other management priorities)

- Actions that are desirable or recommended but with lower priority in the scheme of management actions to be implemented; these may indirectly benefit flora and fauna, such as signage and trail/track maintenance.
- Actions will be implemented if funding and resources are available after completing all P1 and P2 actions.

By prioritising management actions, Melbourne Water and Frankston City Council will be better informed regarding how to incorporate these management actions into Program Maintenance and Capital Works Programs depending on the level of available funding and resources. Consideration has been given to Melbourne Water and Frankston City Council's responsibilities under legislation as well as the site-specific type and level of threat to biodiversity values.

This management plan has been prepared with consideration of the hydrological and floodplain function of the wetland sites. Care has been taken to ensure that the management actions recommended in this plan do not conflict with the hydrological and/or flood capacity function of the site.

Table 11 lists the management actions to be undertaken to protect and enhance the ecological values of Edithvale-SeafordWetlands. These actions relate to Ramsar and SoBS obligations. Table 12 summarises the estimated costs to undertake the recommended management actions.

Table 11 Management actions to protect and enhance the ecological values of Edithvale-Seaford Wetlands. CPS = critical components, processes and services are highlighted in bold type.

Key:

MZ	Management Zone	EPBC	*Environment Protection and Biodiversity Conservation Act 1999*	MW	Melbourne Water	KCC	Kingston City Council
		CaLP	*Catchment and Land Protection Act 1994*	FCC	Frankston City Council		

Action	Legislation applicable	Management Zone	Risk (based on risk assessment)	Values/CPS	Management Category	Target	Edithvale Wetlands Estimated cost	Seaford Wetlands Estimated cost	Management Responsibility (Seaford)	Timing
Priority 1 – Legislative Obligations										
Where possible, grooming of Common Reed to maintain Ecological Character	*EPBC Act 1999*	Edith: MZ 1, 2 Seaf: MZ 1, 2	High	**Waterbird diversity and abundance; physical habitat for waterbirds; and threatened waterbird species.** Flora and vegetation communities.	Program maintenance	Edithvale: MZ 1 groomed annually (c. 33 ha); MZ 2 groomed in a rotational pattern with return frequency determined based on fauna habitat utilisation monitoring (c. 5 ha per year if on five year rotation) Seaford: MZ 1 groomed every two (to five) years depending on access due to seasonal conditions that may prevent slashing for one or more years (c. 61 ha); MZ 2 groomed in a rotational pattern with return frequency determined based on fauna habitat utilisation monitoring (c. 8 ha per year if on five year rotation)	$114,000 per year ($3,000 per hectare)	$115,500 per year ($3,000 per hectare)	MW	Autumn, after Common Reed has flowered, but before seed set.
Conduct a machinery trial for options to cut Common Reed at Seaford Wetland where soft sediments are restricting grooming machinery	*EPBC Act 1999*	Seaf: MZ 1	High	**Waterbird diversity and abundance; physical habitat for waterbirds; and threatened waterbird species.** Flora and vegetation communities.	Investigation	Trial of machinery options completed by Year 3 to determine if alternative mechanically grooming options are viable. This is to occur in conjunction with the above grooming regime and is expected to involve trialing various machinery to cut the Common Reed in locations with soft sediments	NA	$12,000 one-off cost (over three years) Includes additional investigation and hire costs beyond the grooming regime above.	MW	Autumn, after Common Reed has flowered, but before seed set.
Monitor Common Reed management program performance to maintain Ecological Character	*EPBC Act 1999*	Edith: MZ 1, 2 Seaf: MZ 1, 2	-	**Waterbird diversity and abundance; physical habitat for waterbirds; and threatened waterbird species.** Flora and vegetation communities.	Monitoring and assessment	**Flora:** Quadrats established/assessed in Year 1, and reassessed annually **Fauna:** Waterbird abundance, diversity and visitation rates assessed across grooming regimes three times per year by year 3	**Flora**: $9,000 per year **Fauna**: $8,000 per year	**Flora**: $9,000 per year **Fauna**: $8,000 per year	MW	**Flora**: Mar/Apr **Fauna**: Sep–Dec
Where possible, maintain current hydrological regime in wetlands to maintain Ecological Character	*EPBC Act 1999*	Edith: MZ 1, 2 Seaf: MZ 1, 2	Medium	**Waterbird diversity and abundance; waterbird breeding; physical habitat for waterbirds; and threatened waterbird species.** Flora and vegetation communities.	Program maintenance	Where possible, wetlands inundated in winter and early spring, with gradual drawdown to the end of December (noting that this is largely driven by rainfall and evaporation with Melbourne Water able to input minimal influence). Ephemeral areas ideally dry between January and April while deeper pools remain inundated year round.	Running costs to be determined	Running costs to be determined	MW	All year

Action	Legislation applicable	Management Zone	Risk (based on risk assessment)	Values/CPS	Management Category	Target	Edithvale Wetlands Estimated cost	Seaford Wetlands Estimated cost	Management Responsibility (Seaford)	Timing
Undertake a cost-benefit analysis of management option associated with climate change to: - prolong the system as a freshwater to brackish environment; and - manage and facilitate the inevitable change of the system to a more saline environment.	*EPBC Act 1999*	Edith: MZ 1, 2 Seaf: MZ 1, 2	Extreme	**Waterbird diversity and abundance; waterbird breeding; physical habitat for waterbirds; and threatened waterbird species.** Flora and vegetation communities.	Investigation	Build upon the Jacobs (2016b) impacts of climate change assessment to develop a cost-benefit analysis, completed by Year 6 with recommendations incorporated into the revised Ramsar management plan in Year 7.	$10,000 for one-off assessment	$10,000 for one-off assessment	MW	Any time
Monitor abiotic and biotic changes associated with climate change: - Salinity and water quality - Groundwater and surface water level - Bird surveys - Floristic surveys	*EPBC Act 1999*	Edith: MZ 1, 2 Seaf: MZ 1, 2	-	**Waterbird diversity and abundance; waterbird breeding; physical habitat for waterbirds; and threatened waterbird species.** Flora and vegetation communities.	Monitoring and assessment	Monthly surveys undertaken to document surface water levels, water quality, salinity and bird populations, Quarterly surveys undertaken to record ground water levels, Annual surveys to monitor floristic changes	Abiotic: $12,000 per year Floristic: $6,000 per year (note monthly bird monitoring cost is addressed below)	Abiotic: $12,000 per year Floristic: $6,000 per year (note monthly bird monitoring cost is addressed below)	MW	All year
Manage CaLP listed "Regionally Controlled" weeds (Tables 13 and 14), particularly *Spiny Rush	*CaLP Act 1994*	All	High	**Waterbird diversity and abundance; physical habitat for waterbirds; and threatened waterbird species.** Flora and vegetation communities	Program maintenance	Targets (eliminate, control, contain) as specified in Tables 13 and 14	$24,000 per year	$24,000 per year	MW and FCC	All year, 12 visits/yr
Control foxes with soft-jaw traps, maintaining fencing and destroying dens and other harbour (if present)	*CaLP Act 1994*	All	Extreme	**Waterbird diversity and abundance; and threatened waterbird species.** Small mammals, frogs and reptiles.	Program maintenance	Soft-jaw traps checked daily for two weeks between April and May, and data on trap success rates collected and submitted to Melbourne Water Maintain predator-proof fence at Edithvale Wetlands No active warrens/harbour, new dens/harbour fumigated and destroyed within 3 months	$4,000 per year $2,000–$4,000 per year $0–$3,000 per year	$4,000 per year NA $0–$3,000 per year	MW and FCC	April-May All year
Control rabbits and hares by destroying warrens and other harbour (if present)	*CaLP Act 1994*	All	Medium	Flora and vegetation communities.	Program maintenance	No active warrens/harbour, new warrens/harbour fumigated and destroyed within 3 months	$0–$3,000 per year	$5,000–$10,000 per year (more for the first three years)	MW and FCC	Sep
Undertake mosquito monitoring and control (if necessary)	*Health (Infectious Diseases) Regulations 2001 and Public Health and Wellbeing Regulations 2009*	Seaf: MZ1	-	Human health.	Program maintenance	Monthly dip needing for larvae and CO_2 light trapping undertaken in spring and summer (Sept-March/April) If monitoring data indicate that larvae are in high abundance, control with ProLink Briquettes will be undertaken	NA	$8,000 per year	MW	Sept-Feb

Action	Legislation applicable	Management Zone	Risk (based on risk assessment)	Values/CPS	Management Category	Target	Edithvale Wetlands Estimated cost	Seaford Wetlands Estimated cost	Management Responsibility (Seaford)	Timing
Monthly monitoring of bird populations and water level to detect limits of acceptable change to maintain Ecological Character	*EPBC Act 1999*	All	-	**Waterbird diversity and abundance; waterbird breeding; physical habitat for waterbirds; and threatened waterbird species.**	Monitoring and assessment	Bird surveys and monitoring of water levels undertaken monthly and annual reporting to Melbourne Water	$15,000 per year (this is an existing program)	$15,000 per year (this is an existing program)	MW	All year
Potential Acid Sulfate Soil Management	*EPBC Act 1999, CaLP Act 1994, Environmental Protection Act 1970, Coastal Management Act 1995, Planning and Environment Act 1986 and Crown Land (Reserves) Act 1978*	All, especially Seaford	Medium	**Waterbird diversity and abundance; physical habitat for waterbirds; and threatened waterbird species.** Flora and vegetation communities.	Program maintenance	Ensure an Acid Sulfate Management Plan is prepared prior to any excavation works	$6,000 per one-off assessment	$6,000 per one-off assessment	MW	Any time
Implement fire management recommendations provided by Terramatrix (2013)	*Country Fire Authority Act 1958*	Edith: MZ3 Seaf: MZ3, 4	High	Flora and vegetation communities.	Program maintenance	Vegetation within the recommended Asset Protection Zones and Bushfire Moderation Zone managed accordingly from Year 1.	NA	$8,000 per year	MW and FCC	All year
Priority 2 – Best Practice Management										
Incorporate "Downs Estate" into the Ramsar boundary	-	Seaf: MZ 5	-	**Physical habitat for waterbirds;**	Capital/Grants Program	Down's Estate incorporated into Ramsar site by Year 2	NA	$5,000 per one-off investigation	MW and FCC	Any time
Manage high threat weeds (Tables 13 and 14)	-	All	High	Flora and vegetation communities.	Program maintenance	Targets (eliminate, control, contain) as specified in Tables 13 and 14	$8,000 per year	$12,000 per year	MW and FCC	All year, 4-6 visits/yr
Maintain current dog access restrictions (i.e. no dogs in wetlands, on-leash in buffers), install interpretative signage to educate the public of dog and cat impacts	-	All	-	**Waterbird diversity and abundance; waterbird breeding; and threatened waterbird species.**	Capital/Grants program	Signage installed by Year 2. These can be in the form of regulatory and educational interpretative signage.	$5,000–$10,000 for signage/letter drop	$5,000–$10,000 for one-off signage/letter drop	MW, KCC and FCC	Any time
Distribute letters to landholders in the local area regarding cat and dog impacts	-	All	Extreme	**Waterbird diversity and abundance; waterbird breeding; and threatened waterbird species.** Small mammals, frogs and reptiles.	Program maintenance	Letter distributed in Years 2, 5 and 8 to all registered cat and dog owners within 500 m of either wetland.	$5,000 per year	$6,000 per year	MW, KCC and FCC	All year
If incursions occurs in future, undertake pig trapping to remove released pigs (as had occurred at Seaford Wetland)	-	Seaford: All	Medium	Flora and vegetation communities	Program maintenance	Pig(s) removed within 6 months of confirming occurrence	NA	NA	MW and FCC	All year
Check nest boxes, document occupants and remove Common Myna nests and bee hives	-	All	-	**Waterbird breeding.**	Program maintenance	All nest boxes check and cleaned in May each year. Occupancy of nest boxes recorded and submitted to Melbourne Water.	$1,600 per year	$1,600 per year	MW and FCC	May

Action	Legislation applicable	Management Zone	Risk (based on risk assessment)	Values/CPS	Management Category	Target	Edithvale Wetlands Estimated cost	Seaford Wetlands Estimated cost	Management Responsibility (Seaford)	Timing
Revegetation of areas disturbed by management works (e.g. weed control, den destruction)	-	All	-	Flora and vegetation communities	Program maintenance	Bare ground revegetated within two months; all plant losses replaced with 90% survival to year 7; all guards removed once plants are established (c. 1-3 years depending on species and health of plant). To be undertaken in accordance with the species lists provided in Appendix 12 and the revegetation prescriptions prepared by TBLA and Australian Ecosystems (2005; Appendix 13)	Guarded: $11/ plant Unguarded: $3/plant Maintenance: $2/plant	Guarded: $11/ plant Unguarded: $3/plant Maintenance: $2/plant	MW and FCC	Ideally May-Oct
Consolidate Frankston City Council and Melbourne Water boundaries at Seaford Wetland (as per Section 2.5)	-	Seaf: All	-	**Waterbird diversity and abundance; waterbird breeding; physical habitat for waterbirds; and threatened waterbird species.** Flora and vegetation communities.	Capital/Grants program	Divide Seaford Wetland manager boundaries so that Melbourne Water manages all wetland areas and Frankston City Council manages all the exterior areas.	NA	$5,000 for one-off investigation	MW and FCC	Anytime
At Seaford Wetland, investigate feasibility of extending the path through Downs Estate and along the northern boundary to create a complete loop track	-	Seaf: MZ 3, 5	-	**Waterbird diversity and abundance; waterbird breeding; physical habitat for waterbirds; and threatened waterbird species.** Flora and vegetation communities.	Investigation	Investigation undertaken by year 1, and findings implemented by year 2	NA	$4,000 for one off assessment	MW and FCC	Anytime
Maintain fencing around the wetlands	-	Edith: MZ3 Seaf: MZ2, 3, 4, 5	-	**Waterbird diversity and abundance; waterbird breeding; physical habitat for waterbirds; and threatened waterbird species.** Flora and vegetation communities.	Program maintenance	Undertake fence checks twice per year and repair breaches.	$1,000 per year (plus repairs)	$1,000 per year (plus repairs)	MW and FCC	Anytime
Consider the potential need for fencing or seasonal closure of the internal path at Seaford Wetland, and fencing at Down's Estate if included in the Ramsar site (see proposed fencing on Figure 4).	-	Seaf: MZ 1, 2, 5	-	**Waterbird diversity and abundance; waterbird breeding; physical habitat for waterbirds; and threatened waterbird species.** Flora and vegetation communities.	Investigation	Investigation undertaken by year 2, and findings completed by year 4.	NA	$3,000 for one-off investigation	MW and FCC	Anytime
Photo-point monitoring	-	All	-	Flora and vegetation communities	Program maintenance	Monitoring of photo-points undertaken every year	$1,000 per year	$1,000 per year	MW	In line with previous monitoring (October and March)
Native vegetation condition monitoring	-	All	-	Flora and vegetation communities	Monitoring and assessment	Habitat Hectare Assessment or other suitable monitoring approach collected at Year 5	$9,000 for one-off assessment	$9,000 for one-off assessment	MW	Sep–Dec
Monitor pest plant control performance	-	All	-	Flora and vegetation communities	Program maintenance	Distribution and cover of weeds of management concern assessed each year	$2,000 per year	$2,000 per year	MW and FCC	Sep–Nov

Action	Legislation applicable	Management Zone	Risk (based on risk assessment)	Values/CPS	Management Category	Target	Edithvale Wetlands Estimated cost	Seaford Wetlands Estimated cost	Management Responsibility (Seaford)	Timing
Monitor pest animal (rabbit/hare/fox) control performance	-	All	-	**Waterbird diversity and abundance; and threatened waterbird species.** Flora and vegetation communities	Program maintenance	Inspection for warrens / dens at least once per year (if active warrens found undertake more frequent inspections) BirdLife Australia to continue to record foxes and cats observed during monthly bird surveys	$1,000 per year (more if active warrens found)	$1,000 per year (more if active warrens found)	MW and FCC	Sep–Oct
Monitor Eastern Grey Kangaroo population	*Wildlife Act 1975 and Wildlife Regulations 2002*	Edith (south): MZ 1–3	Low-medium	Flora and vegetation communities	Program maintenance	Undertake annual monitoring of the Eastern Grey Kangaroo population using the sweep count procedure to ensure population is maintained between 16-27 kangaroos (see EcoPlan Australia 2015)	$5,000 per year	NA	MW	March-April
Priority 3 – Other Management Priorities										
Manage medium threat weeds (Tables 13 and 14)	-	All	High-Medium	Flora and vegetation communities	Program maintenance	Targets (eliminate, control, contain) as specified in Tables 13 and 14	$8,000 per year	$8,000 per year	MW and FCC	All year, 4 visits/yr
Investigate potential for using fire as a management tool at Seaford Wetlands for #Coast Tea-tree control in MZ3.	-	Seaf: MZ 1–3	High	Flora and vegetation communities	Program maintenance	Feasibility of using fire as a management tool at Seaford for #Coast Tea-tree investigated by Year 3 and implemented accordingly.	NA	$5,000 for one-off investigation	MW and FCC	Any time
Revegetation and supplementary plantings in Damp Sands Herb-rich Woodland and Swamp Scrub vegetation	-	Edith: MZ3 Seaf: MZ 3, 4	-	Flora and vegetation communities	Capital/Grants program	- Clustered plantings of shrubby and robust ground layer species in the Damp Sands Herb-rich Woodland vegetation with primarily mown lawn understorey - Supplementary and expansion plantings of Swamp Scrub - Revegetation of non-remnant areas opposite Seaford North Primary School - All plant losses replaced with 90% survival to year 7; all guards removed once plants are established (c. 1-3 years depending on species and health of plant). - To be undertaken in accordance with the species lists provided in Appendix 12 and the revegetation prescriptions prepared by TBLA and Australian Ecosystems (2005; Appendix 13)	Guarded: $11/ plant Unguarded: $3/plant Maintenance: $2/plant	Guarded: $11/ plant Unguarded: $3/plant Maintenance: $2/plant	FCC	May-Oct
User related issues: rehabilitate unauthorised tracks and disturbances	-	All	-	Flora and vegetation communities	Program maintenance	Negligible unauthorised tracks or disturbances by year 2, new disturbances rehabilitated within 2 months of identification	$1,000–$5,000 per incursion (depends on extent of damage)	$1,000–$5,000 per incursion (depends on extent of damage)	MW and FCC	All year
User related issues: undertake general litter collection and clear litter traps	-	All	Medium	**Physical habitat for waterbirds.** Flora and vegetation communities	Program maintenance	Negligible litter observed onsite and in litter traps	$6,000–$8000 per year	$6,000–$8000 per year	MW and FCC	All year
Mapping and monitoring of significant flora species (Appendix 2)	-	All	-	Flora and vegetation communities	Monitoring and assessment	Distribution and population size mapped and compared in Year 5	$7,000 for one-off assessment	$7,000 for one-off assessment	MW and FCC	Oct–Nov
Targeted surveys for reptiles (Swamp Skink)	-	Edith: MZ 1, 2 Seaf: MZ 1, 2	-	Reptiles.	Monitoring and assessment	One targeted survey completed by Year 3	$8,000 per one-off assessment	$8,000 per one-off assessment	MW and FCC	Nov-Mar
Fish survey to document fish species occurrence	-	Edith: MZ 1, 2 Seaf: MZ 1, 2	-	Fish.	Monitoring and assessment	Fish survey completed by Year 4	$6,000 per one-off assessment	$6,000 per one-off assessment	MW and FCC	Dec–May

Action	Legislation applicable	Management Zone	Risk (based on risk assessment)	Values/CPS	Management Category	Target	Edithvale Wetlands Estimated cost	Seaford Wetlands Estimated cost	Management Responsibility (Seaford)	Timing
Invertebrate survey, with the first priority on aquatic invertebrates and the lower priority on terrestrial invertebrates	-	All	-	Invertebrates	Monitoring and assessment	Invertebrate survey undertaken by Year 6	$6,000 per one-off assessment	$6,000 per one-off assessment	MW	Spring

Costs do not consider CPI.

Summary of costs:

Table 12 Summary of estimated costs to undertake priority management actions at each wetland, Edithvale-Seaford Wetlands.

Site	Priority	Estimated costs per year	Estimated costs for one-off assessments
Edithvale Wetland	Priority 1 management actions	$194,000-$202,000 ^	$16,000
	Priority 2 management actions	$29,600-$34,600 ^	$9,000
	Priority 3 management actions	$15,000-$21,000 ^	$27,000
Seaford Wetland	Priority 1 management actions	$214,500-$222,500 ^	$28,000
	Priority 2 management actions	$29,600-$34,600 ^	$26,000
	Priority 3 management actions	$15,000-$21,000 ^	$32,000

^ Does not include revegetation costs of $11 / guarded plant or $3 / unguarded plant, and $2 / plant for maintenance.

9.4 Priority 1 Management Actions (Legislative Obligations)

9.4.1 Grooming of Common Reed (Program Maintenance)

One of the key criteria for assessing the Limits of Acceptable Change (LAC) for the Edithvale-Seaford Wetlands Ramsar Site is the extent of different habitat types; no habitat type should comprise more than 70% of the total wetland area (see Section 5; Table 5).

While Common Reed *Phragmites australis* plays an important role for birds in providing breeding sites and shelter for waterbirds and marshland passerines (e.g. Golden-headed Cisticola *Cisticola exilis*, Little Grassbird *Megalurus gramineus*, Australian Reed-warbler *Acrocephalus australis*), it's tall and dense habit makes it largely impenetrable for wildlife to feed in, and being very invasive, the species can spread rapidly over wetlands at the expense of other aquatic plants and open mudflats.

To enhance the habitat diversity for a range of fauna species (particularly significant waterbird species that may visit the internationally significant wetlands) grooming of Common Reed is recommended. Although Common Reed is more abundant, this grooming should also address Cumbungi *Typha* spp. Overabundance which is comparatively a lesser issue. Opening these dense reed-beds to create a low open wetland and/or mudflats should diversify habitats making them more suitable to a larger variety of birds such as waders and other shorebirds.

An ongoing experiment has been undertaken at Seaford Wetlands by Greet and Rees (2015) to monitor the recovery of Common Reed after grooming. This study showed that the Common Reed can be effectively controlled provided the culms a subsequently flooded to approximately >20 cm for several months particularly during the spring-summer growth period. They also determined that grooming Common Reed culms after flowering but before seed set was important as it prevented recharging of below-ground energy reserves (i.e. rhizomes). This combination of timing and adequate inundation resulted in minimal Common Reed regrowth and an opening up of the wetland vegetation, with anecdotal evidence supporting a "significant increase in waterbirds using the wetland since it filled, most notably in and around the area where the *Phragmites* [Common Reed] has been cut" (Andrew Silcocks, Birdlife Australia, pers. comm.). In addition, the autumn slashing is best time to access the wetlands as they are driest and should minimise impacts on breeding wildlife.

In areas where flooding was inadequate for Common Reed suppression, the recovery was rapid (Greet and Rees 2015). However, it is thought that utilisation of the 'regrowth' Common Reed by crakes, rails and bitterns will increase significantly when compared to the 'old growth' Common Reed which has very low utilisation rates as it is too dense for effective foraging (Paul Rees, Melbourne Water, pers. comm.).

Melbourne Water has been undertaking regular grooming at Edithvale-Seaford Wetlands since autumn 2012. At Edithvale this included the majority of Edithvale Wetlands South excluding a narrow strip around the permitter, and much of the Common Reed at Edithvale Wetlands North (particularly the southern half toward Edithvale Road). At Seaford the grooming was not as extensive, as very soft sediments (even when the wetland was dry) inhibited access for the rubber tracked grooming bobcat.

Further Common Reed grooming is recommended as part of this management plan. The method to undertake Common Reed grooming at Seaford will need to be investigated to overcome boggy conditions – see below. The grooming regime will comprise two scenarios:

1. The wetland areas that are most likely to receive adequate inundation (Management Zone 1) should be groomed on an annual basis at Edithvale and every two (to five) years at Seaford (depending on sediment firmness and machinery access) until Common Reed is adequately supressed, then groomed on an as needs basis thereafter; and
2. The slightly higher and drier areas (Management Zone 2) should be groomed in 1-ha patches' rotating over a number of years to ensure that habitat diversity is maintained across the site.

The optimum return frequency for the grooming regime needs to be determined based on monitoring of fauna utilisation and vegetation recovery, as discussed in Section 9.4.2 below. This will involve monitoring the diversity and abundance of indigenous plant species as well as weeds (ideally ensuring serious weeds do not increase in cover), and monitoring the utilisation of the various regrowth stages by fauna (returning the grooming to areas once the fauna utilisations rates begin to drop). Given that grooming is a costly management action that may also result in an increase in serious weeds, unnecessary grooming should be minimised where possible if the benefits to fauna habitat utilisation and/or indigenous floral diversity are not being demonstrated.

In an attempt to shield avifauna from some human disturbances a 3 m wide buffer of Common Reed should be retained near walking paths where possible. This may not be suitable in areas close to residential dwellings if fire fuel loads pose a risk. In these situations, the breaks should be strategically positioned to line up with other buffers such as trees on the opposite side of the fence.

Trial of Common Reed Grooming Alternatives

Due to soft sediments at Seaford Wetland restricting access for the rubber tracked grooming bobcat, an investigation into and trial of alternative machinery and/or methods is recommended. Soil firmness should be assessed prior to grooming to determine which areas will be accessible to machinery. Other alternatives include:

- Using smaller tracked or legged (e.g. Menzi Muck) machinery;
- Using machinery with a side arm groomer or basket mower for extra reach;
- Manually slashing the Common Reed either on foot or from a boat, or
- Potentially the use of herbicide to control Common Reed.

9.4.2 Monitoring of Common Reed Management Program Performance (Monitoring and Assessment)

The success of the Common Reed grooming regime should be monitored to evaluate the suppression of this species and Cumbungi, and document the change in diversity and abundance of weeds and indigenous flora species. This monitoring should follow the methods used to monitoring the Common Reed grooming program at Seaford Wetlands (Greet and Rees 2015), preferably (though not essentially) with the addition of more sites to extending the survey into Edithvale Wetland.

In summary, this will involve establishing 5 m x 5 m quadrats at random location in areas of mature Common Reed reed-beds. In line with Greet and Rees (2015), these will mostly be located in relatively low-lying areas along the wetter fringes with similar flooding exposure (i.e. Management Zone 1). A second treatment will also be assessed, with quadrats located in the higher drier Common Reed reed-beds (Management Zone 2). Some control quadrats should be left un-groomed for each treatment. The

quadrats should be surveyed in March/April each year with cover scores being recorded to the nearest 5% for the vegetation/habitat types present (EVC, open water, mudflat, etc.) and each species recorded.

The objective to improve habitat diversity, particularly for waders and other birds, should be assessed by monitoring the response of birds (abundance and diversity as well as frequency of visits) to the altered vegetation structures. Monitoring should occur in a) areas with differing densities and age of Common Reed regrowth, including 'old-growth' Common Reed, b) areas groomed annually as well as intermittently, and c) areas transitioning to more open habitats such as mudflats. There are excellent opportunities to collaborate with external organisations or community groups to implement this action (e.g. Birdlife Australia, Friends of Edithvale-Seaford Wetlands, University of Melbourne).

9.4.3 Maintain Current Hydrology Regime (Program Maintenance)

Although the precise relationship between bird abundances and water levels are not understood (e.g. BirdLife Australia 2016a), general agreement exists that the spread of Common Reed is detrimental to waterbird values through loss of open water habitats, especially mudflats that support large numbers of internationally migratory waders. Furthermore, shallow stable water levels during summer facilitate the growth of Common Reed and the objective is to provide as far as possible the appropriate regime which re-introduces a more natural wetting and drying pattern that facilitates the maintenance of a self-sustaining mosaic of vegetation types and controls the spread of emergent vegetation/Tall Marsh. Therefore, the ideal watering regime would be to fill wetlands to capacity during winter and early-spring, and the slowly drawdown the wetlands into summer to continually expose mudflat habitat for foraging waders (Figure 16; SKM 2011). In autumn, the wetlands would be sufficiently dry enabling grooming of Common Reed. Deeper pools would permanently hold water for waterfowl that require deeper, permanent water during the summer months (e.g. ducks). BirdLife Australia should continue to record water levels at wetland cells during the monthly bird monitoring surveys.

The Wadsleys Pump and regulator gates in the centre and at the bottom of the wetlands are the primary options for Melbourne Water to influence water levels. However, these provide a limited capacity as rainfall and evaporation factors are the biggest drivers (Paul Rees, Melbourne Water, pers. comm.).

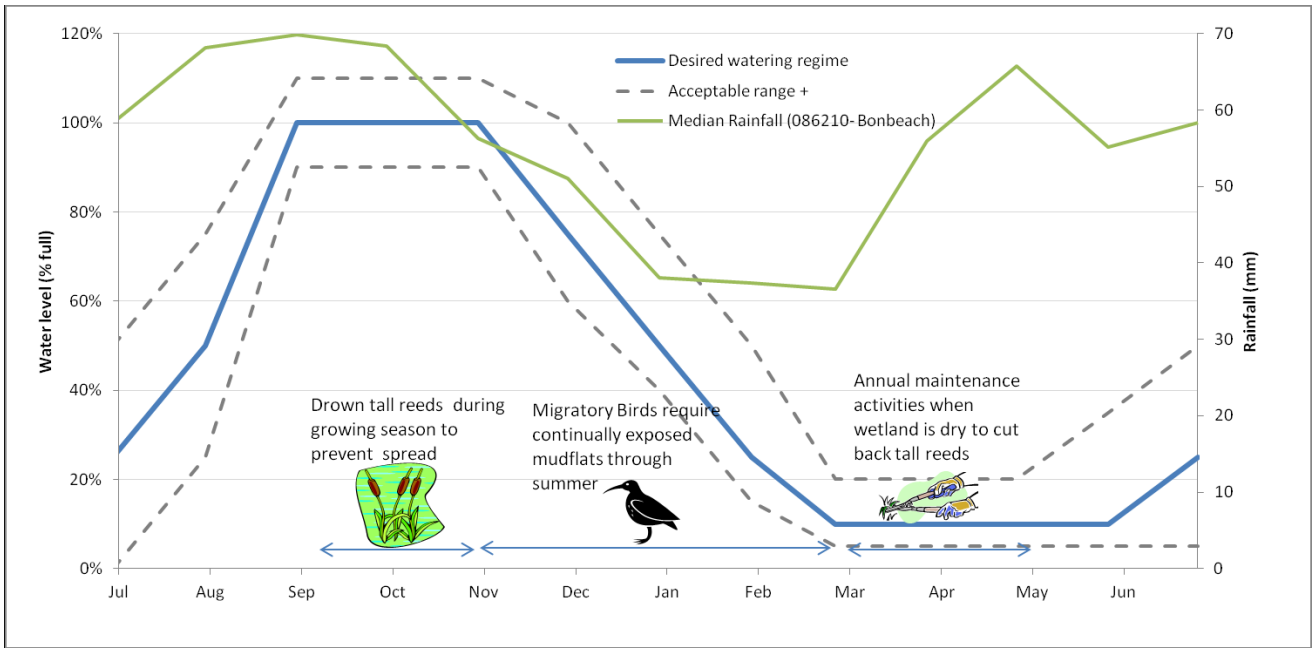


Figure 16 Seasonal water level fluctuations for Edithvale-Seaford Wetlands (source: SKM 2011)

9.4.4 Cost-benefit Analysis of Management Actions Associated with Climate Change (Investigation)

The predicted sea level rise resulting from climate change indicates that saline incursions as a result of storm surges will be occurring at both by 2030, increasing in extent in subsequent decades (DELWP 2015a, b). This will inevitably change the ecological character of Edithvale-Seaford Wetlands, and needs to be recognised as an ongoing and irreversible threat.

A cost-benefit analysis should be undertaken for various management options to:

- prolong the system as a freshwater to brackish environment, noting this will only be a relatively short term benefit as the pressure of sea level rise increases over time; and
- manage and facilitate the inevitable change of the system to a more saline environment.

This should build on the findings of the Jacobs (2016b) climate change assessment.

9.4.5 Monitoring of Abiotic and Biotic Changes with Climate Change (Monitoring and Assessment)

To monitor the progressive transition of the sites to a more saline environment as a result of sea level rise, a number of physical and biotic aspects that will readily reflect the changing conditions should be targeted. These include:

- Recording salinity and water quality levels on a quarterly basis;
- Measuring groundwater levels on a quarterly basis;
- Continuing the monthly bird monitoring surveys (and record surface water levels) (Birdlife Australia) and allowing for an assessment of trends in species occurrences and abundances over time; and

- Developing a vegetation monitoring program that will document the changing abundance and diversity of flora tolerant of differing salinity levels. The design should be statistically robust, based on quantitative data (presumably transect based), cost-effective and repeatable. This should be resurveyed on a yearly basis.

A monitoring program should be designed and established to document and analyse changes over time and to allow management to be adapted accordingly.

9.4.6 Manage CaLP Listed 'Regionally Controlled' Weeds (Program Maintenance)

At Edithvale Wetlands, there are 12 noxious weed species listed as 'Regionally Controlled' under the *Catchment and Land Protection* (CALP) *Act 1994* that require management (eradicate, control, contain), while at Seaford Wetland there are 15 (see Tables 13 and 14). Land owners must take all reasonable steps to prevent the growth and spread of 'Regionally Controlled' species on their land. There is no legal obligation to control weeds listed as 'Restricted' under the CaLP Act, though their spread, either as plants, seeds or contaminants in other material is prohibited. Of the Regionally Controlled weeds identified, Spiny Rush **Juncus acutus* is of highest importance as it poses the biggest threat to wetland values. A large population of this species is present in the adjoining Frankston City Council owned land (Down's Estate) that is proposed for incorporation in to the Ramsar Site (Management Zones 5, see Section 9.5.1 for details). This population should be addressed in conjunction with Frankston City Council as it is an upstream source population that poses a threat to the ecological values of the Ramsar site.

These species were identified during the brief field visits and in the previous ecological reports for the site (TBLA and Australian Ecosystems 2005, Australia Ecosystems 2011a, 2016). Appendix 10 provides the most recent weed mapping. They represent a small proportion of the weed flora, are required to be managed under the *Catchment and Land Protection Act 1994*, and include high and medium threat weed species. At Edithvale, an additional 23 high threat weed and 21 medium threat weed species are listed in Table 13 and addressed as Priority 2 (high threat) and Priority 3 (medium threat) issues. Table 14 lists the additional 21 high threat weed and 26 medium threat weed species identified at Seaford Wetlands, which are addressed as Priority 2 and Priority 3 issues.

Numerous other species may require management in certain circumstances (e.g. to allow for revegetation or to protect specific values), but full-scale management would be untenable. It must also be noted that the weed flora of the site is not static; over time new weed species will colonise, dispersed there by a range of natural agents (e.g. wind and animals). Few recent detailed flora surveys have been undertaken for the entirety of either site, and those that have were not extensive and did not documented all species observed. For these reasons, the weeds listed for control here should not be seen as exhaustive. Ongoing monitoring will allow for the identification of new weed species and their incorporation into the management program as appropriate.

Additional notes regarding weed control and herbicide use are provided in Appendix 11.

Friends of Edithvale-Seaford Wetlands regularly undertake weed control activities and should be continue to be supported to do so.

Table 13 Environmental weeds requiring management within Edithvale Wetlands.

Key:

*	Denotes exotic species
#	Denotes Victorian native species that are introduced to the study area
§	Unclear if this species was recorded at Edithvale or Seaford Wetlands (Ecology Australia 2001)

Status

R	Restricted under the *Catchment and Land Protection* (CaLP) *Act 1994*
C	Regionally Controlled under the CaLP Act
W	Weed of National Significance

Threat (to biodiversity values, based on expert opinion)

High	Highly invasive and/or transformer species (in given situation), effecting severe more or less permanent deleterious changes in vegetation and fauna habitat, floristic composition and structure, preventing vegetation recruitment, and impacting ecosystem function
Medium	Moderately invasive and/or moderately high threat to vegetation and fauna habitat, floristic composition, structure, and recruitment (may be serious as part of multi-species weed invasions)

Strategy

Eradicate	Aim for elimination of populations within the study area, as well as source populations
Control	Control populations to ensure abundance and distribution does not increase beyond current levels
Contain	Manage all new populations to ensure populations do not increase in distribution or abundance (management should focus in areas of remnant vegetation)

Control Method

H	Herbicide: Applied to foliage with spray, wick applicator, etc.; annuals must be sprayed well before seed ripening.
CD	Cut and Dab: Cut down and concentrated herbicide immediately applied to stump, stems, or leaves.
DF	Drill and Fill: Stem drilled and injected with concentrated herbicide or bark “frilled” and herbicide applied.
PR	Physical removal: plants can be physically removed by hand-weeding or with tools when small and/or isolated but soil disturbance is kept to a minimum.
Fire	Fire used to kill mature plants that will not resprout (intensive follow up will be required to remove seedlings as they germinate).

	Scientific Name	Common Name	Status	Threat	Strategy	Treatment
	CaLP listed ‘regionally controlled’ weed species					
*	*Cirsium vulgare*	Spear Thistle	C	Medium	Contain	H
*	*Cynara cardunculus*	Artichoke Thistle	C	Medium	Eradicate	H
§ *	*Cytisus palmensis*	Tree Lucerne	C, W	High	Eradicate	H, CP, DF, PR
*	*Genista linifolia*	Flax-leaf Broom	C, W	High	Eradicate	H, CP, PR
*	*Genista monspessulana*	Montpellier Broom	C, W	High	Eradicate	H, CP, PR
*	*Juncus acutus* subsp. *Acutus*	Spiny Rush	C	High	Eradicate	H
*	*Lycium ferocissimum*	African Box-thorn	C, W	High	Eradicate	H, CP, DF
*	*Moraea flaccida*	One-leaf Cape-tulip	C	Medium	Control	H
*	*Nassella trichotoma*	Serrated Tussock	C, W	High	Control	H
*	*Rubus fruticosus* spp. Agg.	Blackberry	C, W	High	Control	H, CP, PR
§ *	*Senecio jacobaea*	Ragwort	C	Medium	Control	H
§ *	*Silybum marianum*	Variegated Thistle	C	Medium	Control	H
	High threat weeds					
#	*Acacia longifolia* subsp. *Longifolia*	Sallow Wattle		High	Eradicate	CP, PR
#	*Acacia longifolia* subsp. *Sophorae*	Coast Wattle		High	Eradicate	CP, PR
*	*Acacia saligna*	Golden Wreath Wattle		High	Eradicate	CP, PR
*	*Allium triquetrum*	Angled Onion	R	High	Control	H, PR
*	*Casuarina cunninghamiana* subsp. *Cunninghamiana*	River Oak		High	Eradicate	CP, DF
*	*Coprosma repens*	Mirror Bush		High	Eradicate	CP, DF
*	*Disa bracteata*	South African Orchid		High	Control	H, PR
*	*Foeniculum vulgare*	Fennel	R	High	Eradicate	H
*	*Fraxinus angustifolia*	Desert Ash		High	Eradicate	CP, DF, PR
*	*Hakea sericea*	Silky Hakea		High	Eradicate	CP, DF, PR
*	*Hedera helix*	English Ivy		High	Eradicate	H, CP, PR
#	*Leptospermum laevigatum*	Coast Tea-tree		High	Eradicate	CP, DF, PR, Fire
*	*Lophopyrum ponticum*	Tall Wheat-grass		High	Contain	H
#	*Melaleuca armillaris* subsp. *Armillaris*	Giant Honey-myrtle		High	Eradicate	CP, DF
	Melaleuca parvistaminea	Rough-barked Honey-myrtle		High	Eradicate	CP, DF
*	*Oxalis pes-caprae*	Soursob	R	High	Contain	H
*	*Pennisetum clandestinum*	Kikuyu		High	Contain	H
*	*Phalaris aquatica*	Toowoomba Canary-grass		High	Contain	H
#	*Pittosporum undulatum*	Sweet Pittosporum		High	Eradicate	CP, DF, PR
*	*Pinus radiata*	Radiata Pine		High	Eradicate	DF, PR
*	*Prunus cerasifera*	Cherry Plum		High	Eradicate	CP, PR
§ *	*Salix cinerea*	Grey Sallow	R, W	High	Eradicate	CP, DF
§ *	*Typha latifolia*	Great Reedmace		High	Control	H, CP, PR
	Medium threat weeds					
*	*Acacia floribunda*	White Sallow-wattle		Medium	Eradicate	CP, DF
*	*Anthoxanthum odoratum*	Sweet Vernal-grass		Medium	Contain	H
*	*Araujia sericifera*	White Bladder-flower		Medium	Eradicate	H, CP
*	*Callistemon* hybrid	Bottlebrush		Medium	Eradicate	CP
*	*Cotula coronopifolia*	Water Buttons		Medium	Contain	PR
*	*Cynodon dactylon* var. *dactylon*	Couch		Medium	Contain	H
*	*Epilobium hirsutum*	Great Willow-herb		Medium	Control	H
#	*Eucalyptus botryoides*	Southern Mahogany		Medium	Eradicate	CP, DF
*	*Eucalyptus leucoxylon cv. ‘rosea’*	Yellow Gum		Medium	Contain	CP, DF
*	*Eucalyptus robusta*	Swamp Mahogany		Medium	Contain	CP, DF
#	*Eucalyptus sideroxylon*	Mugga		Medium	Contain	CP, DF
*	*Eucalyptus spathulata*	Swamp Mallet		Medium	Contain	CP, DF
*	*Festuca arundinacea*	Tall Fescue		Medium	Contain	CP, DF

	Scientific Name	Common Name	Status	Threat	Strategy	Treatment
*	*Juncus articulatus*	Jointed Rush		Medium	Contain	H
*	*Lagunaria patersonia* subsp. *patersonia*	Pyramid Tree		Medium	Eradicate	CP, DF
#	*Melaleuca lanceolata*	Moonah		Medium	Contain	CP, DF
*	*Paspalum dilatatum*	Paspalum		Medium	Contain	H
*	*Verbena bonariensis*	Purple-top Verbena		Medium	Control	H
§ *	*Paraserianthes lophantha*	Cape Wattle		Medium	Eradicate	CP, DF
§ *	*Salix babylonica*	Weeping Willow		Medium	Eradicate	CP, DF
§ *	*Senecio vulgaris*	Common Groundsel		Medium	Control	H

Table 14 Environmental weeds requiring management within Seaford Wetlands.

Key:

*	Denotes exotic species
#	Denotes Victorian native species that are introduced to the study area
§	Unclear if this species was recorded at Edithvale or Seaford Wetlands (Ecology Australia 2001)

Status

R	Restricted under the *Catchment and Land Protection* (CaLP) *Act 1994*
C	Regionally Controlled under the CaLP Act
W	Weed of National Significance

Threat (to biodiversity values)

High	Highly invasive and/or transformer species (in given situation), effecting severe more or less permanent deleterious changes in vegetation and fauna habitat, floristic composition and structure, preventing vegetation recruitment, and impacting ecosystem function
Medium	Moderately invasive and/or moderately high threat to vegetation and fauna habitat, floristic composition, structure, and recruitment (may be serious as part of multi-species weed invasions)

Strategy

Eradicate	Aim for elimination of populations within the study area, as well as source populations
Control	Control populations to ensure abundance and distribution does not increase beyond current levels
Contain	Manage all new populations to ensure populations do not increase in distribution or abundance (management should focus in areas of remnant vegetation)

Control Method

H	Herbicide: Applied to foliage with spray, wick applicator, etc.; annuals must be sprayed well before seed ripening.
CD	Cut and Dab: Cut down and concentrated herbicide immediately applied to stump, stems, or leaves.
DF	Drill and Fill: Stem drilled and injected with concentrated herbicide or bark “frilled” and herbicide applied.
PR	Physical removal: plants can be physically removed by hand-weeding or with tools when small and/or isolated but soil disturbance is kept to a minimum.
Fire	Fire used to kill mature plants that will not resprout (intensive follow up will be required to remove seedlings as they germinate).

	Scientific Name	Common Name	Status	Threat	Strategy	Treatment
	CaLP listed ‘regionally controlled’ weed species					
*	*Chrysanthemoides monilifera*	Boneseed	C, W	High	Eradicate	CP, PR
*	*Cirsium vulgare*	Spear Thistle	C	Medium	Contain	H
§ *	*Cytisus palmensis*	Tree Lucerne	C, W	High	Eradicate	H, CP, DF, PR
*	*Eragrostis curvula*	African Love-grass	C	High	Eradicate	H
*	*Genista linifolia*	Flax-leaf Broom	C, W	High	Eradicate	H, CP, PR
*	*Genista monspessulana*	Montpellier Broom	C, W	High	Eradicate	H, CP, PR
*	*Juncus acutus* subsp. *Acutus*	Spiny Rush	C	High	Eradicate	H
*	*Lycium ferocissimum*	African Box-thorn	C, W	High	Eradicate	CP, DF
*	*Moraea flaccida*	One-leaf Cape-tulip	C	Medium	Control	H
*	*Rosa rubiginosa*	Sweet Briar	C	High	Eradicate	CP, H
*	*Rubus fruticosus* spp. Agg.	Blackberry	C, W	High	Control	H, PR
*	*Salpichroa origanifolia*	Pampas Lily-of-the-Valley	C	High	Control	H
§ *	*Senecio jacobaea*	Ragwort	C	Medium	Control	H
§ *	*Silybum marianum*	Variegated Thistle	C	Medium	Control	H
*	*Ulex europaeus*	Gorse	C, W	High	Eradicate	H, CP, PR
	High threat weeds					
#	*Acacia longifolia* subsp. *Longifolia*	Sallow Wattle		High	Eradicate	CP, DF
#	*Acacia longifolia* subsp. *Sophorae*	Coast Wattle		High	Eradicate	CP, DF
*	*Acacia saligna*	Golden Wreath Wattle		High	Eradicate	CP, DF
*	*Allium triquetrum*	Angled Onion	R	High	Control	H
*	*Asparagus asparagoides*	Bridal Creeper	R, W	High	Control	H, PR
*	*Casuarina cunninghamiana* subsp. *Cunninghamiana*	River Oak		High	Eradicate	CP, DF
*	*Coprosma repens*	Mirror Bush		High	Eradicate	CP, DF
*	*Cortaderia selloana*	Pampas Grass		High	Eradicate	CP
*	*Delairea odorata*	Cape Ivy		High	Eradicate	CP, DF
*	*Ehrharta calycina*	Perennial Veldt-grass		High	Eradicate	H
*	*Fraxinus angustifolia*	Desert Ash		High	Eradicate	CP, DF
#	*Leptospermum laevigatum*	Coast Tea-tree		High	Eradicate	CP, DF
*	*Lophopyrum ponticum*	Tall Wheat-grass		High	Contain	H
#	*Melaleuca armillaris* subsp. *Armillaris*	Giant Honey-myrtle		High	Eradicate	CP, DF
	Melaleuca parvistaminea	Rough-barked Honey-myrtle		High	Eradicate	CP, DF
*	*Pinus radiata*	Radiata Pine		High	Contain	CP, DF
#	*Pittosporum undulatum*	Sweet Pittosporum		High	Eradicate	CP, DF, PR
*	*Prunus cerasifera*	Cherry Plum		High	Eradicate	CP, DF, PR
§ *	*Salix cinerea*	Grey Sallow	R, W	High	Eradicate	CP, DF
*	*Tradescantia fluminensis*	Wandering Jew		High	Eradicate	H
*	*Zantedeschia aethiopica*	White Arum-lily		High	Eradicate	H

	Scientific Name	Common Name	Status	Threat	Strategy	Treatment
	Medium threat weeds					
*	*Acacia elata*	Cedar Wattle		Medium	Eradicate	CP, DF
*	*Anthoxanthum odoratum*	Sweet Vernal-grass		Medium	Contain	H
*	*Cordyline australis*	New Zealand Cabbage-tree		Medium	Eradicate	CP, DF
*	*Cotula coronopifolia*	Water Buttons		Medium	Contain	PR
*	*Crassula natans* var. *minus*	Water Crassula		Medium	Contain	PR
*	*Cupressus macrocarpa*	Monterey Cypress		Medium	Eradicate	DF
*	*Cynodon dactylon* var. *dactylon*	Couch		Medium	Contain	H
*	*Ehrharta erecta* var. *erecta*	Panic Veldt-grass		Medium	Contain	H
#	*Eucalyptus botryoides*	Southern Mahogany		Medium	Eradicate	DF
*	*Festuca arundinacea*	Tall Fescue		Medium	Contain	H
*	*Gladiolus undulatus*	Wild Gladiolus		Medium	Contain	H
*	*Hyacinthoides hispanica*	Spanish Bluebell		Medium	Eradicate	H
*	*Juncus articulatus*	Jointed Rush		Medium	Contain	H
*	*Lampranthus tegens*	Little Noon-flower		Medium	Control	H
*	*Mesembryanthemum crystallinum*	Common Ice-plant		Medium	Control	H
*	*Oxalis pes-caprae*	Soursob	R	Medium	Contain	H
§ *	*Paraserianthes lophantha*	Cape Wattle		Medium	Eradicate	CP, DF
*	*Paspalum dilatatum*	Paspalum		Medium	Contain	H
*	*Paspalum distichum*	Water Couch		Medium	Contain	H
*	*Pennisetum clandestinum*	Kikuyu		Medium	Contain	H
*	*Phalaris aquatica*	Toowoomba Canary-grass		Medium	Contain	H
*	*Phoenix canariensis*	Canary Island Date-palm		Medium	Eradicate	CP, DF
*	*Phytolacca octandra*	Red-ink Weed		Medium	Control	CP
§ *	*Salix babylonica*	Weeping Willow		Medium	Eradicate	CP, DF
§ *	*Senecio vulgaris*	Common Groundsel		Medium	Control	H
§ *	*Typha latifolia*	Great Reedmace		Medium	Control	H, CP, PR

9.4.7 Control CaLP Listed Pest Animals (Program Maintenance)

Fox control is a high priority action that should be implemented in April/May each year, as has been undertaken during the period of the previous Management Plan. In reserves adjoining residential areas, it is undertaken using soft-jaw trapping as 1080 and PAPP (para-aminopropiophenone) baiting cannot occur within 150 m of a dwelling or 20 m of a waterway or waterbody, effectively eliminating the entire sites from baiting (DEDJTR 2016). The contractor should report on the results, including the number of traps set and number of foxes taken each day, in order to calculate a capture success, and therefore, gauge the success and identify a decline in fox captures over the period of each annual control program.

Maintenance checks of fences (e.g. at Edithvale South Wetland) should be undertaken on a monthly basis with rapid repair where needed to minimise entry of foxes into the site due to non-functioning fences.

European Rabbits *Oryctolagus cuniculus*, European Hares *Lepus europaeus* and Red Foxes *Vulpes vulpes* are listed as established pest animals under the *Catchment and Land Protection* (CaLP) *Act 1994*. The area of most concern appears to be Seaford Wetlands where foxes and rabbits are known to occur (hare may also occur, though this has not been confirmed). Their harbour (rabbit warrens, fox dens, piles of logs/rubbish) within the property, should be destroyed, ensuring indigenous vegetation is not unduly disturbed in the process. If warrens or dens are identified, they should be fumigated and then destroyed/collapsed. Some harbour can be important habitat for native fauna, hence prior to harbour removal, any impacts on native fauna should be considered. Given the impracticality of undertaking pest animal management on a single property (beyond destroying harbour), baiting/trapping actions would only be recommended if they are part of an ongoing landscape strategy being undertaken by Melbourne Water in collaboration with other management agencies.

All pest animal control should be undertaken by a qualified pest control contractor and follow best practice management principals to minimise suffering to target species. Codes of practice and standard operating procedures for managing vertebrate pests which address animal welfare are available at http://www.pestsmart.org.au/.

9.4.8 Mosquito Monitoring and Control (Program Maintenance)

Mosquitoes require management at Seaford Wetland under the *Health (Infectious Diseases) Regulations 2001* and the *Public Health and Wellbeing Regulations 2009* as some species can transmit disease causing pathogens (GHD 2015; Melbourne Water 2016; see Section 4.1.6). Currently, Seaford Wetlands is the only high risk Melbourne Water asset for mosquito outbreaks (DSE 2004; ALS 2010; GHD 2015; Melbourne Water undated[b]).

Annual mosquito and larvae monitoring and control has occurred at Seaford Wetland since 2007 after concerns about the high abundance of mosquitoes had been raised by local residents and schools (Melbourne Water 2016). Melbourne Water proactively monitors Seaford Wetlands each year, throughout spring and summer, when mosquito populations are normally at their highest, commencing in September and continuing until the wetlands have dried up, usually in March/April (Paul Rees, Melbourne Water, pers. comm.). If monitoring data indicate that larvae are in high abundance, control strategies are implemented. During a warm year, Melbourne Water may receive complaints about mosquitoes as early as August, in which case Melbourne Water will undertake a field assessment of the wetlands. The same protocols should continue to be followed.

Monthly monitoring should involve assessing the wetland for suitable breeding habitat, sampling water quality and mosquito trapping:

- Dip sampling (10 dips at each location) to detect mosquito larvae using a standard size dipper (1.5 cups/350 ml) and compared to an abundance rating (ALS 2010; GHD 2015; Melbourne Water undated[b]); and
- CO_2 light traps powered by a 6 volt battery are installed around the wetland and set overnight to capture adult mosquitoes. The number of adult mosquitoes captured in each light trap is compared with an abundance rating and specimens are sent to the Arbovirology Laboratory to be screened for arboviruses (ALS 2010; GHD 2015; Melbourne Water undated[b]).

Mosquito control should involve spreading ProLink Briquettes (see DSE 2004; Garrards 2016; Melbourne Water 2016; Pacific Biologics 2016; Melbourne Water undated[a] and undated[b]) — a c. 5 cm^2 brick of 18 g/kg S-methoprene — into water pools. The active ingredient prevents larvae and pupae development into adult mosquitoes, is considered to have an insignificant effect on other aquatic species and does not bio-accumulate. ProLink Briquettes are effective over an area of c. 10-20 m^2 and should last 150 days (though have found to be effective at Seaford Wetland for three months).

9.4.9 Monitoring of Bird Populations (Biodiversity Monitoring and Assessment)

The Limits of Acceptable Change (LAC) for the Edithvale-Seaford Wetlands Ramsar Site were developed in the recent Ecological Character Description (ECD) addendum (Hale 2016). The Ramsar Rolling Review (DELWP 2016e) provides the most recent assessment of current conditions against LAC, and the 2016 assessment is provided in Section 5 (see Table 5). The LAC are the mechanism against which change in ecological character of a Ramsar site is assessed.

LAC for Edithvale–Seaford Wetlands Ramsar relate to the (Table 5):

- abundance of bird in particular waterbird guilds;
- frequency and abundance of EPBC Act-listed threatened species, the Australasian Bittern and Curlew Sandpiper;
- abundance of EPBC Act-listed migratory Sharp-tailed Sandpiper;
- annual occurrence of breeding waterbirds; and
- extent of different habitat types (i.e. with no habitat comprising more than 70% of the total wetland area).

Therefore, a high priority action is that monthly bird monitoring and water level monitoring undertaken by BirdLife Australia continue to ensure the ecological character of the Ramsar site is maintained within the limits of acceptable change. The surveys undertaken by BirdLife Australia since 1989 have played a key role in developing the LAC, undertaking the 2016 assessment and determining that the LAC were met.

9.4.10 Potential Acid Sulfate Soil Management

Potential acid sulfate soils are well known from the wetlands and broader area (see Sections 3.3 and 8.5; Figure 10). For any works involving excavation into the soil, an Acid Sulfate Soil Management Plan needs to be prepared in accordance with DSE (2010). This is a legal requirement under *Environment Protection and Biodiversity Conservation* (EPBC) *Act 1999*, *Catchment and Land Protection* (CaLP) *Act 1994*, *Environmental Protection Act 1970* and the *Coastal Management Act 1995* (through the *Victorian Coastal Acid Sulfate Soils Strategy* (DSE 2009c)).

9.4.11 Fire Management (Program Maintenance)

The Fire Management Plan by Terramatrix (2013) provides recommended works to minimise the risk of fire at Seaford Wetlands. They provide recommendations for:

- Signage to raise awareness of fire risk, suitable egress, and no entry during Code Red fire danger days;
- Continue managing the perimeter vegetation in line with the requirements of an Asset Protection Zone with low fuel loads:
    - Grass will be no more than 50 mm in height;
    - Trees must not over-hang or touch dwellings or assets;
    - Shrubs under trees must be separated by at least 1.5 times their mature height;
    - Tree canopy separation of at least 2 m;
    - tree canopy cover of no more than 15%; and
    - Tree branches pruned to a height of 2 m above ground level.

Four areas of residential land immediately adjoining the reserve were identified as requiring additional fire protection measures to bring them in line with the Asset Protection Zone (Mersey Crescent/Coolibar Avenue, Wilson Grove, Armstrongs Road (east)/Bethune Court, and Bennett Court/Rossiter Court/Greaves Court):

- Classifying and maintaining two areas as Bushfire Management Zones with moderate fuel loads;
- Considering the use of prescribed fire in the Common Reed dominated wetlands (noting that this may not be effective in reducing biomass in the long-term) and the Damp Sands Herb-rich Woodland;
- Undertaking mechanical removal of fuel in Asset Protection Zones or Bushfire Moderation Zones; and
- Improving site access for tankers.

These recommendations should be followed where possible. If determined to be a feasible option, the use of fire to manage #Coast Tea-tree in the Damp Sands Herb-rich Woodland at Seaford Wetlands could considered.

Using fire to manage Common Reed is not considered viable due to the proximity to houses and the likely outcome of a peat-fire burning for multiple weeks after the above ground fire was extinguished.

9.5 Priority 2 Management Actions (Best Practice Management)

9.5.1 Incorporate 'Downs Estate' into Ramsar Site (Capital/Grants Program)

Frankston City Council's Planning and Environment Department and Melbourne Water are interested in including Downs Estate within the Ramsar boundary (see Sections 2.5 and 4.1.12). Incorporation of Downs Estate into the Ramsar boundary would need to be passed at a Council meeting.

Planning zones and overlays over the property include a Green Wedge Zone), an Urban Floodway Zone, an Environmental Significance Overlay, a Land Subject to Inundation Overlay and a Wildfire Management Overlay. EVCs represented on the property include Aquatic Herbland, Brackish Aquatic Herbland and Tall Marsh (Aspect Studios 2012).

Currently, the water source for Downs Estate comes via flow through the natural drainage line which is supplied from local run-off from rainfall. Melbourne Water is considering pumping water from Wadsleys Drain into the 'old watercourse' natural drainage line which runs southwest across Downs Estate and into the downstream Seaford Wetlands. As the pump delivers c. 15L/min (and there are 1 million cubic metres of storage in the Seaford wetland), the main benefit would be through increasing the habitat in Downs Estate while providing only slightly more water in SN1 (Paul Rees, Melbourne Water, pers. comm.).

Therefore, the periodically filled wetlands have potential to be managed for late-winter and early-spring habitat for waders (e.g. Latham's Snipe). The land immediately adjoining the Seaford Wetlands (to the west of the shared trail) is undoubtedly the most important part of the 'Downs Estate', as it adjoins, is low-lying and subject to flooding and therefore supports complementary values to the Ramsar site. The trail represents a logical boundary between the wetter low-lying area adjoining Seaford and the dryland area to the east of the trail, if the property was to be divided into multiple use zones. For example, the area to the west of the trail could be incorporated into the Ramsar site and the area to the east could be used for other purposes, such as a community centre. A recent Council resolution supported some community activities east of the shared trail (see Section 4.1.12).

The Victorian Waterway Management Strategy provides guidance on extending the boundary of an existing Ramsar site (DEPI 2013b). Under Policy 12.6 of the Strategy, the Victorian Government can recommend extending the boundaries of an existing site to the Australian Government where:

- there is agreement by the owner or land manager and key stakeholders involved in management of the wetland and the actions they propose to meet relevant Ramsar obligations;
- there is compelling evidence that listing will provide clear benefits in:
    - protecting highly significant wetland values relating to the Ramsar criteria for listing;
    - raising the wetland profile; and
    - increasing the level of support for conservation and wise use measures that cannot be achieved through other mechanisms.

Regarding these criteria and incorporation of at least the adjoining parts of 'Downs Estate' into the Ramsar boundary:

- there is agreement between Melbourne Water, Frankston City Council and community groups, such as Bird Life Australia, that 'Downs Estate' should be incorporated into the Ramsar site and managed to protect and enhance Ramsar values (e.g. enhance bird values);
- the land would be used to clearly benefit the existing Ramsar site by:
    - protecting and enhancing the ecosystem services that contributed to the Seaford Wetlands Ramsar listing;
    - buffer and protect the Seaford Wetlands, including the values which contributed to Ramsar listing, from future potential incompatible uses of land to the east; and
    - provide additional/complimentary wetland habitat (at Downs Estate) to the habitat within the Ramsar site (i.e. Seaford Wetlands).
- satisfy the principle of 'wise use' of a Ramsar wetland (i.e. through provision of additional habitat and habitat to buffer the existing Ramsar values).

Melbourne Water and Frankston City Council should continue to hold discussions and investigate the opportunity for incorporation of Downs Estate into the Ramsar boundary. There is considerable scope for involvement of community groups (e.g. Friends of Edithvale-Seaford Wetlands, Down's Estate Community Working Group, BirdLife Australia) in the future use and management of this parcel. If the parcel is incorporated into the Ramsar site, a management plan will need to be developed for the site addressing fencing, weed management and revegetation, and controlling activities to the east of the shared trail under a licence issued by Council to minimise any impacts on migratory shorebirds and other birds utilising Downs Estate if water is returned.

9.5.2 Manage High Threat Weeds (Program Maintenance)

Twenty three and twenty one high threat weeds, not including those listed under the *Catchment and Land Protection* (CALP) *Act 1994*, have been identified as requiring management (eradicate, control, contain) within Edithvale and Seaford Wetlands respectively (Tables 13 and 14). They represent a small proportion of the weed flora, but pose a serious risk to the biodiversity values onsite due to their highly invasive and deleterious impact on the native flora.

At Edithvale and Seaford Wetlands an additional 33 and 41 weeds of management concern have been identified respectively, during the field survey and/or in previous reports for the site (Tables 13 and 14). They are addressed as Priority 1 (Regionally Controlled under the CaLP Act) or Priority 3 (medium threat) issues.

The weeds listed for control here should not be seen as exhaustive as additional weeds of management may be identified onsite in certain situations or as they colonise. An adaptive management process should be undertaken with ongoing monitoring to identify new weeds as they arise.

Additional weed control notes regarding and herbicide use are provided in Appendix 11.

9.5.3 Maintain Dog Restrictions and Increase Signage (capital works)

To minimise impacts of dogs on the wildlife utilising Edithvale-Seaford-Wetland, the current dog restrictions should remain in place. That is, not dogs allowed in the wetland areas, and dogs on-leash only in the buffers. Signage explaining the dog restrictions and educating the public of the impacts of dogs on native wildlife should be installed.

A letter drop to surrounding neighbourhoods within 500 m of either site informing dog owners of domestic dog management issues and potential impacts of pets on biodiversity values within the wetlands should occur in conjunction with the information distributed to cat owners in order to encourage responsible pet ownership (see Section 9.5.4).

9.5.4 Control of Other Pest Animals (Program Maintenance)

It is difficult to control feral and domestic cats from entering Edithvale or Seaford Wetlands due to the largely residential landscape context of the wetlands. Trapping is unlikely to be effective at reducing cat incursions, especially if not undertaken in conjunction with adjoining landowners. Notices to registered cat owners within 500 m of either site regarding cat management issues should be distributed each year as this may contribute towards more responsible cat ownership and a subsequent reduction cat visitation to the wetlands. Friends of Edithvale-Seaford Wetlands could also be supported to hold information evenings regarding responsible pet ownership.

If feral animal issues arise they should be managed accordingly in consultation with a pest control expert.

Control of Mosquitofish at Edithvale-Seaford Wetlands is considered to be unfeasible, primarily because there is likely to be a continuous source for recolonization with inflows from drains feeding the wetlands (Hamer and Parris 2011). Increasing levels of aquatic vegetation may provide shelter for frogs from Mosquitofish, resulting in higher frog survivorship (e.g. Webb and Joss 1997). Options for reducing Mosquitofish abundance may need to be revisited if surveys ever located threatened fish species, such as Dwarf Galaxias at the site.

9.5.5 Undertake Nest Box Monitoring (Program Maintenance)

Nest boxes should be checked and cleaned in May each year. Occupancy of each nest box should be recorded and any pest animals removed (e.g. Common Myna nests, bee hives). Occupancy data should be submitted to Melbourne Water.

9.5.6 Revegetation after Disturbance (Program Maintenance)

Revegetation is proposed for three main purposes:

- To rehabilitate areas after disturbances from activities such as weed removal (e.g. *Spiny Rush), warren/den destruction or grooming;
- To enhance the structural and floristic diversity of Damp Sands Herb-rich Woodland and Swamp Scrub patches; and
- To revegetate an area of currently non-remnant vegetation.

Of these, the rehabilitation after disturbance is considered a Priority 2 management action, while the other two purposes are considered Priority 3 (addressed in Section 9.6.2).

Lists of species suitable for revegetation in various Ecological Vegetation Classes are provided in Appendix 12. For wetland communities, the applicable zone has also been provided based on their tolerance to inundation whereby (Figure 17 illustrates this zonation):

Terrestrial – Dryland vegetation that is primarily outside the natural flooding zone.

Zone 1 – Seasonally wet margins to permanently moist; shallow seasonal inundation in lower part of zone.

Zone 2 – Shallow inundation; upper minimum depth of inundation c. 10 cm; amphibious and emergent aquatic herbs, some straddling Zones 1 and 2.

Zone 3 – Permanent water; submergent and emergent aquatic-herbs, some straddling Zones 2 and 3.

There is considerable scope for involvement of the Friends of Edithvale-Seaford Wetlands in revegetation following disturbance works.

Additional information regarding revegetation is provided in Appendices 12 and 13. The *Edithvale-Seaford Wetlands Revegetation Prescriptions* (TBLA and Australia Ecosystems 2005) document provides more detailed revegetation prescriptions, of which the maps illustrating revegetation locations are provided in Appendix 13.

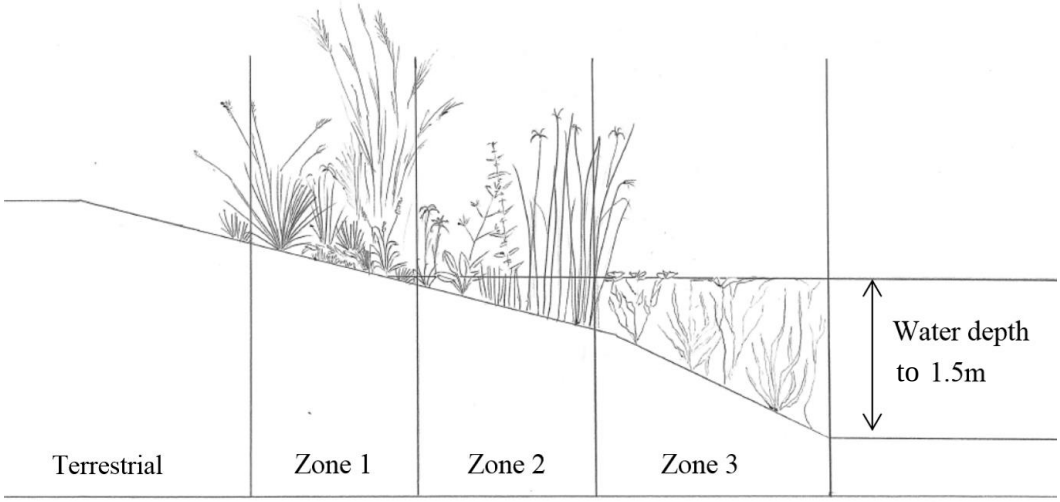


Figure 17 Conceptual cross section of the embankment for revegetating wetland environments, showing terrestrial vegetation and wetland vegetation zones 1, 2 and 3.

9.5.7 Consolidate Melbourne Water and Frankston City Council Management Boundaries at Seaford Wetland (Capital/Grants Program)

For ease of maintenance and to maintain equal standards, the management boundaries at Seaford Wetland should be consolidated giving ownership of the wetland interior to Melbourne Water and the dryland surrounds to Frankston City Council (see Section 2.5 for additional information).

9.5.8 Investigate Path Extension at Seaford Wetland (Investigation)

There is increasing pressure at Seaford Wetland to use the site for running events and other activities. Due to potential disturbances to wildlife, these should be carefully considered before being permitted. To minimise disturbances along the internal track and to give users an alternative route when this track is closed (e.g. during fox trapping), the shared trail could be extended through Down's Estate to, and along the northern boundary (i.e. on the east side of the proposed fencing shown on Figure 4) to link

with the track on the west side of the wetlands. This would create a complete loop/circuit track that does not require site users to traverse through the wetland, reducing disturbance related impacts.

Disturbance impacts could be further reduced through revegetation designed to screen the wetlands from the users traversing around the wetlands (i.e. on the inside of the shared trail/walking track).

The installation of a loop track with screening revegetation (and fencing) would offset the closure of the internal track to the public and allow visitors to get from one side of the wetland to the other without traversing through the core conservation areas (see Section 9.5.9).

9.5.9 Fencing (Program Maintenance)

Both Edithvale and Seaford Wetlands have extensive fencing to restrict access to the wetlands (Figures 3, 4, 14 and 15). These will need to be maintained should breaches occur.

At Seaford Wetland, extension of fencing should be considered through Downs Estate as indicated in Figure 4. The proposed fence extension would ensure the core conservation areas (wetlands and adjoining areas) are fully enclosed within fences. The core conservation areas could be permanently or seasonally closed to the public, restricting public viewing to designated areas along the boundary to minimise noise and visual disturbance impacts on birdlife. A fully enclosed fence around the conservation areas of the wetland would also facilitate enforcement of dog walkers to areas away from the wetlands. This could be undertaken whether or not Downs Estate gets incorporated into the Ramsar boundary.

Closure of the internal track to the public should be considered to prevent users causing disturbance to waterbirds at Seaford Wetland.

9.5.10 Monitoring (Program Maintenance)

Photo-point monitoring

Photo-points previously established across the site in 2011 (Australian Ecosystems 2011b) should be photographed annually and images stored by Melbourne Water (see Figures 14 and 15). Photographs must be taken at each point in the direction of the documented magnetic bearing. The field of view from baseline photos should be replicated in each photograph. Baseline photographs are provided Australian Ecosystems (2011b).

Monitor pest plant control performance

For the most part, weeds of management concern are generally in low abundance. Targets for pest plant control are identified in Tables 13 and 14 (eliminate, control, contain). A standard monitoring form should be developed to record pest plant control performance for each zone.

Monitor pest animal control performance

The site should be inspected in early spring each year to determine whether there are any active rabbit warrens or fox dens. This should be undertaken more regularly if warrens or dens are treated to control pest animals. BirdLife Australia should continue to record the locations of foxes and cats whenever seen during monthly bird surveys.

Monitor Eastern Grey Kangaroo population

The kangaroo management undertaken in March 2016 by VWSA (2016) has reduced the kangaroo population to the recommended sustainable level. Annual monitoring in March/April (when the wetlands are dry) should be undertaken (see EcoPlan Australia 2015) to ensure that the population remains within this stated sustainable range of 16-27 kangaroos. This should use the drive count method as per previous years, to ensure that the counts are as repeatable as possible.

9.5.11 Monitoring (Biodiversity Monitoring and Assessment)

Native vegetation condition monitoring

As part of the *Waterways Sites of Biodiversity Significance Plan 2013*, Melbourne Water intends to monitor the condition of remnant vegetation across each SoBS every five years using the Vegetation Quality Assessment (Habitat Hectares) method. Baseline data were collected in 2010 and then updated in 2015 (Australian Ecosystems 2011a, 2016). The 2010 and 2015 assessments variously used the Vegetation Quality Assessment (VQA) and Index of Wetland Condition (IWC) assessment method making it difficult to compare the condition of vegetation over the five year period (see Section 6.1). Though not designed as a monitoring assessment method, future surveys should follow the VQA methodology as it provides a more detailed assessment of vegetation quality than the IWC assessment method. As the VQA method was not designed to be used as a monitoring tool, the details required to score each component (observed percent cover, diversity and cover of each understorey lifeform, etc.) should also be document for each assessment component.

The Vegetation Quality Assessments should include an inventory of the entire flora for each Habitat Zone or remnant vegetation within the reserve. Resulting data should be added to the Victorian Biodiversity Atlas.

Where possible, the boundaries of each zone should remain consistent with previous years. However, it is expected that some variations will occur as the Common Reed management program proceeds. This has in part been the reason for discrepancies in the EVC and Habitat Zone mapping in 2010 and 2015 (Australian Ecosystems 2011, 2015).

9.6 Priority 3 Management Actions (Other Management Priorities)

9.6.1 Manage Medium Threat Weeds (Program Maintenance)

Tables 13 and 14 list 21 and 26 weed species listed as ‘medium threat’ at Edithvale and Seaford Wetlands, respectively. These species require management within the sites, though precedence must be given to managing CaLP Act listed ‘regionally controlled’ noxious weeds and ‘high threat’ weeds. No medium threat weed species listed in Tables 13 and 14 should be allowed to increase in cover, particularly in areas of groomed Common Reed.

9.6.2 Revegetation and Supplementary Plantings in Woodland, Scrub and Non-Remnant Vegetation (Capital/Grants Program)

To increase the structural and floristic diversity of the Damp Sands Herb-rich Woodland vegetation that primarily comprises canopy trees over mown lawn, clustered plantings of understorey shrubs and robust

ground layer species should be undertaken. Supplementary plantings could also occur in better quality Damp Sands Herb-rich Woodland remnants, particularly after the removal of woody weeds such as #Coast Tea-tree at Seaford Wetlands.

Similarly areas of Swamp Scrub could be expanded or the floristic diversity increased with supplementary plantings. At Seaford Wetlands, a small area of non-remnant vegetation still comprising scattered indigenous wetland and shrub species located opposite Seaford North Primary School should also be revegetated with Swamp Scrub vegetation.

A list of species suitable for revegetation in various Ecological Vegetation Classes is provided in Appendix 12. Additional information regarding revegetation is provided in Appendix 13. The *Edithvale-Seaford Wetlands Revegetation Prescriptions* (TBLA and Australia Ecosystems 2005) document provides more detailed revegetation prescriptions, of which the maps illustrating revegetation locations are provided in Appendix 13.

9.6.3 Manage User-related Issues: New Tracks and Disturbances (Program Maintenance)

Inspections for new tracks or disturbances such as bike tracks and cubby huts should be undertaken during regular maintenance visit. If new tracks or disturbances are located they should be dismantled and the disturbed area rehabilitated as appropriate (e.g. weed control, revegetation). Any resultant weed infestation should be addressed. For example, a bike track with jumps was observed in the eastern most Damp Sands Herb-rich Woodland at Seaford Wetlands, with a resultant African Love-grass *Eragrostis curvula* infestation that requires management.

9.6.4 Manage Lower Priority User Related Issues (Program Maintenance)

General litter is primarily in low abundance around the site. Given the sites close proximity to the sea, litter collection should be undertaken as part of the regular ongoing maintenance of the site. Litter traps at stormwater inlets and outlets should also be regularly cleared, particularly after moderate to large rain events.

9.6.5 Monitoring (Biodiversity Monitoring and Assessment)

Significant Flora Monitoring

No extensive floristic lists are available for the site (TBLA and Australian Ecosystems 2005; Australian Ecosystems 2011a, 2016; DELWP 2016a) or distribution mapping of rare or threatened flora. For this reason, an extensive flora survey is recommended to document the occurrence of rare or threatened (and ideally also regionally significant species) within the site. This should be completed in year one of the management plan, and revisited every five years. This will allow managers to better understand the ecological values of the reserve and manage them accordingly.

The survey should be undertaken in spring by systematically traversing the site, focusing on areas of suitable habitat for rare or threatened flora species identified as potentially utilising the site (Tables 15 and 16 in Appendix 2). The resultant species list should be entered into the Victorian Biodiversity Atlas (DELWP 2016a) and a report prepared including management recommendations to enhance the habitat for the significant flora species found.

Targeted Surveys for Significant Fauna Species

Very little information is available on the reptile and fish species of the Edithvale-Seaford Wetlands (Section 4.1.6).

The wetlands provide potential habitat for the Swamp Skink. Melbourne Water may wish to determine the status of the Swamp Skink at the wetlands as well as the value of the wetlands in general for reptile species by undertaking a targeted survey for this group.

Dwarf Galaxias occurs in slow-flowing shallow ephemeral or permanent freshwater wetlands, such as swamps and drains (DELWP 2015), and has been recorded in other waterways that flow into the Patterson River and in catchments to the south of the site (Coleman et al. 2015). Although it seems unlikely that the Dwarf Galaxias occurs at Edithvale-Seaford Wetlands due to the isolation of the wetlands from their original catchments, a fish survey would provide useful information for the site, as both freshwater and saline water flows enter the wetlands from drains, potentially delivering both freshwater and estuarine inhabiting fish species to the wetlands.

Invertebrate Monitoring

As very little is known about the terrestrial and aquatic invertebrates at the wetlands, it is desirable to undertake an invertebrate inventory survey, particularly for aquatic species. An invertebrate survey would provide useful information for the site, including information or indices relating to the condition of the wetlands.

9.7 Implications for Cultural and Heritage Values

As per the findings of the desktop cultural heritage assessments by Heritage Insight (2016a, b), a Cultural Heritage Management Plan (CHMP) is required for an activity if it:

- occurs within an area of cultural heritage sensitivity (such as a declared Ramsar wetland); and
- is considered a high impact activity (see Heritage Insight 2016a, b for a list of high impact activities).

Although a CHMP is not required for any of the works recommended in this management plan, soils disturbance should be avoided wherever possible. If significant soil disturbance is proposed, the potential impacts and need for a CHMP should be evaluated on a case-by-case basis. A field survey of the study area would be able to provide a more detailed archaeological assessment and identify areas of specific archaeological potential along with any surface Aboriginal sites within the study area. This information could then be used to determine whether mandatory or voluntary CHMP preparation is required for specific proposed works. This would be particularly useful for any activities that do not trigger a mandatory CHMP and could prevent accidental harm to unrecorded Aboriginal cultural heritage material.

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11 Glossary

Acronym	Synonym
AMIS	Asset Management Information System
CaLP Act	Victorian *Catchment and Land Protection Act 1994*
CWP	Capital Works Program
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
EVC	Ecological Vegetation Class
FFG Act	Victorian *Flora and Fauna Guarantee Act 1988*
PM	Program Maintenance
SoBS	Sites of Biodiversity Significance
VROTS	Victorian Rare or Threatened Species
WONS	Weeds of National Significance

Term	Definition
Biodiversity	The variety of all life-forms, the different plants, animals and micro-organisms, the genes they contain, and the ecosystems of which they form a part.
Bioregion	A landscape based approach to classifying the land surface using a range of environmental attributes such as climate, geomorphology, lithology and vegetation.
Ecological Vegetation Class	A type of native vegetation classification that is described through a combination of its floristics, life form and ecological characteristics, and through an inferred fidelity to particular environment attributes. Each EVC includes a collection of floristic communities that occurs across a biogeographic range, and although differing in species, have similar habitat and ecological processes operating.
Exotic	Plants, animals, fungi and other organisms that have been introduced (deliberately or accidentally) to Australia or a given area after European settlement
Habitat Hectares	A measure of the quality and extent of native vegetation, incorporating attributes including presence of large trees, tree canopy health, understorey structure and diversity, weed cover and landscape context
High Threat Weed	Introduced species (including non-indigenous 'natives') with the ability to out-compete and substantially reduce one or more indigenous life forms in the longer term assuming on-going current site characteristics and disturbance regime.
Indigenous	Plant and animal species found naturally in pre-European Australia
Introduced	Deliberately or accidentally brought to Australia or part of Australia, usually by human agency
Native Vegetation	Indigenous vegetation includes vegetation that is native to Australia as well as being native to a specific geographic region.

Appendix 1 Edithvale-Seaford Wetlands Ramsar site land parcels, land status and land managers (from KBR 2009, DSE 2012; updated by DEPI 2013a and DELWP 2016d).

http://services.land.vic.gov.au/maps/pmo.jsp

Wetland	Land parcels (Allotments) (Parish of Lyndhurst)	Land status	Owner/formally assigned land manager	Land Manager (on-ground)
Edithvale North	Lot 1\TP131999, Lot 1\TP225777, Lot 2\TP225777, Lot 1\TP82835, Lot 1\TP414444, Lot 1\TP83139, Lot 1\TP820840, Lot 1\TP820843, Lot 2\TP820843 and Lot 1\TP385644.	Freehold	Melbourne Water	Melbourne Water
Edithvale South	Lot 1\TP95924, Lot 1\TP370109, Lot 1\TP366503, Lot 1\TP132070 and Lot 1\TP138507.	Freehold	Melbourne Water	Melbourne Water
Seaford Wetlands	Northwest: Lot 2\LP138935 and Lot 1\TP117202	Freehold	Frankston City Council	Frankston City Council
	Northwest: Lot 1\TP758882, Lot 1\TP659206, Lot 2\TP659206, Lot 3\TP659206, Lot 4\TP659206, Lot 5\TP659206, Lot 6\225759, Lot 5\225759, Lot 4\225759, Lot 3\225759, Lot 2\225759, Lot 1\225759 and Lot 1/TP824347	Freehold	Melbourne Water	Melbourne Water
	Central: Lot 2070\PP3025.	Freehold	Melbourne Water	Melbourne Water
	Northeast: Lot 1\TP382307.	Freehold	Melbourne Water	Melbourne Water
	Northeast: Lot 93\PP3025.	Freehold	Frankston City Council	Frankston City Council
	Northeast: Lot 86B\PP3025.	Crown Land reserved for conservation of area of natural interest	Melbourne Water as appointed Committee of Management under the *Crown Land (Reserves) Act 1978*, Victoria	Melbourne Water
	Southwest: Lot 25\LP11828, Lot 26\LP11828, Lot 27\LP11828, Lot 28\LP11828, Lot 29\LP11828, Lot 30\LP11828, Lot 52\LP11828, Lot 53\LP11828, Lot 54\LP11828, Lot 55\LP11828, Lot 56\LP11828, Lot 57\LP11828, Lot 1\TP820912, Lot 1\TP821028, Lot 2\TP821028, Lot 2\TP824349, Lot 20\LP11828, Lot 21\LP11828, Lot 22\LP11828, Lot 23\LP11828, Lot 24\LP11828, Lot 21\LP13210, Lot 22\LP13210, Lot 23\LP13210, Lot 24\LP13210, Lot 25\LP13210, Lot 26\LP13210, Lot 97\LP13210, Lot 98\LP13210, Lot 99\LP13210, Lot 100\LP13210, Lot 101\LP13210, Lot 145\LP13210, Lot 146LP13210, Lot 147LP13210, Lot 148LP13210, Lot 149LP13210, Lot 150\LP13210, Lot 217\LP13210, Lot 218\LP13210, Lot 219\LP13210, Lot 220\LP13210, Lot 221\LP13210, Lot 222\LP13210, Lot 1\TP188903, Lot 1\TP376615, Lot 3\TP82102, Lot	Freehold	Melbourne Water	Melbourne Water

Wetland	Land parcels (Allotments) (Parish of Lyndhurst)	Land status	Owner/formally assigned land manager	Land Manager (on-ground)
	4\850290, Lot 4\850290, Lot 2\TP850292, Lot 1\TP820882, Lot 2\TP820882, Lot 4\TP850292, Lot 1\TP820912, Lot 2\TP850299, Lot 4\TP850299, Lot 3\TP820882, Lot 1\TP820912, Lot 6 TP850299, Lot 12\LP6611, Lot 13\LP6611, Lot 14\LP6611, Lot 15\LP6611, Lot 16\LP6611, Lot 17\LP6611, Lot 18\LP6611, Lot 19\LP6611, Lot 20\LP6611, Lot 1\TP881753, Lot 22\LP6611, Lot 23\LP6611, Lot 24\LP6611, Lot 25\LP6611, Lot 2\TP850301, Lot 27\LP6611, Lot 28\LP6611, Lot 29\LP6611, Lot 30\LP6611, Lot 31\LP6611, Lot 32\LP6611, Lot 33\LP6611, Lot 34\LP6611, Lot 35\LP6611, Lot 36\LP6611, Lot 37\LP6611 and Lot 38 LP6611.			
	Southwest: Parcel with no Lot numbers, Lot 9\TP146701, Lot 1\TP850292, Lot 10\TP146701, Lot 3\TP850292, Lot 29\LP11717, Lot 30\LP11717, Lot 31\LP11717, Lot 32\LP11717, Lot 33\LP11717, Lot 34\LP11717, Lot 35\LP11717, Lot 36\LP11717, Lot 37\LP11717, Lot 38\LP11717, Lot 39\LP11717, Lot 54\LP11717, Lot 55\LP11717, Lot 56\LP11717, Lot 57\LP11717, Lot 58\LP11717, Lot 59\LP11717, Lot 60\LP11717, Lot 61\LP11717, Lot 62\LP11717, Lot 63\LP11717, Lot 64\LP11717, Lot 88\LP11717, Lot 89\LP11717, Lot 90\LP11717, Lot 91\LP11717, Lot 92\LP11717, Lot 93\LP11717, Lot 94\LP11717, Lot 95\LP11717, Lot 96\LP11717, Lot 97\LP11717, Lot 98\LP11717, Lot 28\LP12131, Lot 29\LP12131, Lot 30\LP12131, Lot 33\LP12131, Lot 34\LP12131, Lot 35\LP12131, Lot 36\LP12131, Lot 1\TP201413, Lot 1\TP912428, Lot 1\TP850299, Lot 3\TP850299, Lot 1\TP146701, Lot 2\TP146701, Lot 3\TP146701, Lot 4\TP146701, Lot 5\TP146701, Lot 6\TP146701, Lot 7\TP146701, Lot 8\TP146701, Lot 10\TP146701, Lot 11\TP146701, No parcel identification, Lot 118\LP11717, Lot 119\LP11717, Lot 143\LP11717, Lot 144\LP11717, Lot 168\LP11717,Lot 169\LP11717, Lot\10\LP6611, Lot 11\LP6611, Lot 5\TP850299, Lot 1,TP850301, Lot 39 LP6611, Lot 40 LP6611 and Lot 41 LP6611.	Freehold	Frankston City Council	Frankston City Council
	Southeast: Lot 1\TP824348, Lot 24\LP13454, Lot 25\LP13454, Lot 26\LP13454, Lot 27\LP13454, Lot 28\LP13454, Lot 29\LP13454, Lot 30\LP13454, Lot 31\LP13454, Lot 32\LP13454, Lot 33\LP13454, Lot 34\LP13454, Lot 35\LP13454, Lot 36\LP13454, Lot 37\LP13454, Lot 38\LP13454, Lot 39\LP13454, Lot 40\LP13454, Lot 41\LP13454, Lot 42\LP13454, Lot 43\LP13454, Lot 44\LP13454, Lot 45\LP13454, Lot 46\LP13454, Lot 47\LP13454, Lot 48\LP13454, Lot 49\LP13454, Lot 50\LP13454, Lot 77\LP13454, Lot 78\LP13454, Lot 79\LP13454, Lot 80\LP13454, Lot 81\LP13454, Lot 82\LP13454, Lot 83\LP13454, Lot 84\LP13454, Lot 85\LP13454, Lot 86\LP13454, Lot	Freehold	Melbourne Water	Melbourne Water

Wetland	Land parcels (Allotments) (Parish of Lyndhurst)	Land status	Owner/formally assigned land manager	Land Manager (on-ground)
	87\LP13454, Lot 88\LP13454, Lot 89\LP13454, Lot 1\TP850291, Lot 3\TP850291, Lot 45\LP13210, Lot 46\LP13210, Lot 76\LP13210, Lot 77\LP13210, Lot 164\LP13210, Lot 169\LP13210, Lot 200\LP13210, Lot 1\TP188903, Lot 1\TP850298, Lot 3 TP850298, Lot 1\TP820919, Lot 1\TP850300, Lot 3\TP850300, Lot 1\LP10032, Lot 2\LP10032, Lot 3\LP10032, Lot 4\LP10032, Lot 5\LP10032, Lot 6\LP10032, Lot 7\LP10032, Lot 8\LP10032, Lot 9\LP10032, Lot 10\LP10032, Lot 11\LP10032, Lot 12\LP10032, Lot 13\LP10032, Lot 14\LP10032, Lot 15\LP10032, Lot 17\LP10032, Lot 18\LP10032, Lot 19\LP10032, Lot 20\LP10032, Lot 21\LP10032, Lot 22\LP10032, Lot 23\LP10032, Lot 24\LP10032, Lot 25\LP10032, Lot 32LP10032, Lot 33\LP10032, Lot 34\LP10032, Lot 35\LP10032, Lot 36\LP10032, Lot 37\LP10032, Lot 38\LP10032, Lot 39\LP10032, Lot 40\LP10032, Lot 41\LP10032, Lot 42\LP10032, Lot 43\LP10032, Lot 44\LP10032, Lot 45\LP10032, Lot 46\LP10032, 47\LP10032, Lot 48\LP10032, Lot 49\LP10032, Lot 1\TP865059			
	Southeast: Lot PC369422, Lot 1\TP944917, Lot 2\TP944917 and Lot 3\TP944917.	Freehold	Frankston City Council	Frankston City Council

Appendix 2 Significant flora species potentially occurring within the Edithvale-Seaford Wetlands.

A data review on the Victorian Biodiversity Atlas (DELWP 2016a) and the EPBC Act Protected Matters Search Tool (DoE 2016) was conducted for the site to identify rare or threatened flora species that have been recorded or may occur within 5 km of the site. These databases identified 19 rare or threatened plant species that may occur at Edithvale Wetlands and 22 rare or threatened plant species that may occur at Seaford Wetlands. A likelihood of occurrence has been assigned to each of these species at each site based on Ecology Australia's expert opinion and consideration of the following factors:

- Date(s) and number of past records;
- General condition and land use history of the study area, i.e. level of modification;
- Comparisons of site factors (climate, soils, topography) between the study area and sites known to support populations of each threatened species; and
- Whether there is a reasonable expectation that the species would have been recorded during the field survey.

Tables 15 and 16 present the likelihood of occurrence of rare or threatened flora species that could potentially occur Edithvale and Seaford Wetlands, respectively (species with a negligible likelihood of occurrence are not included). Of these, seven species at Edithvale Wetlands and five species at Seaford Wetlands are considered to have a moderate likelihood of occurrence given the proximity of relatively recent records and the presence of potentially suitable habitat.

Table 15 Significant flora species recorded (or modelled to possibly occur) within 5 km of the Edithvale Wetlands (excludes species with negligible likelihood of occurrence).

Key:

EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
VU	Vulnerable under the EPBC Act
FFG Act	*Flora and Fauna Guarantee Act 1988*
L	Listed under the FFG Act
en	Endangered as classified by DELWP (DEPI 2014, DSE 2013)
vu	Vulnerable as classified by DELWP (DEPI 2014, DSE 2013)
r	Rare as classified by DELWP (DEPI 2014)
k	Poorly known as classified by DELWP (DEPI 2014)

Scientific Name	Common Name	Status	Likelihood of occurrence
Amphibromus fluitans	River Swamp Wallaby-grass	VU X	Moderate likelihood of occurrence – suitable habitat present
Austrostipa rudis subsp. *Australis*	Veined Spear-grass	r	Low likelihood of occurrence – potentially suitable habitat
Carex chlorantha	Green-top Sedge	k	Moderate likelihood of occurrence – suitable habitat present
Coronidium gunnianum	Pale Swamp Everlasting	vu	Moderate likelihood of occurrence – potentially habitat present and recorded nearby at the Peninsula Link interchange
Correa alba var. *pannosa*	Velvet White Correa	r	Low likelihood of occurrence – potentially suitable habitat
Lachnagrostis punicea subsp. *Filifolia*	Purple Blown-grass	r L	Moderate likelihood of occurrence – potentially suitable habitat
Philydrum lanuginosum	Woolly Waterlily	vu	Low likelihood of occurrence – modified habitat less suitable
Ranunculus amplus	Lacey River Buttercup	r	Moderate likelihood of occurrence – suitable habitat present and recent records nearby
Ranunculus papulentus	Large River Buttercup	k	Moderate likelihood of occurrence – suitable habitat present and recent records nearby
Xerochrysum palustre	Swamp Everlasting	VU vu L	Moderate likelihood of occurrence – suitable habitat present and recent records nearby

Table 16 Significant flora species recorded (or modelled to possibly occur) within 5 km of the Seaford Wetlands (excludes species with negligible likelihood of occurrence).

Key:

EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
VU	Vulnerable under the EPBC Act
FFG Act	*Flora and Fauna Guarantee Act 1988*
L	Listed under the FFG Act
en	Endangered as classified by DELWP (DEPI 2014, DSE 2013)
vu	Vulnerable as classified by DELWP (DEPI 2014, DSE 2013)
r	Rare as classified by DELWP (DEPI 2014)
k	Poorly known as classified by DELWP (DEPI 2014)
▲	Species not recorded within 5 km of the study area (DELWP 2016a); identified as potentially occurring or potential habitat occurring by the EPBC Act protected matters search tool (DoE 2016)

Scientific Name	Common Name	Status	Likelihood of occurrence
Amphibromus fluitans	River Swamp Wallaby-grass	VU	Moderate likelihood of occurrence – suitable habitat present
Chorizandra australis	Southern Bristle-sedge	k	Moderate likelihood of occurrence – suitable habitat present
Coronidium gunnianum	Pale Swamp Everlasting	vu	Low likelihood of occurrence – suboptimal habitat present
Eleocharis macbarronii	Grey Spike-sedge	k	Moderate likelihood of occurrence – suitable habitat present and recent records nearby
Lachnagrostis punicea subsp. *Filifolia*	Purple Blown-grass	r L	Low likelihood of occurrence – Potentially suitable habitat
Poa labillardierei var. *(Volcanic Plains)*	Basalt Tussock-grass	k	Low likelihood of occurrence – prefers basalt habitats
Poa poiformis var. *ramifer*	Dune Poa	r	Low likelihood of occurrence – calcareous sands or shallow siliceous sands overlying basalt
Ranunculus amplus	Lacey River Buttercup	r	Moderate likelihood of occurrence – suitable habitat present and recent records nearby
Xerochrysum palustre ▲	Swamp Everlasting	VU vu L	Moderate likelihood of occurrence – suitable habitat present and recent records nearby

Appendix 3 Lists of species recorded and frequency of records of bird species recorded at Edithvale Wetlands from 1989 to 2015 and at Seaford Wetlands from 1994 to 2015 during monthly surveys undertaken by Bird Life Australia (summary of surveys from BirdLife Australia Atlas database).

Key:

* denotes introduced species
X Recorded
EPBC *Environment Protection and Biodiversity Conservation Act 1999*
- CE Listed as Critically Endangered under the EPBC Act
- EN Listed as Endangered under the EPBC Act
- VU Listed as Vulnerable under the EPBC Act
- Mi Migratory
- M Marine overfly

FFG *Flora and Fauna Guarantee Act 1988*
- L Listed as threatened under the FFG Act
- N Nominated for listing under the FFG Act

DSE Status according to DSE (2013): Advisory List of Threatened Vertebrate Fauna in Victoria – 2013:
- ce classified as critically endangered in DSE (2013)
- en classified as endangered in DSE (2013)
- vu classified as vulnerable in DSE (2013)
- nt classified as near threatened in DSE (2013)
- dd classified as data deficient in DSE (2013)

Edithvale North Wetlands

Common Name	Scientific Name	No of sightings from 312 surveys	Most recent record	EPBC	FFG	DSE
Stubble Quail	*Coturnix pectoralis*	18	21-Dec-12	M		
Brown Quail	*Coturnix ypsilophora*	2	30-Jun-12			
Magpie Goose	*Anseranas semipalmata*	53	25-Sep-15	M	L	nt
Musk Duck	*Biziura lobata*	232	25-Sep-15	M		vu
Freckled Duck	*Stictonetta naevosa*	11	22-Apr-15		L	en
Black Swan	*Cygnus atratus*	271	20-Jul-15	M		
Australian Shelduck	*Tadorna tadornoides*	8	13-Jan-01			
Australian Wood Duck	*Chenonetta jubata*	25	16-Mar-15			
Pink-eared Duck	*Malacorhynchus membranaceus*	1	27-Aug-14			
Australasian Shoveler	*Anas rhynchotis*	90	16-Jan-15			vu
Grey Teal	*Anas gracilis*	117	25-Sep-15			
Chestnut Teal	*Anas castanea*	270	25-Sep-15			
Pacific Black Duck	*Anas superciliosa*	297	25-Sep-15			
Hardhead	*Aythya australis*	153	16-Jun-15			vu
Blue-billed Duck	*Oxyura australis*	170	22-Apr-15		L	en

Common Name	Scientific Name	No of sightings from 312 surveys	Most recent record	EPBC	FFG	DSE
Australasian Grebe	*Tachybaptus novaehollandiae*	240	20-Jul-15			
Hoary-headed Grebe	*Poliocephalus poliocephalus*	244	25-Sep-15			
Great Crested Grebe	*Podiceps cristatus*	18	30-Dec-14			
*Rock Dove	*Columba livia*	63	12-Sep-13			
*Spotted Dove	*Streptopelia chinensis*	290	25-Sep-15			
Common Bronzewing	*Phaps chalcoptera*	6	13-Dec-13			
Brush Bronzewing	*Phaps elegans*	2	14-Feb-07			
Crested Pigeon	*Ocyphaps lophotes*	124	16-Jun-15			
Tawny Frogmouth	*Podargus strigoides*	3	18-Mar-14			
Fork-tailed Swift	*Apus pacificus*	1	23-Mar-07	Mi,M		
Australasian Darter	*Anhinga novaehollandiae*	4	21-Dec-12			
Little Pied Cormorant	*Microcarbo melanoleucos*	248	20-Jul-15			
Great Cormorant	*Phalacrocorax carbo*	37	22-Nov-13			
Little Black Cormorant	*Phalacrocorax sulcirostris*	33	26-May-15			
Pied Cormorant	*Phalacrocorax varius*	3	12-May-05			nt
Australian Pelican	*Pelecanus conspicillatus*	82	27-Aug-14	M		
Australasian Bittern	*Botaurus poiciloptilus*	98	20-Jul-15	EN	L	en
Australian Little Bittern	*Ixobrychus dubius*	3	14-Nov-12		L	en
White-necked Heron	*Ardea pacifica*	16	21-Nov-14			
Eastern Great Egret	*Ardea modesta*	56	25-Sep-15		L	vu
Intermediate Egret	*Ardea intermedia*	3	21-Feb-06	M	L	en
Cattle Egret	*Ardea ibis*	6	21-Nov-14	Mi,M		
White-faced Heron	*Egretta novaehollandiae*	266	25-Sep-15			
Little Egret	*Egretta garzetta*	3	18-Mar-12	M	L	en
Nankeen Night-Heron	*Nycticorax caledonicus*	10	13-Feb-15	M		nt
Glossy Ibis	*Plegadis falcinellus*	4	19-Sep-12	Mi,M		nt
Australian White Ibis	*Threskiornis molucca*	109	16-Jun-15	M		
Straw-necked Ibis	*Threskiornis spinicollis*	128	16-Jun-15	M		

Common Name	Scientific Name	No of sightings from 312 surveys	Most recent record	EPBC	FFG	DSE
Royal Spoonbill	*Platalea regia*	72	18-Aug-15			nt
Yellow-billed Spoonbill	*Platalea flavipes*	56	26-May-15			
Black-shouldered Kite	*Elanus axillaris*	139	18-Aug-15			
Whistling Kite	*Haliastur sphenurus*	18	16-Apr-14	M		
Brown Goshawk	*Accipiter fasciatus*	48	26-May-15	M		
Collared Sparrowhawk	*Accipiter cirrocephalus*	9	22-Apr-15			
Swamp Harrier	*Circus approximans*	189	25-Sep-15	M		
Little Eagle	*Hieraaetus morphnoides*	5	18-Aug-15			
Nankeen Kestrel	*Falco cenchroides*	53	14-Nov-12	Mi,M		
Brown Falcon	*Falco berigora*	9	27-Apr-12			
Australian Hobby	*Falco longipennis*	69	16-Mar-15			
Peregrine Falcon	*Falco peregrinus*	3	25-Sep-15			
Purple Swamphen	*Porphyrio porphyrio*	283	25-Sep-15			
Lewin's Rail	*Lewinia pectoralis*	2	18-Mar-14		L	vu
Buff-banded Rail	*Gallirallus philippensis*	16	30-Dec-14	M		
Baillon's Crake	*Porzana pusilla*	47	22-Jan-14	M	L	vu
Australian Spotted Crake	*Porzana fluminea*	41	15-Sep-14			
Spotless Crake	*Porzana tabuensis*	29	18-Aug-15	M		
Black-tailed Native-hen	*Tribonyx ventralis*	3	13-Feb-13			
Dusky Moorhen	*Gallinula tenebrosa*	177	26-May-15			
Eurasian Coot	*Fulica atra*	264	16-Jun-15			
Black-winged Stilt	*Himantopus himantopus*	98	16-Jun-15	M		
Red-necked Avocet	*Recurvirostra novaehollandiae*	1	20-Aug-94	M		
Red-capped Plover	*Charadrius ruficapillus*	9	13-Feb-95	M		
Double-banded Plover	*Charadrius bicinctus*	2	02-May-91	Mi,M		
Black-fronted Dotterel	*Elseyornis melanops*	183	25-Sep-15			
Red-kneed Dotterel	*Erythrogonys cinctus*	21	22-Apr-15			
Masked Lapwing	*Vanellus miles*	224	25-Sep-15			
Latham's Snipe	*Gallinago hardwickii*	113	25-Sep-15	Mi,M	N	nt
Common Greenshank	*Tringa nebularia*	16	20-Dec-07	Mi,M		vu
Marsh Sandpiper	*Tringa stagnatilis*	9	06-Dec-06	Mi,M		vu

Common Name	Scientific Name	No of sightings from 312 surveys	Most recent record	EPBC	FFG	DSE
Wood Sandpiper	*Tringa glareola*	5	12-Mar-01	Mi,M		vu
Red Knot	*Calidris canutus*	1	17-Nov-91	Mi,M		en
Red-necked Stint	*Calidris ruficollis*	8	06-Dec-06	Mi,M		
Long-toed Stint	*Calidris subminuta*	1	15-Jan-00	Mi,M		nt
Pectoral Sandpiper	*Calidris melanotos*	6	13-Feb-15	Mi,M		nt
Sharp-tailed Sandpiper	*Calidris acuminata*	45	13-Feb-15	Mi,M		
Curlew Sandpiper	*Calidris ferruginea*	6	26-Sep-94	CE,Mi,M		en
Whiskered Tern	*Chlidonias hybrida*	59	16-Jan-15	M		nt
White-winged Black Tern	*Chlidonias leucopterus*	2	14-Dec-95	Mi,M		nt
Pacific Gull	*Larus pacificus*	23	18-Mar-14	M		
Silver Gull	*Chroicocephalus novaehollandiae*	266	25-Sep-15	M		
Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*	1	14-Jul-09			
Galah	*Eolophus roseicapillus*	62	18-Aug-15			
Long-billed Corella	*Cacatua tenuirostris*	4	16-Jun-15			
Little Corella	*Cacatua sanguinea*	9	22-Apr-15			
Sulphur-crested Cockatoo	*Cacatua galerita*	60	25-Sep-15			
Cockatiel	*Nymphicus hollandicus*	3	13-Feb-13			
Rainbow Lorikeet	*Trichoglossus haematodus*	121	18-Aug-15			
Musk Lorikeet	*Glossopsitta concinna*	43	22-Apr-15			
Little Lorikeet	*Glossopsitta pusilla*	1	06-Dec-09			
Crimson Rosella	*Platycercus elegans*	3	18-Mar-14			
Eastern Rosella	*Platycercus eximius*	187	25-Sep-15			
Red-rumped Parrot	*Psephotus haematonotus*	36	18-Aug-15			
Blue-winged Parrot	*Neophema chrysostoma*	5	28-May-14	M		
Horsfield's Bronze-Cuckoo	*Chalcites basalis*	40	21-Nov-14	M		
Pallid Cuckoo	*Cacomantis pallidus*	11	02-Feb-09	M		
Fan-tailed Cuckoo	*Cacomantis flabelliformis*	5	27-Aug-14	M		
Eastern Barn Owl	*Tyto javanica*	1	27-Apr-98			

Common Name	Scientific Name	No of sightings from 312 surveys	Most recent record	EPBC	FFG	DSE
Laughing Kookaburra	*Dacelo novaeguineae*	2	24-Apr-13			
Sacred Kingfisher	*Todiramphus sanctus*	6	21-Nov-14	M		
Superb Fairy-wren	*Malurus cyaneus*	229	25-Sep-15			
White-browed Scrubwren	*Sericornis frontalis*	74	25-Sep-15			
Yellow Thornbill	*Acanthiza nana*	17	10-Jul-98			
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	9	23-Jul-94			
Brown Thornbill	*Acanthiza pusilla*	139	25-Sep-15			
Spotted Pardalote	*Pardalotus punctatus*	36	16-Jun-15			
Striated Pardalote	*Pardalotus striatus*	5	26-May-15			
Eastern Spinebill	*Acanthorhynchus tenuirostris*	2	23-Mar-07			
White-plumed Honeyeater	*Lichenostomus penicillatus*	263	18-Aug-15			
Noisy Miner	*Manorina melanocephala*	222	25-Sep-15			
Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*	10	22-Apr-15			
Little Wattlebird	*Anthochaera chrysoptera*	140	25-Sep-15			
Red Wattlebird	*Anthochaera carunculata*	253	25-Sep-15			
White-fronted Chat	*Epthianura albifrons*	44	10-Jul-03			
New Holland Honeyeater	*Phylidonyris novaehollandiae*	9	27-Apr-12			
Noisy Friarbird	*Philemon corniculatus*	1	18-Sep-08			
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	73	18-Aug-15	M		
White-winged Triller	*Lalage sueurii*	1	23-Oct-11			
Golden Whistler	*Pachycephala pectoralis*	29	20-Jul-15			
Grey Shrike-thrush	*Colluricincla harmonica*	21	24-Apr-13			
Olive-backed Oriole	*Oriolus sagittatus*	1	16-Nov-05			
Grey Butcherbird	*Cracticus torquatus*	132	25-Sep-15			
Australian Magpie	*Cracticus tibicen*	225	25-Sep-15			
Pied Currawong	*Strepera graculina*	2	11-Jul-07			
Rufous Fantail	*Rhipidura rufifrons*	1	08-Dec-98			

Common Name	Scientific Name	No of sightings from 312 surveys	Most recent record	EPBC	FFG	DSE
Grey Fantail	*Rhipidura albiscapa*	96	25-Sep-15			
Willie Wagtail	*Rhipidura leucophrys*	270	25-Sep-15			
Little Raven	*Corvus mellori*	251	25-Sep-15	M		
Magpie-lark	*Grallina cyanoleuca*	309	25-Sep-15			
Scarlet Robin	*Petroica boodang*	1	16-Jan-15			
Flame Robin	*Petroica phoenicea*	91	18-Aug-15	M		
Horsfield's Bushlark	*Mirafra javanica*	1	24-Oct-10			
*Eurasian Skylark	*Alauda arvensis*	236	25-Sep-15			
Golden-headed Cisticola	*Cisticola exilis*	308	25-Sep-15			
Australian Reed-Warbler	*Acrocephalus australis*	181	25-Sep-15	Mi,M		
Little Grassbird	*Megalurus gramineus*	263	25-Sep-15			
Rufous Songlark	*Cincloramphus mathewsi*	1	20-Dec-07			
Brown Songlark	*Cincloramphus cruralis*	1	13-Dec-13			
Silvereye	*Zosterops lateralis*	22	18-Aug-15	M		
Welcome Swallow	*Hirundo neoxena*	298	25-Sep-15			
Fairy Martin	*Petrochelidon ariel*	3	11-May-95			
Tree Martin	*Petrochelidon nigricans*	5	07-Feb-14	M		
*Common Blackbird	*Turdus merula*	276	25-Sep-15			
*Common Starling	*Sturnus vulgaris*	302	18-Aug-15			
*Common Myna	*Sturnus tristis*	285	25-Sep-15			
Mistletoebird	*Dicaeum hirundinaceum*	2	12-Apr-04			
Red-browed Finch	*Neochmia temporalis*	11	13-Feb-15			
*House Sparrow	*Passer domesticus*	126	13-Feb-15			
*EurasianTree Sparrow	*Passer montanus*	10	12-May-05			
Australasian Pipit	*Anthus novaeseelandiae*	21	18-Mar-12	M		
*European Goldfinch	*Carduelis carduelis*	213	18-Aug-15			
*Common Greenfinch	*Chloris chloris*	160	25-Sep-15			
*Black Duck-Mallard hybrid	*Anas superciliosa – Anas pltyrhynchos*	1	10-Jul-03			

Edithvale South Wetlands

Common Name	Scientific Name	No of sightings from 312 surveys	Most recent record	EPBC	FFG	DSE
Stubble Quail	*Coturnix pectoralis*	1	03-Dec-90	M		
Brown Quail	*Coturnix ypsilophora*	2	12-May-01			
Magpie Goose	*Anseranas semipalmata*	35	20-Jul-15	M	L	nt
Musk Duck	*Biziura lobata*	14	14-Jun-11	M		vu
Freckled Duck	*Stictonetta naevosa*	5	18-Jan-12		L	en
Cape Barren Goose	*Cereopsis novaehollandiae*	2	24-Mar-07	M		
Black Swan	*Cygnus atratus*	253	25-Sep-15			
Australian Shelduck	*Tadorna tadornoides*	19	30-Dec-14			
Australian Wood Duck	*Chenonetta jubata*	29	21-Aug-13			
Pink-eared Duck	*Malacorhynchus membranaceus*	15	23-Dec-11			
Australasian Shoveler	*Anas rhynchotis*	189	25-Sep-15			vu
Grey Teal	*Anas gracilis*	212	25-Sep-15			
Chestnut Teal	*Anas castanea*	259	25-Sep-15			
*Northern Mallard	*Anas platyrhynchos*	2	26-Nov-96			
Pacific Black Duck	*Anas superciliosa*	258	25-Sep-15			
Hardhead	*Aythya australis*	105	30-Dec-14			vu
Blue-billed Duck	*Oxyura australis*	110	17-Oct-14		L	en
Australasian Grebe	*Tachybaptus novaehollandiae*	201	25-Sep-15			
Hoary-headed Grebe	*Poliocephalus poliocephalus*	187	25-Sep-15			
*Rock Dove	*Columba livia*	31	21-Aug-13			
*Spotted Dove	*Streptopelia chinensis*	306	25-Sep-15			
Common Bronzewing	*Phaps chalcoptera*	12	16-Mar-15			
Brush Bronzewing	*Phaps elegans*	1	14-Apr-95			
Crested Pigeon	*Ocyphaps lophotes*	107	25-Sep-15			

Common Name	Scientific Name	No of sightings from 312 surveys	Most recent record	EPBC	FFG	DSE
Tawny Frogmouth	*Podargus strigoides*	1	19-May-11			
Short-tailed Shearwater	*Ardenna tenuirostris*	1	29-Oct-00	Mi,M		
Australasian Darter	*Anhinga novaehollandiae*	6	25-Oct-13			
Little Pied Cormorant	*Microcarbo melanoleucos*	157	25-Sep-15			
Great Cormorant	*Phalacrocorax carbo*	66	18-Mar-14			
Little Black Cormorant	*Phalacrocorax sulcirostris*	42	18-Aug-15			
Pied Cormorant	*Phalacrocorax varius*	2	23-Oct-11			nt
Australian Pelican	*Pelecanus conspicillatus*	96	25-Sep-15	M		
Australasian Bittern	*Botaurus poiciloptilus*	66	20-Jul-15	EN	L	en
Australian Little Bittern	*Ixobrychus dubius*	5	26-Jun-13		L	en
White-necked Heron	*Ardea pacifica*	38	30-Dec-14			
Eastern Great Egret	*Ardea modesta*	51	25-Sep-15	Mi,M	L	vu
Intermediate Egret	*Ardea intermedia*	2	10-Mar-06	M	L	en
Cattle Egret	*Ardea ibis*	21	21-Nov-14	Mi,M		
White-faced Heron	*Egretta novaehollandiae*	238	25-Sep-15			
Little Egret	*Egretta garzetta*	4	14-Feb-12	M	L	en
Nankeen Night-Heron	*Nycticorax caledonicus*	13	02-Jan-13	M		nt
Glossy Ibis	*Plegadis falcinellus*	12	16-Jan-15	Mi,M		nt
Australian White Ibis	*Threskiornis molucca*	146	25-Sep-15	M		
Straw-necked Ibis	*Threskiornis spinicollis*	146	25-Sep-15	M		
Royal Spoonbill	*Platalea regia*	70	13-Feb-15			nt
Yellow-billed Spoonbill	*Platalea flavipes*	80	16-Jan-15			
Black-shouldered Kite	*Elanus axillaris*	149	26-May-15			
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	1	16-Oct-95	Mi,M	L	vu
Whistling Kite	*Haliastur sphenurus*	17	25-Sep-15	M		
Brown Goshawk	*Accipiter fasciatus*	114	20-Jul-15	M		
Collared Sparrowhawk	*Accipiter cirrocephalus*	19	26-May-15			

Common Name	Scientific Name	No of sightings from 312 surveys	Most recent record	EPBC	FFG	DSE
Spotted Harrier	*Circus assimilis*	1	02-Jan-13			nt
Swamp Harrier	*Circus approximans*	218	25-Sep-15	M		
Little Eagle	*Hieraaetus morphnoides*	1	21-Feb-05			
Nankeen Kestrel	*Falco cenchroides*	30	28-May-14	Mi,M		
Brown Falcon	*Falco berigora*	16	21-May-13			
Australian Hobby	*Falco longipennis*	49	27-Aug-14			
Peregrine Falcon	*Falco peregrinus*	5	21-Jun-10			
Purple Swamphen	*Porphyrio porphyrio*	285	25-Sep-15			
Lewin's Rail	*Lewinia pectoralis*	4	10-May-07		L	vu
Buff-banded Rail	*Gallirallus philippensis*	37	22-Jan-14	M		
Baillon's Crake	*Porzana pusilla*	43	13-Feb-15	M	L	vu
Australian Spotted Crake	*Porzana fluminea*	78	15-Sep-14			
Spotless Crake	*Porzana tabuensis*	77	12-Sep-13	M		
Black-tailed Native-hen	*Tribonyx ventralis*	12	22-Jan-14			
Dusky Moorhen	*Gallinula tenebrosa*	225	16-Jan-15			
Eurasian Coot	*Fulica atra*	219	16-Jan-15			
Black-winged Stilt	*Himantopus himantopus*	150	25-Sep-15	M		
Red-necked Avocet	*Recurvirostra novaehollandiae*	6	02-Jan-13	M		
Red-capped Plover	*Charadrius ruficapillus*	2	16-Dec-97	M		
Black-fronted Dotterel	*Elseyornis melanops*	45	18-Aug-15			
Red-kneed Dotterel	*Erythrogonys cinctus*	54	16-Jan-15			
Masked Lapwing	*Vanellus miles*	188	18-Aug-15			
Australian Painted Snipe	*Rostratula australis*	2	09-Dec-08	CE; Mi,M	L	ce
Latham's Snipe	*Gallinago hardwickii*	82	16-Jan-15	Mi,M	N	nt
Little Curlew	*Numenius minutus*	1	17-Aug-90	Mi,M		
Common Greenshank	*Tringa nebularia*	42	25-Oct-13	Mi,M		vu
Marsh Sandpiper	*Tringa stagnatilis*	38	16-Jan-15	Mi,M		vu
Wood Sandpiper	*Tringa glareola*	49	16-Jan-15	Mi,M		vu

Common Name	Scientific Name	No of sightings from 312 surveys	Most recent record	EPBC	FFG	DSE
Red-necked Stint	*Calidris ruficollis*	18	16-Jan-15	Mi,M		
Long-toed Stint	*Calidris subminuta*	1	07-Feb-02	Mi,M		nt
Pectoral Sandpiper	*Calidris melanotos*	13	16-Jan-15	Mi,M		nt
Sharp-tailed Sandpiper	*Calidris acuminata*	94	16-Jan-15	Mi,M		
Curlew Sandpiper	*Calidris ferruginea*	21	16-Jan-15	CE,Mi,M		en
Caspian Tern	*Hydroprogne caspia*	7	16-Jan-15	Mi,M	L	nt
Whiskered Tern	*Chlidonias hybrida*	76	25-Sep-15	M		nt
White-winged Black Tern	*Chlidonias leucopterus*	6	16-Nov-05	Mi,M		nt
Common Tern	*Sterna hirundo*	1	08-Jan-05	Mi,M		
Crested Tern	*Thalasseus bergii*	1	20-Jul-05	M		
Pacific Gull	*Larus pacificus*	34	14-Nov-12	M		
Silver Gull	*Chroicocephalus novaehollandiae*	234	25-Sep-15	M		
Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*	2	23-Oct-11			
Galah	*Eolophus roseicapillus*	59	18-Aug-15			
Long-billed Corella	*Cacatua tenuirostris*	8	19-Sep-12			
Little Corella	*Cacatua sanguinea*	9	16-Jun-15			
Sulphur-crested Cockatoo	*Cacatua galerita*	80	18-Aug-15			
Rainbow Lorikeet	*Trichoglossus haematodus*	120	18-Aug-15			
Musk Lorikeet	*Glossopsitta concinna*	15	16-Mar-15			
Crimson Rosella	*Platycercus elegans*	1	17-Jul-13			
Eastern Rosella	*Platycercus eximius*	31	18-Aug-15			
Red-rumped Parrot	*Psephotus haematonotus*	42	25-Sep-15			
Blue-winged Parrot	*Neophema chrysostoma*	4	16-Jun-15	M		
Horsfield's Bronze-Cuckoo	*Chalcites basalis*	60	25-Sep-15	M		
Black-eared Cuckoo	*Chalcites osculans*	1	20-Sep-96	M		
Pallid Cuckoo	*Cacomantis pallidus*	6	13-Feb-13	M		
Fan-tailed Cuckoo	*Cacomantis flabelliformis*	6	16-Mar-15	M		

Common Name	Scientific Name	No of sightings from 312 surveys	Most recent record	EPBC	FFG	DSE
Southern Boobook	*Ninox novaeseelandiae*	2	24-Apr-13	M		
Eastern Barn Owl	*Tyto javanica*	5	19-Sep-12			
Laughing Kookaburra	*Dacelo novaeguineae*	1	21-May-13			
Sacred Kingfisher	*Todiramphus sanctus*	8	22-Nov-13	M		
Superb Fairy-wren	*Malurus cyaneus*	279	25-Sep-15			
White-browed Scrubwren	*Sericornis frontalis*	109	25-Sep-15			
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	40	16-Jun-15			
Brown Thornbill	*Acanthiza pusilla*	92	25-Sep-15			
Spotted Pardalote	*Pardalotus punctatus*	45	20-Jul-15			
Striated Pardalote	*Pardalotus striatus*	11	26-Jun-13			
Eastern Spinebill	*Acanthorhynchus tenuirostris*	14	18-Aug-15			
Yellow-faced Honeyeater	*Lichenostomus chrysops*	7	16-May-12			
White-plumed Honeyeater	*Lichenostomus penicillatus*	305	25-Sep-15			
Noisy Miner	*Manorina melanocephala*	73	25-Sep-15			
Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*	17	22-Apr-15			
Little Wattlebird	*Anthochaera chrysoptera*	208	25-Sep-15			
Red Wattlebird	*Anthochaera carunculata*	270	25-Sep-15			
White-fronted Chat	*Epthianura albifrons*	12	23-Mar-02			
New Holland Honeyeater	*Phylidonyris novaehollandiae*	159	25-Sep-15			
White-naped Honeyeater	*Melithreptus lunatus*	6	21-Jun-10			
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	104	18-Aug-15	M		
Crested Shrike-tit	*Falcunculus frontatus*	3	10-Sep-04			
Golden Whistler	*Pachycephala pectoralis*	24	15-Sep-14			
Rufous Whistler	*Pachycephala rufiventris*	2	17-Oct-12			
Grey Shrike-thrush	*Colluricincla harmonica*	59	20-Jun-14			

Common Name	Scientific Name	No of sightings from 312 surveys	Most recent record	EPBC	FFG	DSE
Olive-backed Oriole	*Oriolus sagittatus*	1	15-Sep-06			
White-browed Woodswallow	*Artamus superciliosus*	1	18-Mar-14			
Grey Butcherbird	*Cracticus torquatus*	83	18-Aug-15			
Australian Magpie	*Cracticus tibicen*	194	25-Sep-15			
Pied Currawong	*Strepera graculina*	1	15-Sep-14			
Grey Fantail	*Rhipidura albiscapa*	80	16-Jun-15			
Willie Wagtail	*Rhipidura leucophrys*	291	25-Sep-15			
Little Raven	*Corvus mellori*	284	25-Sep-15	M		
Satin Flycatcher	*Myiagra cyanoleuca*	1	16-Mar-15	Mi,M		
Restless Flycatcher	*Myiagra inquieta*	1	15-Mar-96			
Magpie-lark	*Grallina cyanoleuca*	308	25-Sep-15			
Scarlet Robin	*Petroica boodang*	2	16-Jan-15			
Flame Robin	*Petroica phoenicea*	96	18-Aug-15	M		
*Eurasian Skylark	*Alauda arvensis*	127	28-May-14			
Golden-headed Cisticola	*Cisticola exilis*	276	25-Sep-15			
Australian Reed-Warbler	*Acrocephalus australis*	207	25-Sep-15	Mi,M		
Little Grassbird	*Megalurus gramineus*	292	25-Sep-15			
Rufous Songlark	*Cincloramphus mathewsi*	1	23-Oct-11			
Silvereye	*Zosterops lateralis*	84	20-Jul-15	M		
Welcome Swallow	*Hirundo neoxena*	308	25-Sep-15			
Fairy Martin	*Petrochelidon ariel*	17	14-Aug-12			
Tree Martin	*Petrochelidon nigricans*	11	11-Mar-09	M		
*Common Blackbird	*Turdus merula*	309	25-Sep-15			
*Song Thrush	*Turdus philomelos*	5	10-Oct-08			
*Common Starling	*Sturnus vulgaris*	308	25-Sep-15			
*Common Myna	*Sturnus tristis*	303	25-Sep-15			
Mistletoebird	*Dicaeum hirundinaceum*	1	23-Mar-02			
Red-browed Finch	*Neochmia temporalis*	49	25-Sep-15			
*House Sparrow	*Passer domesticus*	259	25-Sep-15			
*EurasianTree Sparrow	*Passer montanus*	22	05-Feb-08			
Australasian Pipit	*Anthus novaeseelandiae*	4	18-Mar-12	M		
*European Goldfinch	*Carduelis carduelis*	226	25-Sep-15			

Common Name	Scientific Name	No of sightings from 312 surveys	Most recent record	EPBC	FFG	DSE
*Common Greenfinch	*Chloris chloris*	253	25-Sep-15			
*Domestic Goose	*Anser anser*	2	30-Dec-14			
*Domestic Duck	*Anas platyrhynchos*	7	13-Feb-15			

Seaford Wetlands

Common Name	Scientific Name	No of sightings from 252 surveys	Most recent record	EPBC	FFG	DSE
Stubble Quail	*Coturnix pectoralis*	3	25-Nov-11	M		
Brown Quail	*Coturnix ypsilophora*	7	27-Nov-13			
Musk Duck	*Biziura lobata*	8	26-Mar-13	M		vu
Freckled Duck	*Stictonetta naevosa*	18	31-Dec-14		L	en
Cape Barren Goose	*Cereopsis novaehollandiae*	4	26-Jul-10	M		
Black Swan	*Cygnus atratus*	225	29-Sep-15	M		
Australian Shelduck	*Tadorna tadornoides*	37	25-Mar-15			
Australian Wood Duck	*Chenonetta jubata*	38	23-Jul-15			
Pink-eared Duck	*Malacorhynchus membranaceus*	28	30-Apr-15			
Australasian Shoveler	*Anas rhynchotis*	54	30-Apr-15			vu
Grey Teal	*Anas gracilis*	219	29-Sep-15			
Chestnut Teal	*Anas castanea*	248	29-Sep-15			
*Northern Mallard	*Anas platyrhynchos*	4	24-Jun-05			
Pacific Black Duck	*Anas superciliosa*	242	29-Sep-15			
Hardhead	*Aythya australis*	103	26-Jun-15		L	en
Blue-billed Duck	*Oxyura australis*	106	20-Feb-15			
Australasian Grebe	*Tachybaptus novaehollandiae*	89	31-Aug-15			
Hoary-headed Grebe	*Poliocephalus poliocephalus*	197	29-Sep-15			
Great Crested Grebe	*Podiceps cristatus*	3	31-Oct-13			
*Rock Dove	*Columba livia*	65	26-Apr-13			
*Spotted Dove	*Streptopelia chinensis*	251	29-Sep-15			

Common Name	Scientific Name	No of sightings from 252 surveys	Most recent record	EPBC	FFG	DSE
Common Bronzewing	*Phaps chalcoptera*	60	29-Sep-15			
Brush Bronzewing	*Phaps elegans*	1	21-Feb-07			
Crested Pigeon	*Ocyphaps lophotes*	137	29-Sep-15			
White-throated Needletail	*Hirundapus caudacutus*	2	03-Apr-96	Mi,M		vu
Australasian Darter	*Anhinga novaehollandiae*	13	28-Apr-14			
Little Pied Cormorant	*Microcarbo melanoleucos*	93	25-Mar-15			
Great Cormorant	*Phalacrocorax carbo*	73	25-Mar-15			
Little Black Cormorant	*Phalacrocorax sulcirostris*	112	25-Mar-15			
Australian Pelican	*Pelecanus conspicillatus*	177	29-Sep-15	M		
Australasian Bittern	*Botaurus poiciloptilus*	25	31-Aug-15	EN	L	en
Australian Little Bittern	*Ixobrychus dubius*	1	09-Dec-94		L	en
White-necked Heron	*Ardea pacifica*	15	31-Oct-14			
Eastern Great Egret	*Ardea modesta*	110	29-Sep-15	Mi,M	L	vu
Intermediate Egret	*Ardea intermedia*	1	24-Feb-12	M	L	en
Cattle Egret	*Ardea ibis*	11	26-Apr-11	Mi,M		
White-faced Heron	*Egretta novaehollandiae*	207	29-Sep-15			
Little Egret	*Egretta garzetta*	3	25-Feb-13	M	L	en
Nankeen Night-Heron	*Nycticorax caledonicus*	3	24-Feb-12	M		nt
Glossy Ibis	*Plegadis falcinellus*	2	29-Sep-15	Mi,M		nt
Australian White Ibis	*Threskiornis molucca*	118	29-Sep-15	M		
Straw-necked Ibis	*Threskiornis spinicollis*	112	29-Sep-15	M		
Royal Spoonbill	*Platalea regia*	128	25-Mar-15			nt
Yellow-billed Spoonbill	*Platalea flavipes*	64	31-Dec-14			
Black-shouldered Kite	*Elanus axillaris*	184	31-Aug-15			

Common Name	Scientific Name	No of sightings from 252 surveys	Most recent record	EPBC	FFG	DSE
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	2	26-Jun-15	Mi,M	L	vu
Whistling Kite	*Haliastur sphenurus*	29	23-Jul-15	M		
Brown Goshawk	*Accipiter fasciatus*	106	29-Sep-15	M		
Collared Sparrowhawk	*Accipiter cirrocephalus*	27	30-Apr-15			
Swamp Harrier	*Circus approximans*	202	29-Sep-15	M		
Wedge-tailed Eagle	*Aquila audax*	1	26-Apr-11			
Little Eagle	*Hieraaetus morphnoides*	7	26-Apr-11			
Nankeen Kestrel	*Falco cenchroides*	100	29-Sep-15	Mi,M		
Brown Falcon	*Falco berigora*	27	27-Jan-15			
Australian Hobby	*Falco longipennis*	69	31-Dec-14			
Peregrine Falcon	*Falco peregrinus*	15	20-Feb-15			
Purple Swamphen	*Porphyrio porphyrio*	247	29-Sep-15			
Lewin's Rail	*Lewinia pectoralis*	2	27-Nov-13		L	vu
Buff-banded Rail	*Gallirallus philippensis*	10	27-Nov-13	M		
Baillon's Crake	*Porzana pusilla*	20	20-Feb-15	M	L	vu
Australian Spotted Crake	*Porzana fluminea*	34	29-Jan-14			
Spotless Crake	*Porzana tabuensis*	38	20-Feb-15	M		
Black-tailed Native-hen	*Tribonyx ventralis*	4	31-Jan-13			
Dusky Moorhen	*Gallinula tenebrosa*	127	27-Jan-15			
Eurasian Coot	*Fulica atra*	159	29-May-15			
Black-winged Stilt	*Himantopus himantopus*	109	26-Jun-15	M		
Red-necked Avocet	*Recurvirostra novaehollandiae*	17	31-Aug-15	M		
Red-capped Plover	*Charadrius ruficapillus*	35	23-Nov-02	M		
Double-banded Plover	*Charadrius bicinctus*	3	21-Mar-14	Mi,M		
Black-fronted Dotterel	*Elseyornis melanops*	105	31-Aug-15			
Red-kneed Dotterel	*Erythrogonys cinctus*	34	26-Jun-15			
Masked Lapwing	*Vanellus miles*	215	29-Sep-15			

Common Name	Scientific Name	No of sightings from 252 surveys	Most recent record	EPBC	FFG	DSE
Latham's Snipe	*Gallinago hardwickii*	93	29-Sep-15	Mi,M	N	nt
Black-tailed Godwit	*Limosa limosa*	2	19-May-05	Mi,M		vu
Common Greenshank	*Tringa nebularia*	60	20-Feb-15	Mi,M		vu
Marsh Sandpiper	*Tringa stagnatilis*	7	21-Mar-14	Mi,M		vu
Wood Sandpiper	*Tringa glareola*	2	06-Jan-06	Mi,M		vu
Red-necked Stint	*Calidris ruficollis*	15	27-Jan-15	Mi,M		
Long-toed Stint	*Calidris subminuta*	1	27-Feb-14	Mi,M		nt
Pectoral Sandpiper	*Calidris melanotos*	6	27-Jan-15	Mi,M		nt
Sharp-tailed Sandpiper	*Calidris acuminata*	61	25-Mar-15	Mi,M		
Curlew Sandpiper	*Calidris ferruginea*	15	27-Jan-15	CE,Mi,M		en
Red-necked Phalarope	*Phalaropus lobatus*	2	06-Jan-06	Mi,M		
Caspian Tern	*Hydroprogne caspia*	2	04-Jan-02	Mi,M	L	nt
Whiskered Tern	*Chlidonias hybrida*	34	29-Sep-15	M		nt
Common Tern	*Sterna hirundo*	1	07-Nov-99	Mi,M		
Pacific Gull	*Larus pacificus*	28	27-Feb-14	M		
Silver Gull	*Chroicocephalus novaehollandiae*	245	29-Sep-15	M		
Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*	4	24-Oct-11			
Galah	*Eolophus roseicapillus*	82	29-Sep-15			
Long-billed Corella	*Cacatua tenuirostris*	1	26-Mar-13			
Little Corella	*Cacatua sanguinea*	4	25-Jul-13			
Sulphur-crested Cockatoo	*Cacatua galerita*	43	30-Apr-15			
Cockatiel	*Nymphicus hollandicus*	1	28-Nov-14			
Rainbow Lorikeet	*Trichoglossus haematodus*	242	29-Sep-15			
Scaly-breasted Lorikeet	*Trichoglossus chlorolepidotus*	1	18-Mar-11			
Musk Lorikeet	*Glossopsitta concinna*	84	23-Jul-15			
Purple-crowned Lorikeet	*Glossopsitta porphyrocephala*	1	18-Mar-11			

Common Name	Scientific Name	No of sightings from 252 surveys	Most recent record	EPBC	FFG	DSE
Crimson Rosella	*Platycercus elegans*	2	10-Apr-99			
Eastern Rosella	*Platycercus eximius*	197	29-Sep-15			
Swift Parrot	*Lathamus discolor*	4	25-Mar-15	En; M	L	en
Red-rumped Parrot	*Psephotus haematonotus*	3	26-Jun-14			
Blue-winged Parrot	*Neophema chrysostoma*	10	31-Oct-14	M		
Horsfield's Bronze-Cuckoo	*Chalcites basalis*	83	29-Sep-15	M		
Shining Bronze-Cuckoo	*Chalcites lucidus*	4	27-Sep-13	M		
Pallid Cuckoo	*Cacomantis pallidus*	22	27-Sep-13	M		
Fan-tailed Cuckoo	*Cacomantis flabelliformis*	29	30-Apr-15	M		
Eastern Barn Owl	*Tyto javanica*	3	30-May-12			
Laughing Kookaburra	*Dacelo novaeguineae*	4	28-May-13			
Sacred Kingfisher	*Todiramphus sanctus*	6	25-Nov-11	M		
Superb Fairy-wren	*Malurus cyaneus*	252	29-Sep-15			
White-browed Scrubwren	*Sericornis frontalis*	250	29-Sep-15			
Striated Fieldwren	*Calamanthus fuliginosus*	33	26-Jun-15			
Yellow Thornbill	*Acanthiza nana*	6	20-Jul-06			
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	203	31-Aug-15			
Brown Thornbill	*Acanthiza pusilla*	245	29-Sep-15			
Spotted Pardalote	*Pardalotus punctatus*	205	29-Sep-15			
Striated Pardalote	*Pardalotus striatus*	31	30-Apr-15			
Eastern Spinebill	*Acanthorhynchus tenuirostris*	35	23-Jul-15			
Yellow-faced Honeyeater	*Lichenostomus chrysops*	21	28-Apr-14			
White-eared Honeyeater	*Lichenostomus leucotis*	11	30-Apr-15			
White-plumed Honeyeater	*Lichenostomus penicillatus*	251	29-Sep-15			
Noisy Miner	*Manorina melanocephala*	178	29-Sep-15			
Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*	43	30-Apr-15			
Little Wattlebird	*Anthochaera chrysoptera*	248	29-Sep-15			

Common Name	Scientific Name	No of sightings from 252 surveys	Most recent record	EPBC	FFG	DSE
Red Wattlebird	*Anthochaera carunculata*	250	29-Sep-15			
White-fronted Chat	*Epthianura albifrons*	164	29-Sep-15			
Scarlet Honeyeater	*Myzomela sanguinolenta*	1	30-Oct-09			
New Holland Honeyeater	*Phylidonyris novaehollandiae*	233	29-Sep-15			
White-naped Honeyeater	*Melithreptus lunatus*	27	28-Apr-14			
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	199	29-Sep-15	M		
Crested Shrike-tit	*Falcunculus frontatus*	48	20-Feb-15			
Golden Whistler	*Pachycephala pectoralis*	50	23-Jul-15			
Rufous Whistler	*Pachycephala rufiventris*	4	25-Mar-09			
Grey Shrike-thrush	*Colluricincla harmonica*	213	29-Sep-15			
Olive-backed Oriole	*Oriolus sagittatus*	5	26-Nov-10			
Dusky Woodswallow	*Artamus cyanopterus*	126	29-Sep-15			
Grey Butcherbird	*Cracticus torquatus*	212	29-Sep-15			
Australian Magpie	*Cracticus tibicen*	251	29-Sep-15			
Grey Currawong	*Strepera versicolor*	1	26-Jul-10			
Rufous Fantail	*Rhipidura rufifrons*	2	25-Mar-15	Mi,M		
Grey Fantail	*Rhipidura albiscapa*	224	29-Sep-15			
Willie Wagtail	*Rhipidura leucophrys*	248	29-Sep-15			
Australian Raven	*Corvus coronoides*	1	02-Jul-00			
Little Raven	*Corvus mellori*	223	29-Sep-15	M		
Magpie-lark	*Grallina cyanoleuca*	250	29-Sep-15			
Scarlet Robin	*Petroica boodang*	10	25-Jul-13			
Red-capped Robin	*Petroica goodenovii*	1	21-Mar-14			
Flame Robin	*Petroica phoenicea*	113	31-Aug-15	M		
Pink Robin	*Petroica rodinogaster*	2	27-Jun-12	M		
Eastern Yellow Robin	*Eopsaltria australis*	220	29-Sep-15			
*Eurasian Skylark	*Alauda arvensis*	234	29-Sep-15			
Golden-headed Cisticola	*Cisticola exilis*	250	29-Sep-15			
Australian Reed-Warbler	*Acrocephalus australis*	151	29-Sep-15	Mi,M		

Common Name	Scientific Name	No of sightings from 252 surveys	Most recent record	EPBC	FFG	DSE
Tawny Grassbird	*Megalurus timoriensis*	1	21-Mar-14			
Little Grassbird	*Megalurus gramineus*	245	29-Sep-15			
Rufous Songlark	*Cincloramphus mathewsi*	6	29-Aug-12			
Brown Songlark	*Cincloramphus cruralis*	3	29-Aug-12			
Silvereye	*Zosterops lateralis*	235	29-Sep-15	M		
Welcome Swallow	*Hirundo neoxena*	246	29-Sep-15			
Fairy Martin	*Petrochelidon ariel*	39	25-Mar-15			
Tree Martin	*Petrochelidon nigricans*	28	31-Dec-14	M		
*Common Blackbird	*Turdus merula*	252	29-Sep-15			
*Song Thrush	*Turdus philomelos*	21	09-Oct-01			
*Common Starling	*Sturnus vulgaris*	250	29-Sep-15			
*Common Myna	*Sturnus tristis*	246	29-Sep-15			
Mistletoebird	*Dicaeum hirundinaceum*	67	23-Jul-15			
Red-browed Finch	*Neochmia temporalis*	97	29-Sep-15			
*House Sparrow	*Passer domesticus*	220	29-Sep-15			
*EurasianTree Sparrow	*Passer montanus*	37	25-Mar-08			
Australasian Pipit	*Anthus novaeseelandiae*	47	27-Jan-15	M		
*European Goldfinch	*Carduelis carduelis*	248	29-Sep-15			
*Common Greenfinch	*Chloris chloris*	107	29-May-15			
*Domestic Duck	*Anas platyrhynchos domesticus*	82	02-Jul-03			
*Black Duck-Mallard hybrid	*Anas superciliosa – Anas platyrhynchos*	2	27-Jan-15			

Appendix 4 List of threatened and/or migratory species recorded at Edithvale Wetlands from 1989 to 2015 and at Seaford Wetlands from 1994 to 2015 during monthly surveys undertaken by Bird Life Australia (summary of surveys from BirdLife Australia Atlas database).

Key:

* denotes introduced species
X Recorded
EPBC *Environment Protection and Biodiversity Conservation Act 1999*
- CE Listed as Critically Endangered under the EPBC Act
- EN Listed as Endangered under the EPBC Act
- VU Listed as Vulnerable under the EPBC Act
- Mi Migratory
- M Marine overfly

FFG *Flora and Fauna Guarantee Act 1988*
- L Listed as threatened under the FFG Act
- N Nominated for listing under the FFG Act

DSE Status according to DSE (2013): Advisory List of Threatened Vertebrate Fauna in Victoria – 2013:
- ce classified as critically endangered in DSE (2013)
- en classified as endangered in DSE (2013)
- vu classified as vulnerable in DSE (2013)
- nt classified as near threatened in DSE (2013)
- dd classified as data deficient in DSE (2013)

Common Name	Scientific Name	EPBC	FFG	DSE	Edithvale North	Edithvale South	Seaford
Stubble Quail	*Coturnix pectoralis*	M			X	X	X
Magpie Goose	*Anseranas semipalmata*	M	L	nt	X	X	
Musk Duck	*Biziura lobata*	M		vu	X	X	X
Freckled Duck	*Stictonetta naevosa*		L	en	X	X	X
Cape Barren Goose	*Cereopsis novaehollandiae*	M				X	X
Australasian Shoveler	*Anas rhynchotis*			vu	X	X	X
Hardhead	*Aythya australis*			vu	X	X	X
Blue-billed Duck	*Oxyura australis*		L	en	X	X	X
Short-tailed Shearwater	*Ardenna tenuirostris*	Mi,M				X	
Fork-tailed Swift	*Apus pacificus*	Mi,M				X	
White-throated Needletail	*Hirundapus caudacutus*	Mi,M		vu			X
Pied Cormorant	*Phalacrocorax varius*			nt	X	X	
Australian Pelican	*Pelecanus conspicillatus*	M			X	X	X
Australasian Bittern	*Botaurus poiciloptilus*	EN	L	en	X	X	X
Australian Little Bittern	*Ixobrychus dubius*		L	en	X	X	X
Eastern Great Egret	*Ardea modesta*	Mi,M	L	vu	X	X	X

Common Name	Scientific Name	EPBC	FFG	DSE	Edithvale North	Edithvale South	Seaford
Intermediate Egret	*Ardea intermedia*	M	L	en	X	X	X
Cattle Egret	*Ardea ibis*	Mi,M			X	X	X
Little Egret	*Egretta garzetta*	M	L	en	X	X	X
Nankeen Night-Heron	*Nycticorax caledonicus*	M		nt	X	X	X
Glossy Ibis	*Plegadis falcinellus*	Mi,M		nt	X	X	X
Australian White Ibis	*Threskiornis molucca*	M			X	X	X
Straw-necked Ibis	*Threskiornis spinicollis*	M			X	X	X
Royal Spoonbill	*Platalea regia*			nt	X	X	X
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	Mi,M	L	vu		X	X
Whistling Kite	*Haliastur sphenurus*	M			X	X	X
Brown Goshawk	*Accipiter fasciatus*	M			X	X	X
Spotted Harrier	*Circus assimilis*			nt		X	
Swamp Harrier	*Circus approximans*	M			X	X	X
Nankeen Kestrel	*Falco cenchroides*	Mi,M			X	X	X
Lewin's Rail	*Lewinia pectoralis*		L	vu	X	X	X
Buff-banded Rail	*Gallirallus philippensis*	M			X	X	X
Baillon's Crake	*Porzana pusilla*	M	L	vu	X	X	X
Spotless Crake	*Porzana tabuensis*	M			X	X	X
Black-winged Stilt	*Himantopus himantopus*	Mi,M			X	X	X
Red-necked Avocet	*Recurvirostra novaehollandiae*	Mi,M			X	X	X
Red-capped Plover	*Charadrius ruficapillus*	,M			X	X	X
Double-banded Plover	*Charadrius bicinctus*	Mi,M			X		X
Australian Painted Snipe	*Rostratula australis*	CE; Mi,M	L	ce		X	
Latham's Snipe	*Gallinago hardwickii*	Mi,M	N	nt	X	X	X
Little Curlew	*Numenius minutus*	Mi,M				X	
Black-tailed Godwit	*Limosa limosa*	Mi,M		vu			X
Common Greenshank	*Tringa nebularia*	Mi,M		vu	X	X	X
Marsh Sandpiper	*Tringa stagnatilis*	Mi,M		vu	X	X	X
Wood Sandpiper	*Tringa glareola*	Mi,M		vu	X	X	X
Red Knot	*Calidris canutus*	Mi,M		en	X		
Red-necked Stint	*Calidris ruficollis*	Mi,M			X	X	X

Common Name	Scientific Name	EPBC	FFG	DSE	Edithvale North	Edithvale South	Seaford
Long-toed Stint	*Calidris subminuta*	Mi,M		nt	X	X	X
Pectoral Sandpiper	*Calidris melanotos*	Mi,M		nt	X	X	X
Sharp-tailed Sandpiper	*Calidris acuminata*	Mi,M			X	X	X
Curlew Sandpiper	*Calidris ferruginea*	CE,Mi,M		en	X	X	X
Red-necked Phalarope	*Phalaropus lobatus*	Mi,M					X
Caspian Tern	*Hydroprogne caspia*	Mi,M	L	nt		X	X
Whiskered Tern	*Chlidonias hybrida*	M		nt	X	X	X
White-winged Black Tern	*Chlidonias leucopterus*	Mi,M		nt	X	X	
Common Tern	*Sterna hirundo*	Mi,M				X	X
Crested Tern	*Thalasseus bergii*	M				X	
Pacific Gull	*Larus pacificus*	M			X	X	X
Silver Gull	*Chroicocephalus novaehollandiae*	M			X	X	X
Swift Parrot	*Lathamus discolor*	En; M	L	en			X
Blue-winged Parrot	*Neophema chrysostoma*	M			X	X	X
Horsfield's Bronze-Cuckoo	*Chalcites basalis*	M			X	X	X
Black-eared Cuckoo	*Chalcites osculans*	M				X	
Shining Bronze-Cuckoo	*Chalcites lucidus*	M					X
Pallid Cuckoo	*Cacomantis pallidus*	M			X	X	X
Fan-tailed Cuckoo	*Cacomantis flabelliformis*	M			X	X	X
Southern Boobook	*Ninox novaeseelandiae*	M				X	
Sacred Kingfisher	*Todiramphus sanctus*	M			X	X	X
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	M			X	X	X
Rufous Fantail	*Rhipidura rufifrons*	Mi,M					X
Little Raven	*Corvus mellori*	M			X	X	X
Satin Flycatcher	*Myiagra cyanoleuca*	Mi,M				X	
Flame Robin	*Petroica phoenicea*	M			X	X	X
Pink Robin	*Petroica rodinogaster*	M					X
Australian Reed-Warbler	*Acrocephalus australis*	Mi,M			X	X	X
Silvereye	*Zosterops lateralis*	M			X	X	X
Tree Martin	*Petrochelidon nigricans*	M			X	X	X
Australasian Pipit	*Anthus novaeseelandiae*	M			X	X	X

Appendix 5 Non-avian fauna species recorded within the Edithvale-Seaford Wetlands Ramsar Site (see Ecology Australia 2001; KBR 2009; DELWP 2016).

Key:

* denotes introduced species

EPBC *Environment Protection and Biodiversity Conservation Act 1999*
- CE Listed as Critically Endangered under the EPBC Act
- EN Listed as Endangered under the EPBC Act
- VU Listed as Vulnerable under the EPBC Act
- Mi Migratory
- M Marine overfly

FFG *Flora and Fauna Guarantee Act 1988*
- L Listed as threatened under the FFG Act
- N Nominated for listing under the FFG Act

DSE Status according to DSE (2013): Advisory List of Threatened Vertebrate Fauna in Victoria – 2013:
- ce classified as critically endangered in DSE (2013)
- en classified as endangered in DSE (2013)
- vu classified as vulnerable in DSE (2013)
- nt classified as near threatened in DSE (2013)
- dd classified as data deficient in DSE (2013)

Scientific Name	Common Name	DSE 2013	EPBC	FFG
Mammals				
Tachyglossus aculeatus	Short-beaked Echidna			
Antechinus agilis	Agile Antechinus			
Isoodon obesulus obesulus	Southern Brown Bandicoot	nt	EN	L
Trichosurus vulpecula	Common Brushtail Possum			
Pseudocheirus peregrinus	Common Ringtail Possum			
Petaurus breviceps	Sugar Glider			
Macropus giganteus	Eastern Grey Kangaroo			
Wallabia bicolor	Swamp Wallaby			
Pteropus poliocephalus	Grey-headed Flying-fox	vu	VU	L
Tadarida australis	White-striped Freetail Bat			
Nyctophilus geoffroyi	Lesser Long-eared Bat			
Scotorepens orion	Eastern Broad-nosed Bat			
Chalinolobus gouldii	Gould's Wattled Bat			
Chalinolobus morio	Chocolate Wattled Bat			
Vespadelus darlingtoni	Large Forest Bat			
Vespadelus regulus	Southern Forest Bat			
Vespadelus vulturnus	Little Forest Bat			
Rattus fuscipes	Bush Rat			
Rattus lutreolus	Swamp Rat			
Hydromys chrysogaster	Water Rat (Rakali)			
**Rattus rattus*	Black Rat		*	
**Rattus norvegicus*	Brown Rat		*	
**Mus musculus*	House Mouse		*	
**Oryctolagus cuniculus*	European Rabbit		*	

Scientific Name	Common Name	DSE 2013	EPBC	FFG
**Lepus capensis*	Brown Hare			
**Felis catus*	Cat		*	
**Vulpes vulpes*	European Fox			
**Canis lupus familiaris*	Dog		*	
Reptiles				
Chelodina longicollis	Eastern Snake-necked Turtle	dd		
Christinus marmoratus	Marbled Gecko			
Pygopus lepidopodus	Common Scaly-foot			
Amphibolurus muricatus	Tree Dragon			
Acritoscincus duperreyi	Eastern Three-lined Skink			
Liopholis whitii GROUP	White's Skink			
Lampropholis delicata	Delicate Skink			
Eulamprus tympanum tympanum	Southern Water Skink			
Lampropholis guichenoti	Garden Skink			
Niveoscincus metallicus	Metallic Skink			
Saproscincus mustelinus	Weasel Skink			
Lerista bougainvillii	Bougainville's Skink			
Pseudemoia entrecasteauxii	Southern Grass Skink			
Tiliqua nigrolutea	Blotched Blue-tongued Lizard			
Tiliqua scincoides	Common Blue-tongued Lizard			
Notechis scutatus	Tiger Snake			
Pseudechis porphyriacus	Red-bellied Black Snake			
Pseudonaja textilis	Eastern Brown Snake			
Austrelaps superbus	Lowland Copperhead			
Drysdalia coronoides	White-lipped Snake			
Suta flagellum	Little Whip Snake			
Frogs				
Limnodynastes dumerilii	Southern Bullfrog (ssp. unknown)			
Limnodynastes peronii	Striped Marsh Frog			
Limnodynastes tasmaniensis	Spotted Marsh Frog (race unknown)			
Neobatrachus sudellae	Common Spadefoot Toad			
Paracrinia haswelli	Haswell’s Froglet			
Crinia signifera	Common Froglet			
Pseudophryne semimarmorata	Southern Toadlet	vu		
Litoria ewingii	Southern Brown Tree Frog			
Litoria raniformis	Growling Grass Frog	en	Vu	L
Litoria verreauxii verreauxii	Verreaux's Tree Frog			
Fish				
Anguilla australis	Southern Shortfin Eel			
Galaxias truttaceus	Spotted Galaxias			

Scientific Name	Common Name	DSE 2013	EPBC	FFG
Galaxias brevipinnis	Climbing Galaxias			
Galaxias maculatus	Common Galaxias			
**Gambusia holbrooki*	Eastern Gambusia			

Appendix 6 Details of microbat surveys undertaken by Parson Brinckerhoff (2009 and 2010), Edithvale-Seaford Wetlands Ramsar Site.

Key:
X Positively identified
P Potential call detection
FFG *Flora and Fauna Guarantee Act 1988*
L Listed as threatened under the FFG Act
DSE Status according to DSE (2013): Advisory List of Threatened Vertebrate Fauna in Victoria – 2013:
vu classified as vulnerable in DSE (2013)
dd classified as data deficient in DSE (2013)

Common name	Species name	FFG	DSE 2013	Edithvale Wetlands	Seaford Wetlands
Chocolate Wattled Bat	*Chalinolobus morio*			X	
Gould's Wattled Bat	*Chalinolobus gouldii*			X	X
Large Forest Bat	*Vespadelus darlingtoni*			X	X
Southern Forest Bat	*Vespadelus regulus*			X	X
Little Forest Bat	*Vespadelus vulturnus*			X	
Southern Freetail Bat	*Mormopterus* sp 4			X	X
Eastern Freetail Bat / Southern Freetail Bat	*Mormopterus* sp 2 / *Mormopterus* sp 4			X	X
White-striped Freetail Bat	*Tadarida australis*			X	X
Lesser Long-eared Bat	*Nyctophilus geoffroyi*			X	
Gould's Wattled Bat/Mormopterus sp.	*Chalinolobus gouldii/ Mormopterus* sp.				X
Large Forest Bat/ Eastern Bent-wing Bat	*Vespadelus darlingtoni/ Miniopterus schreibersii oceanensis*				X
Forest Bat spp.	*Vespadelus* spp.			X	X
Long-eared Bat spp.	*Nyctophilus* spp.			X	X
Eastern Bent-wing Bat	*Miniopterus schreibersii oceanensis*	L	vu	P	P
Eastern Broad-nosed Bat	*Scotorepens orion*			P	P
Yellow-bellied Sheathtail Bat	*Saccolaimus flaviventris*	L	dd		P

Appendix 7 Hydrology of wetland cells at Edithvale-Seaford Wetlands (see Section 6.3).

Table 17 Hydrology of the wetland cells at Edithvale Wetlands (summarised from GHD 2006, KBR 2009, SKM 2011, DSE 2012 and Jacobs 2016 and updated from data provided by Paul Rees, Melbourne Water).

Hydrological Cell	Water sources	Water Discharges	Morphology	Watering regime	Habitat
Edithvale South					
ES1 (Main Wetland)	Three drains from the developed urban catchment to the east (via sediment ponds)	To Edithvale North (EN1) via a siphon under Edithvale Road when water levels reach 0.00 m AHD	Natural dish-shaped cross-section underlain by a thick layer of peat which thins towards the edges.	Inundated in winter and spring (standing water level generally sits at 0.00 m AHD, but rises to 0.78 m AHD during rain events)	Shallow and deep fresh-brackish marsh
	Overland flows	During rain events discharges to Edithvale North Wetlands at Centre Swamp Drain when water levels are above the invert level of the weir (-0.02m AHD)	Depth is normally c. 0.45 m (the deepest part is 0.3 m below sea level and water level is usually 0.2 m AHD at peak level, but up to 1.25 m AHD in a 1 in 100 year average return interval (ARI) event (Paul Rees, Melbourne Water, pers. comm.).	Drawdown and drying occurs in summer and autumn to below 0.00 m AHD	Drawdown during summer and autumn creates critical mudflat foraging habitat for migratory shorebirds
	Overflows from Centre Swamp Drain during storms with 1 in 2 year annual return interval (ARI)			Maximum drying is generally by late-January, but may occur earlier during drought conditions	Supports a heavy growth of Salt/Marsh Club-rush (*Bolboschoenus caldwellii*) in late-summer and autumn – the key to maintain peats and nutrient cycling and control *Typha* invasion
	Flood overflows from Centre Swamp Drain are generally controlled by inflows into Edithvale North (EN1)			Unseasonal event flows may partially or totally rewet the area	
ES1a, ES1b and ES1c (Drought Refuges)	ES1a and ES1b - pumping from Centre Swamp Drain during prolonged dry periods (enters via ES1a and overflows to ES1b) in addition to the sources to ES1 (Main Wetland)	None known	Excavated pools are deeper than the main wetland (ES1)	Inundated in winter and spring (standing water level generally at 0.00 m AHD), but rises to 0.78 m AHD during rain events)	Drought refuges support permanent water, except during drought
	ES1c - Groundwater in addition to the sources to ES1 (Main Wetland)			Generally dry out every year, except during unusually wet years (level will sit at -0.40 m AHD or lower depending on rainfall)	
Edithvale North					
EN1	Mostly from ES1 via a siphon crest in ES1 at -0.01 m AHD under Edithvale Road	To EN2 at Weir 1 at -0.15 m AHD	Constructed within the former floodplain	Generally inundated in winter and spring (level will sit at 0.00 m AHD or below)	Fresh-brackish
	Also via Weir 5 from Centre Swamp Drain at 0.2 m AHD	To EN2 via overflow at -0.13 m AHD	Shallow, peat-lined cell with concentric marsh zones and an island in the centre	Drying in summer and autumn	Supports a heavy growth of Salt/Marsh Club-rush (*Bolboschoenus caldwellii*) in late-summer and autumn
	Leakage from groundwater			Generally dries-up every year, but some wet summers will result in a residual pool in autumn	The management objective is to provide habitat for waders, dabbling and filter-feeding waterbird species
				A moist area is maintained during dry periods by groundwater	
EN2	From EN1 at Weir 1 at -0.15 m AHD	To EN3 at Weir 2 at -0.37 m AHD, but is dependent on the ponded level in EN3; excess flows can be directed to the Dog Pond	Constructed within the former floodplain and reach deep into the sandy substrates that underlie the area	During winter and spring, will fill from EN1 – level is determined by level in EN3 with a minimum of -0.40 m AHD	Fresh-brackish
			The invert level of EN2 is -1.95 m AHD		
			Data for EN2 suggest that it ranges in depth from 0.00 m (i.e. empty) (-1.95 m AHD) recorded in Feb 2016, to more than 2.00 m (gauge under water) (>0.15 m AHD) (Paul Rees, Melbourne Water, pers. comm.).		

Hydrological Cell	Water sources	Water Discharges	Morphology	Watering regime	Habitat
	Groundwater	To Dog Pond via a high level overflow channel at c. 0.4 m AHD	A series of weirs between EN3, EM3a and EN2 limit the total drawdown under prolonged dry or drought conditions	Drawdown generally to c. -0.5 m AHD during average years, but may drawdown to -1.2 m AHD during drought years	
				System responds to groundwater in summer which is controlled by area saturation and drawdown to invert low flow pipe in Centre Swamp Drain floodway to south	
EN3 (main open water pond)	From EN2 at Weir 2 at -0.37 m AHD	To Centre Swamp Drain via two 150 mm outlet pipes	The invert level of EN3 is -1.9 m AHD	Will fill to -0.2 to 0.3 m in wet years, but may be much lower during low rainfall'	EN3 is the main open water pond
	From EN3a via Weir 3 at -0.23 m AHD	To Centre Swamp Drain via a high level overflow channel (overflows top of outlets to be set at -0.2 to 0.3 m AHD)	Data for EN3 suggest that it ranges in depth from 0.42 m (-1.48 m AHD) to 2.00 m (-0.1 m AHD) (Paul Rees, Melbourne Water, pers. comm.)	Filling of pond to full supply level generally only occurs in July-October	EN3 water levels are responsive to groundwater. Levels can be -1.2 m AHD during drought years with salinity levels of 10,000-12,000 us/cm, or -0.2-0.4 m AHD in wetter periods with salinities of 4,000-5,000 us/cm.
	From EN4 via Weir 3 at -0.98 m AHD			Drawdown generally to c. -0.5 m AHD during average years, but may drawdown to -1.2 m AHD during drought years	
	From groundwater			During summer, is occasionally filled from subdivision stormwater and overflow from EN1 and EN2	
EN3a	From Stormwater drains to the north via litter traps and Sediment Ponds E4 and E5	To EN3 via Weir 3 at -0.23 m AHD and Weir 4 at -0.98 m AHD		Filling of pond to full supply level generally only occurs in July-October	EN3a water levels are responsive to groundwater. Levels can be -1.2 m AHD during drought years with salinity levels of 10,000-12,000 us/cm, or -0.2-0.4 m AHD in wetter periods with salinities of 4,000-5,000 us/cm.
	From stormwater from an overland flow-path via litter traps and Sediment Ponds EN4 and EN5			Drawdown via groundwater and evaporation response generally to c. -0.5 m AHD during average years, but may drawdown to -1.2 m AHD during drought years	
	From groundwater		Water levels in EN3 and EN3a are generally responsive to the groundwater table, which varies in height, but can draw down to -1.95 m AHD during drought years. Salinity is therefore a problem in EN3 and EN3a e.g. 10,000 to 12,000 us/cm (GHD 2006). In wetter seasons, the standing water can reach 0.00 to 0.15 m AHD and salinity is lower e.g. 4,000 to 5,000 us/cm (GHD 2006).		
Dog Pond	Water level is controlled by groundwater	None	Constructed within the former floodplain	Relies on inflows from EN2 to be above the standing groundwater height	
	Dog Pond can receive water from EN2 via a high level overflow channel at c. -0.4 m AHD		Deep, reaching into the sandy substrates that underlie the area	Generally dry by late-January	
EN4 (Sediment Pond)	Stormwater from stormwater drains to the north	To EN3a		During winter and spring, the water level and overflow is controlled by a sill at c. -0.2 m AHD	Deep pool generally supports freshwater and provides good habitat for Blue-billed Ducks, Musk Ducks and Australasian Bittern
	Overland flow			Drawdown to the weir at -0.2 m AHD, and then evaporation and inflows control the level	

Hydrological Cell	Water sources	Water Discharges	Morphology	Watering regime	Habitat
EN5 (Sediment Pond)	Stormwater from stormwater drains to the north	To EN3a		During winter and spring, water levels respond to main pond height in EN3	
	Overland flow			Drawdown occurs during summer and is generally dry by late-December	
EC1 and EC2 (Edithvale Common Wetlands	EC1 – Ephemeral Wetland fills to 0.1 m AHD from a diversion weir in the outfall pipeline from Centre Swamp Drain	None		During winter and spring, the ephemeral wetland fills to 0.1 m AHD from a diversion weir in the outfall pipeline from Centre Swamp Drain	The ephemeral wetland provided good habitat for Latham's Snipe and duck species prior to improvements to drainage (Will Steele, Melbourne Water, pers. comm.)
				The wetland is generally dry by the end of November	
	EC2 – Shallow depression is only filled by local run-off	None	Shallow depression located to the east of the "Duck Inn"	Only fills in wet years	The ephemeral wetland provides good Latham's Snipe and frog habitat
				The wetland is dry by the end of November	

Table 18 Hydrology of the wetland cells at Seaford Wetlands (summarised from GHD 2006, KBR 2009, SKM 2011, DSE 2012 and Jacobs 2016).

Hydrological Cell	Water sources	Water Discharges	Morphology	Watering regime	Habitat
Seaford North					
SN1 (Main Header Pool)	Rising main transfers base flows from Wadsleys Road Drain to the north	Discharges via a central pipe (c. 600 mm) which can feed into either SCW1 or SCE2. variable level regulator - 0.145m AHD to 0.8m AHD	Standing water levels during winter and spring are generally at 0.6 m AHD and are controlled via overflow orifices in earth bund	Standing water levels during winter and spring are fill and maintain at 0.6 m AHD	Fresh-brackish
	The centre drain (old Seaford Drain) runs from north to south through the site and carries inflows to SN1 through higher ground (also see Aurecon 2011). Gates enable the direction of water flow to the east or west.		Level of side caste overflow structure in east is at 0.80 m AHD and/or sag point in west is at 0.80 m AHD (levee was upgraded in 2013, Paul Rees, pers. comm.)).	Summer water levels are at c. 0.45 m AHD	Maintains permanent water
		Overflows to the west into SCW1		Summer-autumn maintenance flows occur via Wadsleys Drain	
		Overflows to the east into SCE2			
		System is manually operated to redirect and discharge flows to a centre drain after November to allow for drying			
SN2	Local rainfall	None	Ephemeral wetlands that form part of the areas original morphology- ephemeral areas are blocked by landforms of the former swamp that are disrupted by Eel Race Drain	Ephemeral wetlands wet during winter and spring Generally dry during summer and autumn	Ephemeral wetlands providing important habitat for waders and insectivorous birds in late-spring
*SN Downs Land	Local rainfall	None	Seasonal wetlands in a series of old watercourses	Ephemeral wetlands only fill during a wet winter	Ephemeral wetlands with potential to be managed for late-winter and early-spring habitat for waders
Seaford Central					
SCW1	Stormwater fed by Seaford North local drainage system to the west via undiverted drains	Discharges to the centre drain	Deeper substrate under shallow peats was disturbed historically during extensive cropping	SCW1 is wetter than natural due to the drainage inputs, cessation of the overall through drainage, a lack of saline groundwater interception on the drains from	Long-term running of freshwater has resulted in excessive growth of Common Reed,

Hydrological Cell	Water sources	Water Discharges	Morphology	Watering regime	Habitat
				Seaford North and the long-term running of freshwater through the pool in summer months	Cumbungi and Spiny Rush
	The surrounding levee is not totally impermeable and therefore the drain is not fully regulated; it overtops to the east when water levels reach 14 cm in height and to the west at 12 cm (Paul Rees, Melbourne Water, pers. comm.).		SCW1 has an invert of 0.14 m AHD, with a range of 0.00m (0.14 m AHD) to 0.70 m (0.84 m AHD)	SCW1 and SCE2 operate independently below 0.14 m, but are connected above this point as essentially one large pool, as the levee on either side of the main drain has low points of 0.28 m AHD on the west and 0.31 m AHD on the east. In an average year, SCW1 and SCE2 will be disconnected initially in autumn, they will slowly fill-up until they reach 0.31 m AHD (0.12 to 0.14 m deep) at which point they will become connected over most of the winter and spring, until in late-spring and early-summer, they draw down below 0.31 m AHD and are no longer connected.	
	Overflow sill from SN1 at 0.80 m AHD		The western margin of the cell was historically filled for subdivision with a steep interface between the swamp and fill	Water levels in winter and spring sit at c. 0.4 m AHD and are controlled at two locations by sills to the centre drain, but will pond higher than this level during flood events	
	From the central pipe (c. 600 mm) from SN1				
	Groundwater				
SCE2	Overflow from SN1 at 0.8 m AHD	Overflows via a sill in the south corner of the cell to SCE2a at c. 0.7 m AHD	Is the least disturbed of the cells and supports original morphology	Supports a relatively natural wetting and drying regime and dries in summer and autumn with exception of residual pools and unseasonal events	Management regime aims to reflect a natural cycle
	From the central pipe (c. 600 mm) from SN1		SCE2 has an invert of 0.19 m AHD, with a range of 0.00m (0.19 m AHD) to 0.60m (0.79 m AHD) and generally dries out in summer.	SCW1 and SCE2 operate independently below 0.14 m, but are connected above this point as essentially one large pool, as the levee on either side of the main drain has low points of 0.28 m AHD on the west and 0.31 m AHD on the east. In an average year, SCW1 and SCE2 will be disconnected initially in autumn, they will slowly fill-up until they reach 0.31 m AHD (0.12 to 0.14 m deep) at which point they will become connected over most of the winter and spring, until in late-spring and early-summer, they draw down below 0.31 m AHD and are no longer connected.	Important habitat for waders with a large productive mudflat available from September to December
			Peat layers are predominantly intact	Water levels pond to 0.45 m AHD in late-spring following which supply is halted, except for unseasonal event inflows.	Supports a heavy growth of Marsh Club-rush (*Bolboschoenus caldwellii*) in late-summer and autumn
			Water levels are controlled by sills in the southwest corner adjacent to the centre drain	Water levels should desiccate to mudflats by mid-December (inflows from SN1 cease by late-October). Unseasonal flows could refill the cell.	
SCE2a	From SCE2	Overflows to SSE4	This cell is part of SCE2, but is separated from it by a low level weir on the northern margin	Minor ponding occurs to 0.55 m AHD during winter due to the old fill mound of the centre drain	Shallow brackish wetland
	The surrounding levee is not totally impermeable and therefore the drain is not fully regulated; it overtops to the east when water levels reach 14 cm in height and to the west at 12 cm (Paul Rees, Melbourne Water, pers. comm.).	Overflows to SSW1	Is the least disturbed of the cells and supports original morphology	Separation from SCE2 by the low level weir results in draining and drying separately in late-spring	
			Peat layers are predominantly intact	Generally dry in summer and autumn, except for some residual pool areas in natural landform	

Hydrological Cell	Water sources	Water Discharges	Morphology	Watering regime	Habitat
Seaford South					
SSW1	Numerous inlets in the form of high level surcharges from local drains to the west (most smaller events do not surcharge because they are intercepted by the James Street Pump Station system)	Via the Austin Road outlet (water levels are controlled by an outlet orifice in the southeast corner of SSW1 which allows pondage up to 0.3 m AHD or drainage down to 0.1 m AHD and is connected to the Austin Road outlet)	Constructed within the former floodplain in 1989 and is the lowest point in the Seaford system	During winter and spring, water levels are generally maintained at 0.18 – 0.35 m AHD by the outlet orifice to Austin Road outlet	Highly saline and impacted by acid sulphate oxidation (low pH)
		A higher level overflow weir to SSW3 on the southern side of the cell is set at 0.5 m AHD	Excavation has intercepted the sub-stratum of the wetland	During summer and autumn, water levels will be maintained at 0.25-0.30 m AHD by base flows	Limited productivity and lower diversity of flora and fauna due to
			Ponds to 0.35 m AHD and drains at 0.1 m AHD		Deep wetland used by a range of diving duck species
			SSW1 has an invert level of 0.08 m AHD and ranges from 0.00 (0.08 m AHD) to 0.68 (0.76 m AHD) m.		A saline water tolerant species of mosquito (*Aedes camphotrincus)* is a risk at higher salinities
SSE2	Fed by local drains to the east	Overflows to SSE4	Perched cell that has been leveed-off from the remainder of the Swamp to receive a fresher water regime in the centre of the Swamp	During winter and spring, water levels can reach 0.7 - 0.8 AHD	Semi-permanent wetland generally supports water of c. 3,000 us/cm, but can be fresher when local drains supply run-off
				In summer, this wetland generally dries to one or two residual pools at 0.3 m AHD	The cell has been colonised by Cumbungi
					The pool supports good habitat, especially for frogs
SSW3	From SSW1 via the overflow at 0.18 – 0.35 m AHD controlled by the outlet orifice to Austin Road outlet	The outlet control occurs at the Austin Road end and deliver water to the local drainage system via the Weatherstone Road Drain	Modified cell	During winter and spring, this cell operates at c. 0.45 m AHD by overflow weir on central pipe	The salinity of water in this cell is highly variable, but generally is above 20,000 us/cm
	From SSW1 via the higher level overflow weir at 0.5 m AHD	Variable crest regulator at 0.045 to 0.55 m AHD	SSW3 has an invert level of 0.21 m AHD and ranges from 0.00 m (0.21m AHD) to 0.66 m (0.87m AHD).	During summer and autumn, water levels hold to a pool height of 0.45 m AHD, or lower depending on event inflows and tidal back flooding	This cell is dominated by Common Reed
	This cell can receive tidal intrusion from Kananook Creek via the Bardia Avenue and Weatherstone Road Drain if the floodgate and pump system fail	If the flood gates on Kananook Creek get blocked, water backs-up and flows back into Seaford Wetlands (Paul Rees, Melbourne Water, pers. comm.)			This cell supports habitat for a variety of waterfowl
SSE4	Receives overflows from SCE2a	To drains in the southwest corner of the cell	Cell has two components: (i) the major component occurs adjacent to Francis Street and Austin Road; and (ii) a smaller component lies on the western side of SSE2	Only wet in winter when will hold to 0.45 -0.50 m AHD, but also responsive to water levels in SSW3	Ephemeral wetland
	From Stormwater drains to the east			During summer and autumn, this cell is generally dry, but will receive major flood inflows from Austin Road	Wetland dominated by halophytes, such as Salt Marsh Rush/Sea Rush (*Juncus kraussii*)
	Receives major flood inflows from Austin Road				

*Not currently part of the Ramsar site

Appendix 8 The risk assessment for threats at Edithvale-Seaford Wetlands Ramsar Site.

The risk assessment process adopted for this project is consistent with the ISO 31000:2009, Risk management – Principles and guidelines and the Standards Australia Handbook: Environmental risk management - principles and process (HB 203-2000; Standards Australia and Standards New Zealand 2006). The risk assessment approach follows a structured and iterative process, with the following steps:

4. Establish the context – existing values and environmental conditions;
5. Identify risks – threats and associated potential impacts; and
6. Analyse risks – assign likelihoods and consequences to determine level of risk

Establishing the context

A review of existing published and unpublished information relevant to the Edithvale-Seaford Wetlands Ramsar Site was undertaken to identify and summarise the important environmental, social and cultural values; current condition and potential threats to ecological character.

The risk assessment was based on a desktop review of existing information, supplemented by stakeholder knowledge; the latter gained through a stakeholder workshop and site visit.

Identifying risks

The approach uses a hierarchical process to identify potential risks as follows:

- Pressures – activities in the Edithvale-Seaford Wetlands or surrounding area that could affect ecological character
- Stressors – the physical or chemical changes that could arise as a result of an activity
- Effects – the potential responses caused by the stressors.

This allows for clear identification of the underlying causes of risks and threats to ecological character of the Ramsar site, separating the threat from the impact.

Analyse risks

Impact pathways were developed that integrated each level of the hierarchy and these formed the basis of a formal risk analysis process. Likelihood and consequence were assigned to each **impact pathway** in its entirety. See below for an example for an impact pathway:

Pressures	Stressors	Impact
Pollution: Urban stormwater	Increased toxicants	Impacts waterbirds

Likelihood and consequence descriptions used in this assessment are provided in Table 19 and Table 20, respectively, with the risk matrix (Table 21) showing how they combine to score the overall risk. A number of ground rules for the risk assessment were established:

- The risk assessment was focussed on assessing risks to ecological character over the next 15 years.
- In assessing each impact pathway all likely future changes (population, land use, climate change) were considered.
- Where possible all decisions were based on multiple lines of evidence (Table 22).

Table 19 Likelihood

Almost certain	Likely	Possible	Unlikely	Rare
Is expected to occur in most circumstances	Will probably occur in most circumstances	Could occur	Could occur but not expected	Occurs only in exceptional circumstances

Table 20 Consequence

Category	Insignificant	Minor	Moderate	Major	Extreme
Habitat, communities and / or assemblages	Alteration or disturbance to habitat within natural variability. Less than 1% of the area of habitat affected or removed.	1 to 5% of the area of habitat affected in a major way or removed.	5 to 30% of the area of habitat affected in a major way or removed.	30 to 90% of the area of habitat affected in a major way or removed.	Greater than 90% of the area of habitat affected in a major way or removed.
Species and / or groups of species (including protected species)	Population size or behaviour may have changed but it is unlikely that there would be any detectable change outside natural variation / occurrence.	Detectable change to population size and / or behaviour, with no detectable effect on population viability (recruitment, breeding, recovery) or dynamics. Recovery in less than 1 year.	Detectable change to population size and / or behaviour, with no effect on population viability (recruitment, breeding, recovery) or dynamics. Recovery in 1 to 2 years	Detectable change to population size and / or behaviour, with an impact on population viability and or dynamics.	Local extinctions are imminent / immediate or population no longer viable.
Cultural /social	Short-term interruptions in recreational use (days) and perception as a high amenity place unaltered.	Recreational activities restricted and perceptions of amenity altered in a localised area for short-term (weeks)	Recreational activities restricted and perceptions of amenity altered in a localised area for medium term (months).	Long-term disruption to recreational activities and perceptions of amenity altered for 1- 5 years.	Long-term disruption to recreational activities and perceptions of amenity altered for > 5 years.

Table 21 Risk matrix

	Consequence					
	Category	**Insignificant**	**Minor**	**Moderate**	**Major**	**Extreme**
Likelihood	**Almost certain**	Negligible	Medium	High	Extreme	Extreme
	Likely	Negligible	Medium	Medium	High	Extreme
	Possible	Negligible	Low	Medium	High	High
	Unlikely	Negligible	Low	Low	Medium	Medium
	Rare	Negligible	Negligible	Negligible	Low	Medium

The risk assessment was undertaken by Jenny Hale (Ramsar specialist) and checked by Andrew McMahon.

Table 22 Risk assessment for the Edithvale-Seaford Wetlands Ramsar Site. Cells highlighted in blue provide a description of the pressure / stressor that is applicable to the relevant impact pathways below

Pressures	Stressors	Impact	Likelihood of impact	Consequence of impact	Risk	Evidence / comments
Pollution: urban stormwater	**Increased nutrients and sediments**					**The Edithvale-Seaford Wetlands are located within a highly urbanised area and the dominant water source for the system is stormwater and drainage water (SKM 2011). Urban water sources are known to be high in nutrient and sediment loads, particularly carried in the first flushes after heavy rainfall (ANZECC and ARMCANZ 2000). Monitoring of water column nutrient concentrations indicates eutrophic conditions at both Seaford and Edithvale Wetlands and periodic high turbidity (> 100 NTU) (Melbourne Water unpublished data). However, this is not surprising for urban wetlands receiving primarily stormwater inflows and there is no indication of a sustained rising trend. In addition, sediments and particulate nutrients are controlled by sediment traps at major drain inflows.**
Pollution: urban stormwater	Increased nutrients	Adversely impacts vegetation and habitat	Unlikely	Minor	Low	Temporary Australian wetlands are adapted to periods of high nutrients and the storage of nutrients in the sediment (McComb and Qiu 1998). It is likely that some species of emergent vegetation benefit from nutrient inflows.
Pollution: urban stormwater	Increased nutrients	Adversely impacts waterbird diversity and abundance	Unlikely	Minor	Low	Based on the number of waterbirds supported at highly eutrophic wetlands (e.g. Western Treatment Plant; Menkhorst et al. 2015) it does not seem likely that birds at the site are adversely impacted by increased nutrients and sediments and may even benefit from increased productivity.
Pollution: urban stormwater	Increased nutrients	Adversely impacts waterbird breeding	Unlikely	Minor	Low	As above
Pollution: urban stormwater	Increased nutrients	Adversely impacts threatened species (Australasian bittern and curlew sandpiper)	Unlikely	Minor	Low	As above
Pollution: urban stormwater	Increased nutrients	Adversely affects other fauna	Possible	Minor	Low	Although obligate aquatic species such as fish and amphibians may be more sensitive to changes in water quality. Australian fauna are adapted to temporary wetland systems that exhibit periodic eutrophic conditions.
Pollution: urban stormwater	Increased nutrients	Adversely affects wetland function (drainage and flood mitigation services)	Possible	Minor	Low	Increased sediments and sedimentation may result in a decline in storage capacity at the wetlands. This is currently managed with sediment traps that are periodically emptied to remove sediment.
Pollution: urban stormwater	Increased nutrients	Adversely affects recreation and amenity values	Possible	Minor	Low	Short term increases in odour or unsightly visible algal blooms may impact wetland users for short periods of time.
Pollution: urban stormwater	Increased nutrients	Adversely affects scientific and monitoring values	Rare	Negligible	Negligible	Possibly not even a plausible impact pathway.
Pollution: urban stormwater	Increased nutrients	Adversely affects cultural values	Possible	Minor	Low	Short term increases in odour or unsightly visible algal blooms may impact cultural values for short periods of time.
Pollution: urban stormwater	**Toxicants**					**Studies from elsewhere indicate that urban stormwater and drainage can contain be a source of a number of toxicants such as heavy metals, petroleum derivatives, herbicides and pesticides (Gobbel et al. 2007). Data collected by Melbourne Water from sediments and the water column indicate concentrations of toxicants within ANZECC trigger values, with occasional exceptions for mercury and Total recoverable hydrocarbons. Sediment traps are installed and have been proven effective elsewhere in reducing toxicant loads to urban wetlands (Birch et al. 2005).**
Pollution: urban stormwater	Toxicants	Adversely impacts vegetation and habitat	Unlikely	Minor	Low	Concentrations of toxicants are largely within guideline levels and unlikely to affect the growth of wetland vegetation. There is a small likelihood of a spill of herbicides, which could have a measurable, but short term impact.
Pollution: urban stormwater	Toxicants	Adversely impacts waterbird diversity and abundance	Unlikely	Minor	Low	Concentrations are likely too low to have a sustained impact.
Pollution: urban stormwater	Toxicants	Adversely impacts waterbird breeding	Unlikely	Minor	Low	Concentrations are likely too low to have a sustained impact.
Pollution: urban stormwater	Toxicants	Adversely impacts threatened species (Australasian bittern and curlew sandpiper)	Unlikely	Minor	Low	Concentrations are likely too low to have a sustained impact.
Pollution: urban stormwater	Toxicants	Adversely affects other fauna	Possible	Minor	Low	Amphibians are known to be highly sensitive to toxicants in their environment (Mann and Bidwell 1999; Mann et al. 2003). Higher likelihood score reflects this.
Pollution: urban stormwater	Toxicants	Adversely affects wetland function (drainage and flood mitigation services)	Rare	Negligible	Negligible	Not a plausible impact pathway.
Pollution: urban	Toxicants	Adversely affects recreation and	Rare	Minor	Negligible	Concentrations of toxicants are well below those for primary contact recreation (ANZECC and ARMCANZ 2000). Main impact

Pressures	Stressors	Impact	Likelihood of impact	Consequence of impact	Risk	Evidence / comments
stormwater		amenity values				would be from decreased amenity values through impacts to other biota.
Pollution: urban stormwater	Toxicants	Adversely affects scientific and monitoring values	Rare	Minor	Negligible	Not a plausible impact pathway.
Pollution: urban stormwater	Toxicants	Adversely affects cultural values	Rare	Minor	Negligible	As for recreational and amenity values.
Water management: urban stormwater	**Altered water regimes**					**An assessment of water regime requirements and current water regime at Edithvale-Seaford Wetlands indicated that Edithvale maintains an adequate water regime (except during extreme drought when it dries too quickly). The stability of the shallow wetlands at Seaford was, however, not ideal (SKM 2011). A capital works program was developed with construction of capital works in 2013. The site is now managed to slowly drawdown water levels during late spring and summer to both control invasive plants and provide habitat for shorebirds. The ability to manage water levels at the Ramsar sites is, however, limited. The site acts as flood mitigation and control for stormwater and is largely reliant on water inflows following heavy rainfall. Risks are assessed under the new management regime which includes the new infrastructure.**
Water management: urban stormwater	Altered water regimes	Adversely impacts vegetation and habitat	Likely	Moderate	Medium	Control of invasive plants and domination of the site by a few aggressive species has been an ongoing issue. It is likely that this will continue into the future given the limitations on water regime management at the site.
Water management: urban stormwater	Altered water regimes	Adversely impacts waterbird diversity and abundance	Possible	Moderate	Medium	Hydrology and vegetation type have been identified as the most important habitat components for supporting waterbirds at the Ramsar site (Tzaros and Silcocks 2004). Any changes to habitat are likely to affect waterbird abundance and diversity.
Water management: urban stormwater	Altered water regimes	Adversely impacts waterbird breeding	Possible	Moderate	Medium	Breeding of many species is tightly linked to duration of inundation. Any sudden drawdowns could affect waterbird breeding success.
Water management: urban stormwater	Altered water regimes	Adversely impacts threatened species (Australasian bittern and curlew sandpiper)	Possible	Moderate	Medium	These two wading species use shallow water feeding habitat that may be affected by altered water regimes and prolonged inundation or drying.
Water management: urban stormwater	Altered water regimes	Adversely affects other fauna	Possible	Moderate	Medium	Particularly important for obligate aquatic fauna, if drying occurs over long periods.
Water management: urban stormwater	Altered water regimes	Adversely affects wetland function (drainage and flood mitigation services)	Rare	Negligible	Negligible	Not a plausible pathway
Water management: urban stormwater	Altered water regimes	Adversely affects recreation and amenity values	Unlikely	Minor	Low	Wetland and other amenity values exist in both the presence and absence of water. It is possible that a fluctuating water regime provides educational opportunities about the importance and values of temporary wetland systems.
Water management: urban stormwater	Altered water regimes	Adversely affects scientific and monitoring values	Rare	Negligible	Negligible	Not a plausible pathway
Water management: urban stormwater	Altered water regimes	Adversely affects cultural values	Unlikely	Minor	Low	As above for amenity values.
Water management: urban stormwater	**Increased salinity**					**Prolonged drying results in saline water entering the system from groundwater (GHD 2006). There is also some concentration of salts in the system as wetlands dry. Water quality data from the site indicate periodic rises in salinity (linked to water regime) but no sustained trend over time (Melbourne Water unpublished data).**
Water management: urban stormwater	Increased salinity	Adversely impacts vegetation and habitat	Possible	Moderate	Medium	Has been known to lead to an increase in the invasive spiny rush at the site. Altered salinity could result in a decline in freshwater taxa at the expense of more salt tolerant species.
Water management: urban stormwater	Increased salinity	Adversely impacts waterbird diversity and abundance	Unlikely	Minor	Low	Most of the species that occur at the site can tolerate a wide range of salinity conditions. The main impact pathway would be from loss of habitat.
Water management: urban stormwater	Increased salinity	Adversely impacts waterbird breeding	Unlikely	Minor	Low	Breeding of many species is tightly linked to duration of inundation. Any sudden drawdowns could affect waterbird breeding success.
Water management: urban stormwater	Increased salinity	Adversely impacts threatened species (Australasian bittern and curlew sandpiper)	Likely	Major	High	Curlew sandpiper feeds in both saline and freshwater environments. The Australasian bittern, however, is a freshwater species and declines elsewhere have been recorded when systems became secondary salinised (Jaensch, 2004).
Water management: urban stormwater	Increased salinity	Adversely affects other fauna	Likely	Moderate	Medium	Particularly important for obligate aquatic fauna, such as frogs and fish that are not adapted to saline conditions, particularly if salinity exceeds species tolerances.
Water management: urban stormwater	Increased salinity	Adversely affects wetland function (drainage and flood mitigation services)	Rare	Negligible	Negligible	Not a plausible pathway

Pressures	Stressors	Impact	Likelihood of impact	Consequence of impact	Risk	Evidence / comments
Water management: urban stormwater	Increased salinity	Adversely affects recreation and amenity values	Possible	Minor	Low	Altered amenity values from altered vegetation, increasing saline conditions.
Water management: urban stormwater	Increased salinity	Adversely affects scientific and monitoring values	Rare	Negligible	Negligible	Not a plausible pathway
Water management: urban stormwater	Increased salinity	Adversely affects cultural values	Possible	Moderate	Medium	Altered cultural values from altered vegetation, increasing saline conditions.
Urban development and recreation	**Litter**					**Litter is a common occurrence in urban stormwater systems. Melbourne Water has installed litter traps to manage the problem and limit litter entering the wetlands.**
Urban development and recreation	Litter	Adversely impacts vegetation and habitat	Rare	Negligible	Negligible	Very low likelihood of impact on vegetation and habitat given the extent of litter at the site.
Urban development and recreation	Litter	Adversely impacts waterbird diversity and abundance	Unlikely	Moderate	Low	Entanglement is a problem for some birds and waterbirds are also susceptible to ingestion of litter and micro-plastics with effects on nutrition and toxicity reported (Sutherland et al. 2012).However, the level of litter is low, making for low likelihoods.
Urban development and recreation	Litter	Adversely impacts waterbird breeding	Unlikely	Moderate	Low	As above
Urban development and recreation	Litter	Adversely impacts threatened species (Australasian bittern and curlew sandpiper)	Unlikely	Moderate	Low	As above
Urban development and recreation	Litter	Adversely affects other fauna	Unlikely	Moderate	Low	As above
Urban development and recreation	Litter	Adversely affects wetland function (drainage and flood mitigation services)	Rare	Negligible	Negligible	Not a plausible pathway?
Urban development and recreation	Litter	Adversely affects recreation and amenity values	Possible	Minor	Low	Litter does not extend across the site, but localised build-ups at drains and traps are unsightly.
Urban development and recreation	Litter	Adversely affects scientific and monitoring values	Rare	Negligible	Negligible	Not a plausible impact pathway.
Urban development and recreation	Litter	Adversely affects cultural values	Possible	Moderate	Medium	As per amenity value impacts.
Disturbance of Acid Sulfate Soils (ASS)	**Acidity and liberation of heavy metals**					**Areas of ASS and Potential ASS are present in the Edithvale-Seaford Wetlands (O'Neill 2013). If disturbed due to prolonged drying of wetland areas or physical disturbance of the soil surface, then sulphuric acid is formed and can liberate metals from the sediments. Risks are associated with both acidification and the liberation of metals from the sediments (noting that sediment metal concentrations are generally low and within ANZECC sediment guidelines). Low pH (3–5) has been periodically recorded at Seaford Wetlands, but not Edithvale (Melbourne Water unpublished data). Melbourne Water has developed and implemented an ASS management plan (O'Neill 2013) to minimise risks associated with works in the wetlands.**
Disturbance ASS	Acidity and liberation of metals	Adversely impacts vegetation and habitat	Possible	Moderate	Medium	Acidity is a risk to a number of wetland plant species (Sammut et al. 1996). The management of ASS at the site mitigates the likelihood and extent of impacts.
Disturbance ASS	Acidity and liberation of metals	Adversely impacts waterbird diversity and abundance	Possible	Minor	Low	Unlikely to be directly impacted from acidity and low level metal release, but impacts may be felt through the food chain from effects on prey.
Disturbance ASS	Acidity and liberation of metals	Adversely impacts waterbird breeding	Possible	Minor	Low	As above
Disturbance ASS	Acidity and liberation of metals	Adversely impacts threatened species (Australasian bittern and curlew sandpiper)	Possible	Minor	Low	As above
Disturbance ASS	Acidity and liberation of metals	Adversely affects other fauna	Possible	Moderate	Medium	There is a high potential for disturbed acid sulfate soils to destroy eggs and resting/estivating stages of frogs, reptiles and macroinvertebrates (Fitzpatrick et al. 2008).
Disturbance ASS	Acidity and liberation of metals	Adversely affects wetland function (drainage and flood mitigation services)	Possible	Minor	Low	Not a plausible pathway?
Disturbance ASS	Acidity and liberation of metals	Adversely affects recreation and amenity values	Possible	Moderate	Medium	Disturbance of ASS can result in unsightly conditions and odours. Likely to persist only for short durations in localised areas.

Pressures	Stressors	Impact	Likelihood of impact	Consequence of impact	Risk	Evidence / comments
Disturbance ASS	Acidity and liberation of metals	Adversely affects scientific and monitoring values	Rare	Negligible	Negligible	Not a plausible pathway?
Disturbance ASS	Acidity and liberation of metals	Adversely affects cultural values	Possible	Moderate	Medium	As above for amenity values.
Invasive species	**Invasive native species: *Phragmites* and *Typha***					**Vegetation monitoring indicates that common reed has contracted from 2013 to 2015 in low lying areas at Seaford Wetlands, but expanded in other areas, reflecting water regime changes during and post Millennium drought (Greet 2015). Melbourne Water has committed significant resources to the management of common reed within the Ramsar site, having undertaken trials of different control methods and implemented a dedicated management program.**
Invasive species	Invasive native species: *Phragmites* and *Typha*	Adversely impacts vegetation and habitat	Likely	Major	High	This is actively managed by Melbourne Water and the risk has been assessed considering this intensive management regime.
Invasive species	Invasive native species: *Phragmites* and *Typha*	Adversely impacts waterbird diversity and abundance	Likely	Major	High	Impacts through altered habitat, particularly for birds that require open water or mudflats for foraging.
Invasive species	Invasive native species: *Phragmites* and *Typha*	Adversely impacts waterbird breeding	Possible	Minor	Low	Most waterbirds prefer the protective cover of reed beds for breeding, providing they're not overly dense.
Invasive species	Invasive native species: *Phragmites* and *Typha*	Adversely impacts threatened species (Australasian Bittern and Curlew Sandpiper)	Likely	Major	High	Australasian bittern requires cover of emergent vegetation, but density must be controlled to facilitate movement and hunting behaviours. Curlew sandpiper requires open mudflat habitat and control of emergent vegetation is essential.
Invasive species	Invasive native species: *Phragmites* and *Typha*	Adversely affects other fauna	Likely	Moderate	Medium	The mosaic of wetland habitats is important for diversity of fauna. Moves towards a monoculture of *Phragmites* would reduce the sites capacity to support a diversity of species.
Invasive species	Invasive native species: *Phragmites* and *Typha*	Adversely affects wetland function (drainage and flood mitigation services)	Likely	Major	High	Increases in plant biomass limit the wetlands storage capacity and increase the risk of localised flooding.
Invasive species	Invasive native species: *Phragmites* and *Typha*	Adversely affects recreation and amenity values	Possible	Moderate	Medium	The amenity values of the site would be diminished if the habitat mosaic including open water was no longer present and biodiversity values were reduced.
Invasive species	Invasive native species: *Phragmites* and *Typha*	Adversely affects scientific and monitoring values	Possible	Moderate	Medium	The scientific value of a less diverse site would be lower than a diverse one.
Invasive species	Invasive native species: *Phragmites* and *Typha*	Adversely affects cultural values	Possible	Moderate	Medium	As per amenity value impacts.
Invasive species	**Spiny rush (*Juncus acutus*)**					**Vegetation monitoring from 2013 to 2015 indicates that spiny rush cover has remained relatively stable over that period (Greet 2015). Melbourne Water has an active invasive plant control program that targets spiny rush (among other invasive species).**
Invasive species	Spiny rush (*Juncus acutus*)	Adversely impacts vegetation and habitat	Likely	Moderate	Medium	Although spiny rush is highly invasive it will be limited to salinised areas of the site.
Invasive species	Spiny rush (*Juncus acutus*)	Adversely impacts waterbird diversity and abundance	Likely	Minor	Medium	Related to loss of habitat values, however, providing the rush does not become too dense, and is limited to saline areas, it likely to be minor.
Invasive species	Spiny rush (*Juncus acutus*)	Adversely impacts waterbird breeding	Likely	Minor	Medium	As above
Invasive species	Spiny rush (*Juncus acutus*)	Adversely impacts threatened species (Australasian Bittern and Curlew Sandpiper)	Likely	Moderate	Medium	Australasian Bittern is unlikely to use the saline areas of the site. An expansion of spiny rush into mudflat habitat could impact the Curlew Sandpiper foraging habitat.
Invasive species	Spiny rush (*Juncus acutus*)	Adversely affects other fauna	Likely	Minor	Medium	Lower number of other fauna species using the saline areas of the site.
Invasive species	Spiny rush (*Juncus acutus*)	Adversely affects wetland function (drainage and flood mitigation services)	Unlikely	Minor	Low	Minor reductions in storage capacity possible.
Invasive species	Spiny rush (*Juncus acutus*)	Adversely affects recreation and amenity values	Possible	Minor	Low	As long as contained to small areas of salinised habitat, impact is small.
Invasive species	Spiny rush (*Juncus acutus*)	Adversely affects scientific and monitoring values	Possible	Negligible	Negligible	As long as contained to small areas of salinised habitat, impact is small.
Invasive species	Spiny rush (*Juncus*	Adversely affects cultural values	Possible	Minor	Low	As long as contained to small areas of salinised habitat, impact is small.

Pressures	Stressors	Impact	Likelihood of impact	Consequence of impact	Risk	Evidence / comments
	acutus)					
Invasive species	**Predators (foxes, cats and rats)**					**While there are no trend data available, foxes and cats are regularly observed during bird surveys at the Ramsar site (Silcocks et al. 2006, Silcocks 2013). Melbourne Water undertakes periodic pest control in Edithvale South. Kingston Council have been undertaking pest control near Edithvale North and Melbourne Water together with City of Frankston undertake pest control at Seaford.**
Invasive species	Predators (foxes, cats and rats)	Adversely impacts waterbird diversity and abundance	Almost certain	Moderate	High	Predation by foxes, cats and rats is a significant threat to foraging waterbirds, particularly waders that are not out on deep, open water.
Invasive species	Predators (foxes, cats and rats)	Adversely impacts waterbird breeding	Almost certain	Moderate	High	Nesting birds and eggs are vulnerable to predation.
Invasive species	Predators (foxes, cats and rats)	Adversely impacts threatened species (Australasian Bittern and Curlew Sandpiper)	Almost certain	Major	Extreme	The consequences of mortality of a few birds from small threatened populations are higher than for more common species.
Invasive species	Predators (foxes, cats and rats)	Adversely affects other fauna	Likely	Moderate	Medium	Other fauna at the site is also vulnerable to predation, but perhaps at lower risk than waterbirds.
Invasive species	**Native species: kangaroos**					**Recent surveys indicated a density of 1.8 kangaroos per hectare at Edithvale Wetlands. This is two to three times the sustainable population (Hynes 2015a). Melbourne Water has implemented control strategies.**
Invasive species	Native species: kangaroos	Adversely impacts vegetation and habitat	Possible	Minor	Low	Primary impact is through trampling not grazing and impact is low (Hynes 2015b).
Invasive species	Native species: kangaroos	Adversely affects recreation and amenity values	Possible	Minor	Low	Risk of injury from fleeing / disturbed kangaroos is minor as visitors to the wetland centre are low.
Invasive species	Native species: kangaroos	Adversely affects other fauna	Likely	Moderate	Medium	Impacts to bush birds, nesting birds and ground mammals are expected from grazing of terrestrial grasslands in the site (Hynes 2015b).
Invasive species	**Grazing animals (pigs, rabbits)**					**Rabbits are regularly observed within the site, and recently there has been evidence of a pig in the Seaford Wetlands. Melbourne Water undertakes pest control within the site.**
Invasive species	Grazing animals (pigs, rabbits)	Adversely impacts vegetation and habitat	Almost certain	Minor	Medium	While it is almost certain that rabbits (and the single pig) are grazing on vegetation, this is likely to be limited to dryland areas with respect to rabbits.
Invasive species	Grazing animals (pigs, rabbits)	Adversely impacts waterbird diversity and abundance	Possible	Minor	Low	Based on impacts to vegetation and habitat.
Invasive species	Grazing animals (pigs, rabbits)	Adversely impacts waterbird breeding	Possible	Minor	Low	Based on impacts to vegetation and habitat.
Invasive species	Grazing animals (pigs, rabbits)	Adversely impacts threatened species (Australasian Bittern and Curlew Sandpiper)	Possible	Minor	Low	Based on impacts to vegetation and habitat.
Invasive species	Grazing animals (pigs, rabbits)	Adversely affects other fauna	Possible	Minor	Low	Based on impacts to vegetation and habitat.
Invasive species	Grazing animals (pigs, rabbits)	Adversely affects wetland function (drainage and flood mitigation services)	Rare	Negligible	Negligible	Not a plausible pathway?
Invasive species	Grazing animals (pigs, rabbits)	Adversely affects recreation and amenity values	Unlikely	Minor	Low	Minor impacts to amenity value over small areas.
Invasive species	Grazing animals (pigs, rabbits)	Adversely affects scientific and monitoring values	Rare	Negligible	Negligible	Not a plausible pathway?
Invasive species	Grazing animals (pigs, rabbits)	Adversely affects cultural values	Unlikely	Minor	Low	Minor impacts to amenity value over small areas.
Recreational activities	**Human disturbance (noise and visual disturbance)**					**Edithvale-Seaford Wetlands are within an urban setting and there is ambient noise and visual disturbance from traffic and other surrounding urban activities, as well as from recreational users of the site, including those that use the site for casual walking, birdwatching and dog walking on- and off-leash. There is also increasing pressure to use the site for events (e.g. running events). The centre of the wetlands, however, has restricted access.**

Pressures	Stressors	Impact	Likelihood of impact	Consequence of impact	Risk	Evidence / comments
Recreational activities	Human disturbance (noise and visual disturbance)	Adversely impacts waterbird diversity and abundance	Possible	Moderate	Medium	Human presence impacts on shorebirds is well documented (e.g. Weston 2003; Weston and Elgar 2005 and 2007; Antos et al. 2007; Weston et al. 2012; Martin et al. 2015). For migratory shorebirds impacts may include displacement from foraging areas, reduced feeding and unnecessary energy use feared to impact birds abilities to successfully make the return journey to the northern hemisphere to breed. For breeding waterbirds, the disturbance may result in periods of reduced parental care and absences from the nest, exposing eggs or nestlings to increased risk of predation or weather effects potentially resulting in a lower chance of survivorship of young and reduced breeding success. Restricted access at the site reduces both the likelihood and magnitude of disturbance.
Recreational activities	Human disturbance (noise and visual disturbance)	Adversely impacts waterbird breeding	Possible	Moderate	Medium	As above.
Recreational activities	Human disturbance (noise and visual disturbance)	Adversely impacts threatened species (Australasian bittern and curlew sandpiper)	Possible	Moderate	Medium	As above.
Recreational activities	Human disturbance (noise and visual disturbance)	Adversely affects other fauna	Possible	Moderate	Medium	Other resident fauna are likely to be more habituated to urban environment and therefore less likely to be impacted by noise and visual disturbance in an urban setting than waterbirds.
Climate change						**Regional climate projections have recently been released by CSIRO for sub-cluster regions in Australia. The relevant region for Edithvale-Seaford Wetlands is "Southern Slopes Victoria West" http://www.climatechangeinaustralia.gov.au/en/climate-projections/future-climate/regional-climate-change-explorer/sub-clusters/?current=SSVWC&tooltip=true&popup=true. Of concern for the Ramsar site is the potential increased fire risk under hotter and drier conditions, the implications of sea level rise on Seaford Wetlands and altered water regimes in a future climate of more extreme rainfall events.**
Climate change	**Increased frequency / intensity of fire**					**The intensity and frequency of fires in south eastern Australia is predicted to rise under future climate predictions (Williams et al. 2013). The risk of unplanned fires will increase and it is likely that if commenced the fire would spread rapidly and burn the peat layer (Terramatrix 2013). Melbourne Water has a fire management plan in place. Terramatrix (2013) undertook a risk assessment for this pressure and stressor and those have been adapted to the consequence and likelihood tables used here.**
Climate change	Increased frequency / intensity of fire	Adversely impacts vegetation and habitat	Possible	Major	High	As per Terramatrix (2013).
Climate change	Increased frequency / intensity of fire	Adversely impacts waterbird diversity and abundance	Possible	Major	High	As per Terramatrix (2013).
Climate change	Increased frequency / intensity of fire	Adversely impacts waterbird breeding	Possible	Major	High	As per Terramatrix (2013).
Climate change	Increased frequency / intensity of fire	Adversely impacts threatened species (Australasian Bittern and Curlew Sandpiper)	Possible	Major	High	As per Terramatrix (2013).
Climate change	Increased frequency / intensity of fire	Adversely affects other fauna	Possible	Major	High	As per Terramatrix (2013).
Climate change	Increased frequency / intensity of fire	Adversely affects wetland function (drainage and flood mitigation services)	Possible	Minor	Low	As per Terramatrix (2013).
Climate change	Increased frequency / intensity of fire	Adversely affects recreation and amenity values	Unlikely	Major	Medium	As per Terramatrix (2013).
Climate change	Increased frequency / intensity of fire	Adversely affects scientific and monitoring values	Rare	Minor	Negligible	As per Terramatrix (2013).
Climate change	Increased frequency / intensity of fire	Adversely affects cultural values	Unlikely	Major	Medium	As per Terramatrix (2013).
Climate change	**Sea level rise**					**Sea levels are predicted to increase by 0.08 to 0.18 m by 2030 with a very high degree of confidence (Grose et al. 2015). Local assessments indicate that sea water could rise up into the wetlands through connecting channels and rising groundwater over the period 2030 – 2070, substantially altering the character of the wetlands (DELWP 2015).**
Climate change	Sea level rise	Adversely impacts vegetation and habitat	Almost certain	Major	Extreme	Saline intrusion likely to transition habitat from freshwater to brackish and reed dominated to halophyte (saltmarsh) dominance, including potential expansion of Sea Rush, Shrubby Glasswort, and various halophytic herbs. Melbourne Water suggest that there

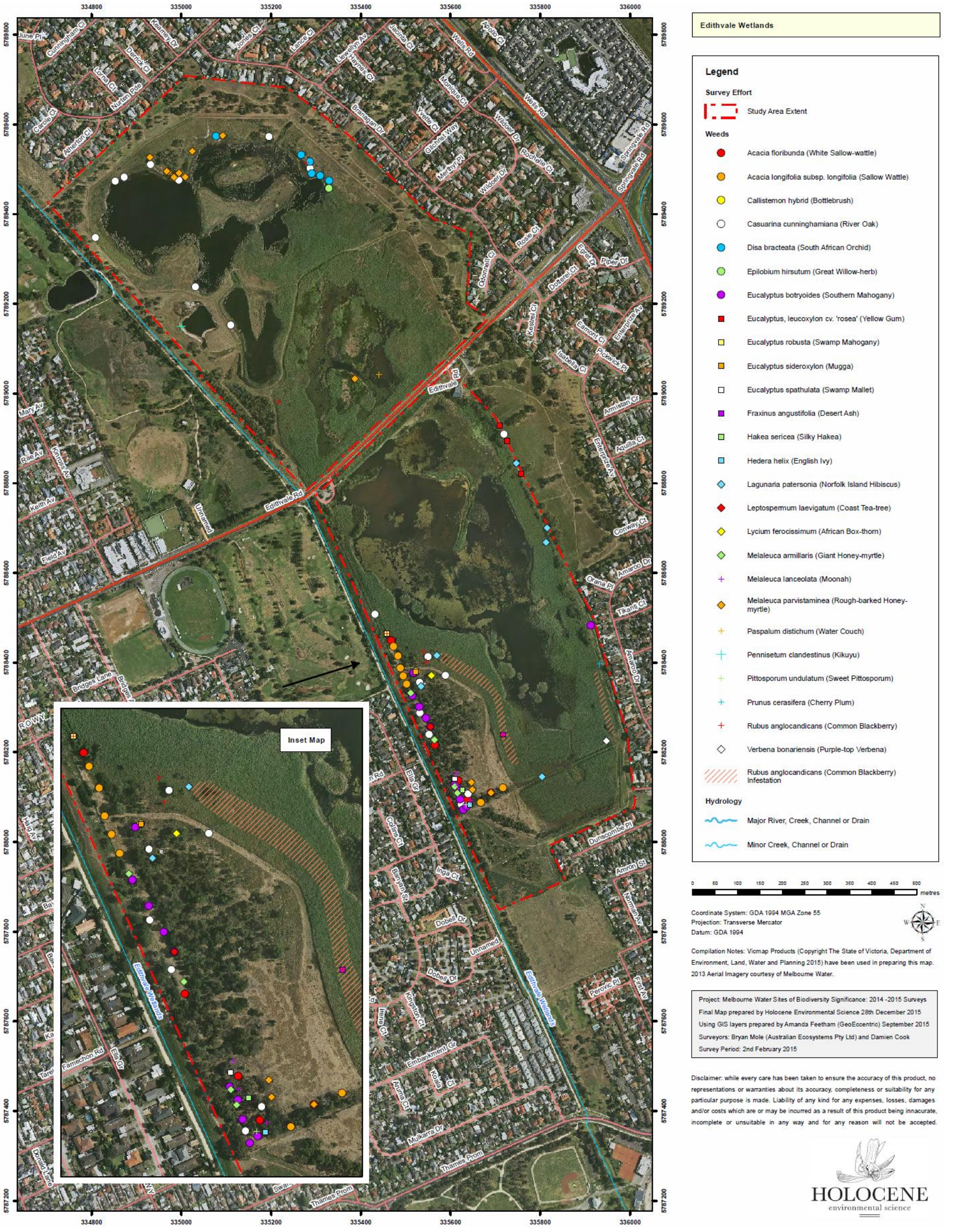
Pressures	Stressors	Impact	Likelihood of impact	Consequence of impact	Risk	Evidence / comments
						is greater potential to mitigate the impacts of sea level rise at Edithvale (feasible) than Seaford (much less feasible).
Climate change	Sea level rise	Adversely impacts waterbird diversity and abundance	Almost certain	Major	Extreme	Loss or much reduced breeding habitat for freshwater dependent species e.g. Australasian Bittern, Blue-billed Duck, Hardyheads and Baillon's Crake.
Climate change	Sea level rise	Adversely impacts waterbird breeding	Almost certain	Major	Extreme	Loss or much reduced breeding habitat for freshwater dependent waterbirds – as above.
Climate change	Sea level rise	Adversely impacts threatened species (Australasian bittern and curlew sandpiper)	Almost certain	Major	Extreme	Loss or much reduced habitat for Australasian Bittern, potentially neutral to low impact for Curlew Sandpiper.
Climate change	Sea level rise	Adversely affects other fauna	Almost certain	Major	Extreme	Loss or reduced habitat for seed-dependant passerines e.g. Little Grassbird, Australian Reed-warbler.
Climate change	Sea level rise	Adversely affects wetland function (drainage and flood mitigation services)	TBD	TBD	#N/A	Discuss implications with Melbourne Water.
Climate change	Sea level rise	Adversely affects recreation and amenity values	Possible	Minor	Low	Change in wetland character may have a minor impact on amenity values.
Climate change	Sea level rise	Adversely affects scientific and monitoring values	Likely	Moderate	Medium	Change in ecological character will diminish its value as a remnant of Carrum Swamp.
Climate change	Sea level rise	Adversely affects cultural values	Possible	Moderate	Medium	On-going change from its original state will likely reduce its cultural values.
Climate change	**Increased frequency & intensity of storms**					**Extreme events (storms and high rainfall events) are predicted to occur with high confidence (Grose et al. 2015). As the dominant water source at Edithvale-Seaford Wetlands is urban stormwater, it is likely that this will arrive less frequency, but with higher magnitudes.**
Climate change	Increased frequency & intensity of storms	Adversely impacts vegetation and habitat	Possible	Moderate	Medium	Storm surges (tides) with added wind force plus sea level rise is predicted to increase the area of tidal inundation (DELWP 2015) potentially damaging habitat and enhancing a trend of ecological change.
Climate change	Increased frequency & intensity of storms	Adversely impacts waterbird diversity and abundance	Possible	Moderate	Medium	Increased storms and flooding could reduce the wetlands role as a storm refuge/roosting habitat, further impacting on waterbirds.
Climate change	Increased frequency & intensity of storms	Adversely impacts waterbird breeding	Possible	Moderate	Medium	Increased spring-summer storms could impact on waterbird breeding.
Climate change	Increased frequency & intensity of storms	Adversely impacts threatened species (Australasian bittern and curlew sandpiper)	Possible	Moderate	Medium	Increased storms and tidal inundation would further impact on an already compromised habitat for Australasian Bittern. Storms would impact on the foraging capacity for migratory shorebirds.
Climate change	Increased frequency & intensity of storms	Adversely affects other fauna	Possible	Moderate	Medium	Storm damage to habitat would impact on most fauna.
Climate change	Increased frequency & intensity of storms	Adversely affects wetland function (drainage and flood mitigation services)	Possible	Major	High	Any information about whether this will go over capacity?
Climate change	Increased frequency & intensity of storms	Adversely affects recreation and amenity values	Possible	Moderate	Medium	Potential loss of amenity and recreation values due to storm damage.
Climate change	Increased frequency & intensity of storms	Adversely affects scientific and monitoring values	Possible	Moderate	Medium	Increased frequency of severe perturbations generally deleterious for scientific and monitoring values
Climate change	Increased frequency and intensity of storms (increased intensity of stormwater)	Adversely affects cultural values	Possible	Moderate	Medium	Potential change to land forms and geomorphological process.

Appendix 9 Works undertaken by Melbourne Water since the production of the last Ramsar Management Plan (KBR 2009).

Works	Melbourne Water/Company	Timeframe
Reports		
Hydrology / Enviro Water Requirements	SKM	from 2010 to 2011
Weeds and Overabundant Natives	Australian Ecosystems	2011
Bird Diversity and Abundance	Birds Australia	2010 and 2011
	BirdLife Australia	2013a, 2013b, 2015 and 2016
Kangaroo Management Plan	Ecoplan	2015
Kangaroo Control	VWSA	2016
Fire Management Plan (Seaford Wetlands)	Terramatrix	2013
In Progress		
Hydrology (Update REALM, Risk Assessment, and Operational Plan)	Jacobs	2014-current
Water Quality Review and Direction	Jacobs	2016
Habitat Hectare and trajectories	Australian Ecosystems	2015
Monitoring		
Birds and Frogs (frog calls only)	BirdLife Australia	Monthly from 2008-current
Frog Census	Volunteers	2012–2013
Bat Monitoring	Parsons Brinckerhoff	2009 and 2010
Kangaroo Count	Ecoplan	2013-2015
	VWSA	2016
Mosquitos	Ecowise	2008–2010,
	ALS	2011
	GHD	2012-current
Water Quality -	Waterwatch	from 2009 to2010,
	GHD	from 2011– current
Groundwater Monitoring	GHD	2014-current
Water Level	Thiess	from 2008–2012
	BirdLife Australia	from 2013-current
Weed Mapping	Australian Ecosystems	in 2011 and 2015
Habitat Hectares	Australian Ecosystems	in 2010 and 2015
Tall Marsh/*Phragmites* Mapping	Australian Ecosystems in and	2011
	Melbourne Water	2013
Vegetation Quadrats (Seaford)	University of Melbourne	from 2013 –current
Photo-points (Seaford)	Australian Ecosystems	in 2010
	University of Melbourne	from 2013– current
Photo-points (Edithvale)	Australian Ecosystems	in 2010
	Melbourne Water	in 2014
Capital Works		
Edithvale Education Centre	Melbourne Water	2011

Works	Melbourne Water/Company	Timeframe
Upgrade to Edithvale South Wetlands Bird Hide	Friends of Edithvale-Seaford Wetlands	2016
Seaford Hydrology Works –	Melbourne Water	from 2011 to 2014
Weed Removal and Revegetation of Seaford (east)	Melbourne Water	from 2008–2010
Maintenance		
Weed Control – Edithvale	Melbourne Water	Monthly from 2008 by
Weed Control – Seaford	Melbourne Water	Monthly from 2008
	FCC	On-going
Pest Control	Melbourne Water contractor	2013 and 2015
Nest Box Clearing	Melbourne Water	2012/2013, 2013/2014 and 2014/2015
Kangaroo Management (Sterilisation)	VWSA	2009 and 2016
Mosquito Management (Spray or Briquettes) –	Melbourne Water	monthly and on-going from 2008
Grooming of *Phragmites* –	CSA	2011 to current
Desilting -	Melbourne Water	on-going and annual
Community		
ESW Community Liaison Committee (CLC)	CLC	Quarterly meetings on-going

Appendix 10 Mapping of weeds of management concern at Edithvale and Seaford Wetlands, undertaken by Australian Ecosystems (2016).



Seaford Wetlands

Legend

Survey Effort

- Study Area Extent

High Priority Weeds

- Acacia longifolia (Sallow Wattle)
- Chrysanthemoides monilifera (Boneseed)
- Coprosma repens (Mirror Bush)
- Juncus acutus (Spiny Rush)
- Lycium ferocissimum (African Box-thorn)
- Mesembryanthemum crystallinum (Common Ice Plant)
- Phytolacca octandra (Red-ink Weed)
- Pinus radiata (Radiata Pine)
- Pittosporum undulatum (Sweet Pittosporum)
- Rosa rubiginosa (Sweet Briar)
- Rubus anglocandicans (Common Blackberry)
- Salpichroa origanifolia (Pampas Lily-of-the-valley)
- Ulex europaeus (Gorse)
- Coprosma repens (Mirror Bush)
- Casuarina cunninghamiana (River Oak)
- Scattered Acacia longifolia (Sallow Wattle), Rubus anglocandicans (Common Blackberry) and Ulex europaeus (Gorse)
- Leptospermum laevigatum (Coast Tea-tree)

Hydrology

- Major River, Creek, Channel or Drain
- Minor Creek, Channel or Drain

Transportation

- Freeway

Transportation

- Highway
- Sealed Arterial Road
- Sealed Road

0 50 100 150 200 250 300 350 400 450 500 metres

Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994

Compilation Notes: Vicmap Products (Copyright The State of Victoria, Department of Environment, Land, Water and Planning 2015) have been used in preparing this map. 2013 Aerial Imagery courtesy of Melbourne Water.

Project: Melbourne Water Sites of Biodiversity Significance: 2014 -2015 Surveys
Final Map prepared by Holocene Environmental Science 28th December 2015
Using GIS layers prepared by Amanda Feetham (GeoEccentric) September 2015
Surveyors: Bryan Mole (Australian Ecosystems Pty Ltd) and Damien Cook
Survey Period: 3rd - 4th February 2015

HOLOCENE
environmental science

Appendix 11 Additional weed control and revegetation information.

Herbicide use

All herbicide usage must be in accordance with the following:

- All use of herbicides (and associated additives) will be in accordance with the product label. Off-label use of herbicides may be permitted where approval has been granted from a state government department (e.g. Department of Environment, Land, Water and Planning).
- Site-specific planning for herbicide use (application methods, chemicals used, weather conditions, plant phenology, etc.) will be employed to avoid off-target herbicide damage to indigenous vegetation. Off-target herbicide damage is the detrimental application of herbicide to plant species that have not been targeted for control. While this generally applies to plants in and around the point of herbicide application, it may also refer to organisms (flora and fauna) some distance away.

Revegetation / supplementary planting

The process of revegetation requires planning, documentation, implementation, monitoring and maintenance, all of which are essential in ensuring success. Each of these stages is discussed below in relation to the reserve. More information can also be found in *Melbourne Water Provenance Policy*, *Melbourne Water Standard for Plant Installation* and *Melbourne Water Standard for Plant Supply* (Melbourne Water 2013c, 2014a, b, respectively).

Appendix 12 Plant species suitable for revegetation in the various habitat types of Edithvale-Seaford Wetlands Ramsar Site (brackish wetlands, freshwater wetlands, Swamp Scrub and Damp Sands Herb-rich Woodland).

Key:

Structural role

- A Structural dominant of the vegetation stratum
- B Localised structural co-dominant in vegetation stratum
- C Scattered thinly or discontinuously as small groups or isolated individuals with low overall cover

Planting zone (wetlands only)

- 1 Seasonally wet margins to permanently moist; shallow seasonal inundation in lower part of zone
- 2 Shallow inundation; minimum depth of inundation c. 10 cm; amphibious and emergent aquatic herbs, some
- 3 Permanent water; submergent and emergent aquatic-herbs, some straddling Zones 2 and 3

Freshwater Wetlands

Scientific Name	Common Name	Structural role	Planting zone
Grasses and graminoids			
Alisma plantago-aquatica	Water Plantain	C	2
Amphibromus fluitans	River Swamp Wallaby-grass	C	1, 2
Baumea arthrophylla	Fine Twig-sedge	A	2
Baumea articulata	Jointed Twig-sedge	C	2
Bolboschoenus medianus	Marsh Club-sedge	C	1, 2
Cladium procerum	Leafy Twig-rush	C	2
Cycnogeton procerum (broad erect leaves)	Water Ribbons	B	2
Eleocharis acuta	Common Spike-sedge	B	1, 2
Eleocharis sphacelata	Tall Spike-sedge	A	3
Juncus amabilis	Hollow Rush	B	1
Juncus australis	Austral Rush	B	1
Juncus holoschoenus	Joint-leaf Rush	C	1
Juncus pallidus	Pale Rush	C	1
Juncus pauciflorus	Loose-flower Rush	C	1
Juncus procerus	Tall Rush	C	1, 2
Potamogeton cheesemanii	Small-fruit Pondweed	C	2, 3
Potamogeton crispus	Curly Pondweed	C	3
Potamogeton ochreatus	Blunt Pondweed	C	3
Schoenoplectus tabernaemontani	River Club-sedge	B	3
Schoenus brevifolius	Zig-zag Bog-sedge	C	1
Stuckenia pectinata	Fennel Pondweed	C	3
Triglochin striata	Streaked Arrowgrass	C	1, 2
Vallisneria australis	Eel Grass	C	3
Dicot herbs			
Centella cordifolia	Centella	B	1
Crassula helmsii	Swamp Crassula	C	1, 2
Epilobium billardierianum ssp. billardierianum	Smooth Willow-herb	C	1
Epilobium billardierianum ssp. cinereum	Grey Willow-herb	C	1
Epilobium hirtigerum	Hairy Willow-herb	C	1
Lilaeopsis polyantha	Australian Lilaeopsis	B	2

Scientific Name	Common Name	Structural role	Planting zone
Liparophyllum exaltatum	Erect Marsh-flower	C	2, 3
Lobelia anceps	Angled Lobelia	C	1, 2
Lycopus australis	Australian Gipsywort	C	1, 2
Lythrum hyssopifolia	Small Loosestrife	C	1, 2
Myriophyllum caput-medusae	Coarse Water-milfoil	C	3
Myriophyllum crispatum	Upright Water-milfoil	C	2, 3
Myriophyllum simulans	Amphibious Water-milfoil	b	2
Ornduffia reniformis	Running Marsh-flower	C	2, 3
Ottelia ovalifolia	Swamp Lily	C	2, 3
Persicaria decipiens	Slender Knotweed	C	
Philydrum lanuginosum	Woolly Waterlily	C	1
Selliera radicans	Shiny Swamp-mat	B	1

Brackish Wetlands

Scientific Name	Common Name	Structural role	Planting zone
Grasses and graminoids			
Baumea arthrophylla	Fine Twig-sedge	C	2
Baumea articulata	Jointed Twig-sedge	C	2
Baumea juncea	Bare Twig-sedge	C	1
Bolboschoenus caldwellii	Salt Club-sedge	B	1, 2
Cladium procerum	Leafy Twig-rush	C	2
Cycnogeton procerum (broad erect leaves)	Water Ribbons	C	2
Distichlis distichophylla	Australian Salt-grass	B	1
Eleocharis acuta	Common Spike-sedge	A	1, 2
Juncus kraussii ssp. australiensis	Sea Rush	A	1, 2
Juncus pallidus	Pale Rush	C	1, 2
Poa poiformis var. poiformis	Coast Tussock-grass	C	1
Potamogeton crispus	Curly Pondweed	C	3
Potamogeton ochreatus	Blunt Pondweed	C	3
Stuckenia pectinata	Fennel Pondweed	B	3
Schoenoplectus tabernaemontani	River Club-sedge	C	3
Triglochin striata	Streaked Arrowgrass	A	1, 2
Dicot herbs			
Apium prostratum ssp. prostratum	Sea Celery	C	1
Chenopodium glaucum	Glaucous Goosefoot	C	1
Crassula helmsii	Swamp Crassula	C	1, 2
Disphyma crassifolium ssp. clavellatum	Rounded Noon-flower	C	1
Lilaeopsis polyantha	Australian Lilaeopsis	B	1
Lobelia anceps	Angled Lobelia	B	1
Thyridia repens	Creeping Monkey-flower	B	1, 2
Myriophyllum salsugineum	Lake Water-milfoil	B	3

Scientific Name	Common Name	Structural role	Planting zone
Myriophyllum verrucosum	Red Water-milfoil	C	2, 3
Samolus repens	Creeping Brookweed	C	1, 2
Selliera radicans	Shiny Swamp-mat	A	1, 2

Swamp Scrub

Scientific name	Common name	Structural role	Notes
Trees			
Acacia melanoxylon	Blackwood	B	
Eucalyptus camaldulensis	River Red-gum	C	
Eucalyptus ovata var. ovata	Swamp Gum	C	
Shrubs			
Acacia stricta	Hop Wattle	C	
Acacia verticillata	Prickly Moses	B	
Bursaria spinosa ssp. spinosa	Sweet Bursaria	C	
Cassinia aculeata	Common Cassinia	C	
Goodenia ovata	Hop Goodenia	B	
Hakea nodosa	Yellow Hakea	C	
Leptospermum lanigerum	Woolly Tea-tree	B	
Leptospermum scoparium	Manuka	B	
Melaleuca ericifolia	Swamp Paperbark	A	
Melaleuca squarrosa	Scented Paperbark	C	
Ozothamnus ferrugineus	Tree Everlasting	B	
Ozothamnus rosmarinifolius	Rosemary Everlasting	C	
Rhagodia candolleana ssp. candolleana	Seaberry Saltbush	C	
Rubus parvifolius	Small-leaf Bramble	B	
Viminaria juncea	Golden Spray	C	
Grasses and graminoids			
Apodasmia brownii	Coarse Twine-rush	C	
Baumea arthrophylla	Fine Twig-sedge	C	Permanently moist soils
Baumea articulata	Jointed Twig-sedge	C	Permanently moist soils
Baumea juncea	Bare Twig-sedge	C	
Carex appressa	Tall Sedge	B	Seasonally moist soils
Carex fascicularis	Tassel Sedge	C	Permanently moist soils
Carex gaudichaudiana	Fen Sedge	C	Seasonally moist soils
Carex tereticaulis	Hollow Sedge	C	Seasonally moist soils
Chorizandra australis	Heron Bristle-sedge	C	Permanently moist soils
Cladium procerum	Leafy Twig-rush	C	Permanently moist soils
Cycnogeton procerum (broad erect leaves)	Water Ribbons	B	Permanently moist soils
Cyperus lucidus	Leafy Flat Sedge	C	Permanently moist soils
Distichlis distichophylla	Australian Salt-grass	C	Brackish environments
Empodisma minus	Spreading Rope-rush	C	
Gahnia radula	Thatch Saw-sedge	C	
Gahnia sieberiana	Red-fruit Saw-sedge	B	
Gahnia trifida	Coast Saw-sedge	C	Brackish environments
Gleichenia microphylla	Scrambling Coral-fern	C	
Hemarthria uncinata var. uncinata	Mat Grass	C	

Scientific name	Common name	Structural role	Notes
Juncus amabilis	Hollow Rush	B	Seasonally moist soils
Juncus australis	Austral Rush	B	Seasonally moist soils
Juncus flavidus	Gold Rush	C	
Juncus holoschoenus	Joint-leaf Rush	C	Seasonally moist soils
Juncus kraussii ssp. australiensis	Sea Rush	C	Brackish environments
Juncus pallidus	Pale Rush	C	Seasonally moist soils
Juncus pauciflorus	Loose-flower Rush	C	Seasonally moist soils
Juncus procerus	Tall Rush	C	Permanently moist soils
Lepidosperma longitudinale	Pithy Sword-sedge	C	Moist soils
Lepyrodia muelleri	Common Scale-rush	C	Moist soils
Lomandra longifolia ssp. longifolia	Spiny-headed Mat-rush	C	
Poa labillardierei var. labillardierei	Common Tussock-grass	C	
Schoenus brevifolius	Zig-zag Bog-sedge	C	Moist soils
Schoenus lepidosperma	Slender Bog-sedge	C	
Other (dicot herbs, scramblers/climbers, ferns)			
Acaena novae-zelandiae	Bidgee-widgee	B	
Clematis microphylla	Small-leaved Clematis	C	
Lycopus australis	Australian Gipsywort	C	Permanently moist soils
Pteridium esculentum	Austral Bracken	C	
Pteris tremula	Tender Brake	C	
Tetragonia implexicoma	Bower Spinach	C	

Damp Sands Herb-rich Woodland

Scientific name	Common name	Structural role
Trees		
Acacia mearnsii	Black Wattle	C
Acacia melanoxylon	Blackwood	B
Allocasuarina littoralis	Black Sheoak	B
Allocasuarina verticillata	Drooping Sheoak	C
Banksia integrifolia ssp. integrifolia	Coast Banksia	B
Eucalyptus camaldulensis	River Red-gum	C
Eucalyptus ovata var. ovata	Swamp Gum	C
Eucalyptus radiata ssp. radiata	Narrow-leaf Peppermint	C
Eucalyptus viminalis ssp. pryoriana	Coast Manna-gum	A
Shrubs		
Acacia oxycedrus	Spike Wattle	C
Acacia paradoxa	Hedge Wattle	C
Acacia stricta	Hop Wattle	C
Acacia suaveolens	Sweet Wattle	C
Acacia ulicifolia	Juniper Wattle	C
Allocasuarina paradoxa	Green Sheoak	C
Amperea xiphoclada var. xiphoclada	Broom Spurge	C
Aotus ericoides	Common Aotus	C
Banksia marginata	Silver Banksia	B
Bossiaea cinerea	Showy Bossiaea	B
Bursaria spinosa ssp. spinosa	Sweet Bursaria	B
Cassinia aculeata	Common Cassinia	C
Correa reflexa var. reflexa	Common Correa	B

Scientific name	Common name	Structural role
Dillwynia glaberrima	Smooth Parrot-pea	C
Dillwynia sericea s.l.	Showy Parrot-pea	C
Epacris impressa	Common Heath	B
Indigofera australis	Austral Indigo	C
Leptospermum myrsinoides	Heath Tea-tree	B
Leptospermum scoparium	Manuka	B
Leucopogon ericoides	Pink Beard-heath	C
Leucopogon virgatus var. virgatus	Common Beard-heath	B
Monotoca scoparia	Prickly Broom-heath	C
Olearia lirata	Snowy Daisy-bush	C
Olearia ramulosa	Twiggy Daisy-bush	C
Ozothamnus ferrugineus	Tree Everlasting	C
Persoonia juniperina	Prickly Geebung	C
Platylobium obtusangulum	Common Flat-pea	C
Ricinocarpos pinifolius	Wedding Bush	C
Grasses and graminoids		
Apodasmia brownii	Coarse Twine-rush	C
Gahnia radula	Thatch Saw-sedge	C
Hemarthria uncinata var. uncinata	Mat Grass	C
Lomandra longifolia ssp. longifolia	Spiny-headed Mat-rush	C
Poa labillardierei var. labillardierei	Common Tussock-grass	C
Poa sieberiana var. sieberiana	Grey Tussock-grass	C
Other (dicot herbs, scramblers/climbers, ferns)		
Acaena novae-zelandiae	Bidgee-widgee	B
Dianella brevicaulis	Small-flower Flax-lily	C
Clematis microphylla	Small-leaved Clematis	C
Pteridium esculentum	Austral Bracken	C

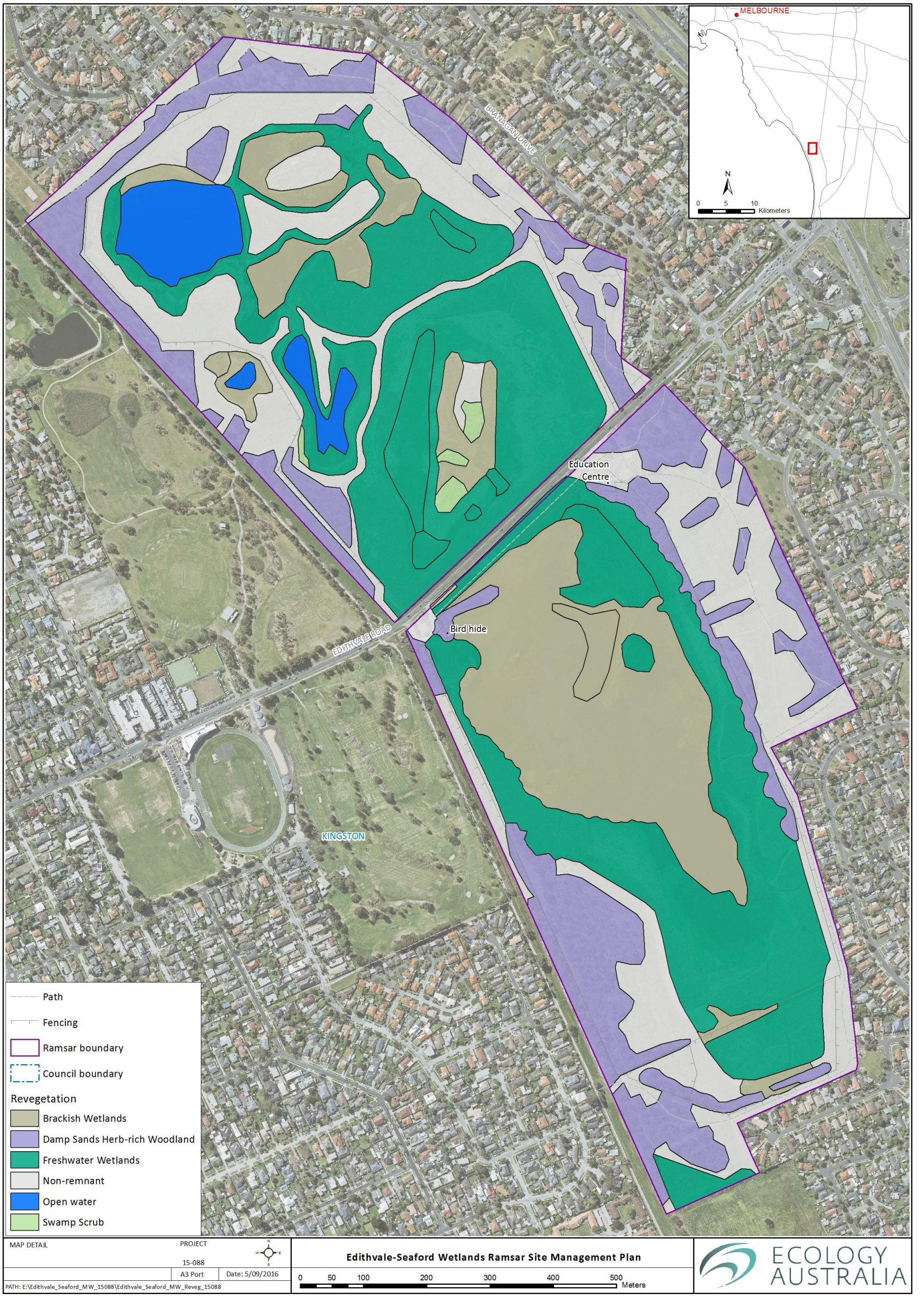


Figure 18Edithvale Wetlands revegetation zones.

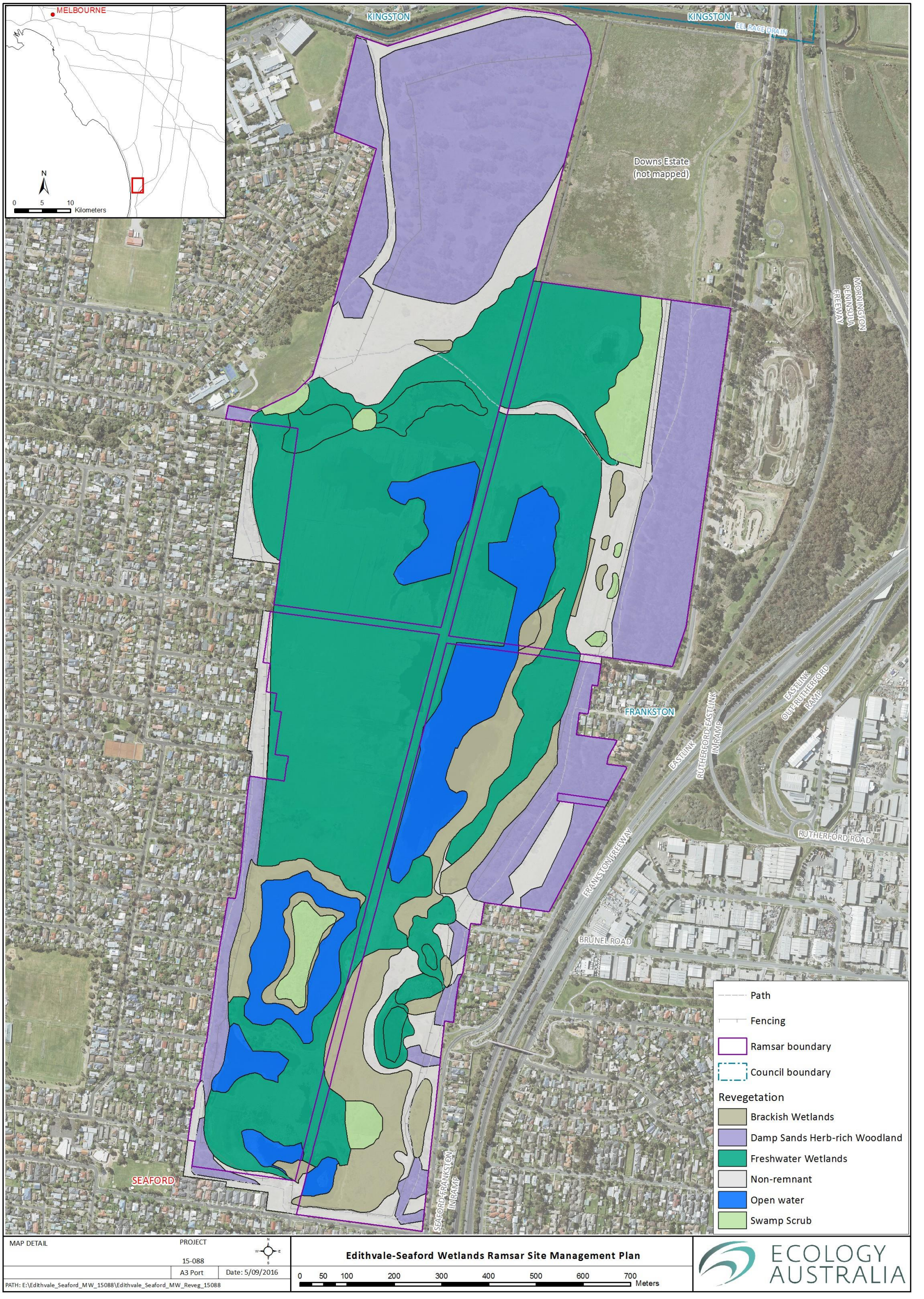
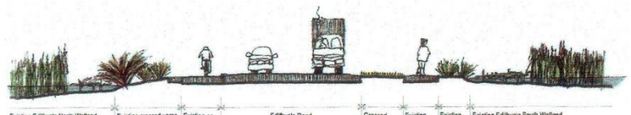


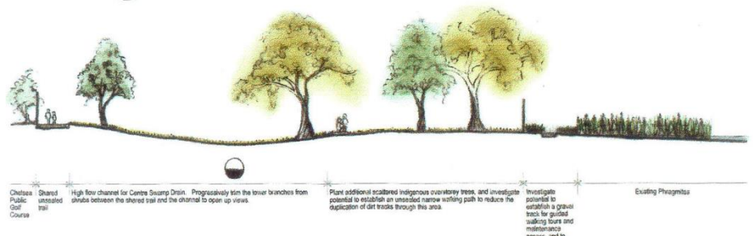
Figure 19Seaford Wetlands revegetation zones.

Appendix 13 Revegetation prescriptions for Edithvale-Seaford Wetlands from TBLA and Australian Ecosystems (2005).

The Edithvale-Seaford Wetlands Revegetation Prescriptions (TBLD and Australian Ecosystems 2005) provides a detailed revegetation strategy for Edithvale-SeafordWetlands. This information is still useful and for the most part relevant. The figures illustrating the details of the revegetation prescriptions are provided below (TBLD and Australian Ecosystems 2005).

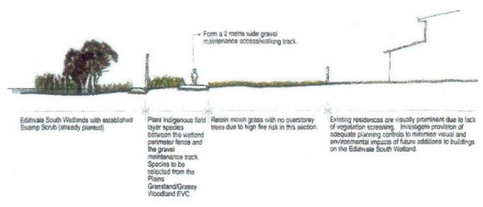


1 SKETCH SECTION THROUGH LANDSCAPE ZONE A
Edithvale Road
Not to Scale



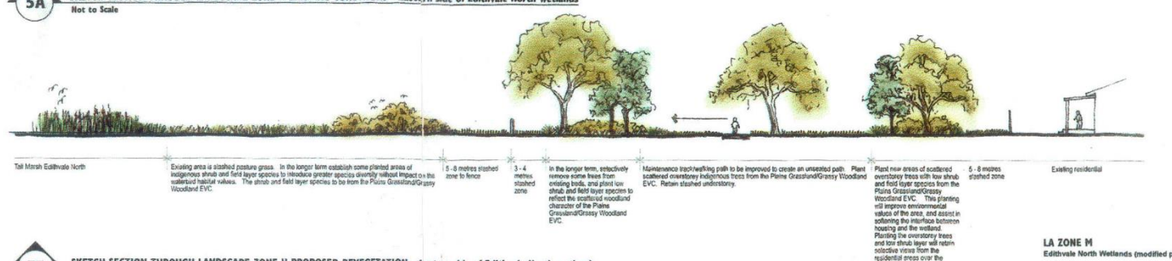
2 SKETCH SECTION THROUGH LANDSCAPE ZONE B EDITHVALE SOUTH
Adjacent to Chelsea Public Golf Course
Not to Scale

3 SKETCH SECTION THROUGH LANDSCAPE ZONE C
Shared trail adjacent to residential properties
Not to Scale

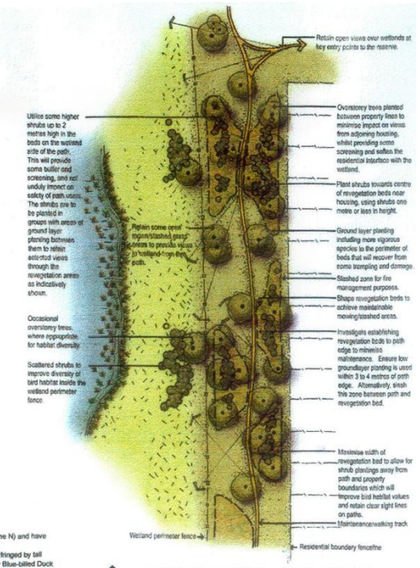


4 SKETCH SECTION THROUGH LANDSCAPE ZONE F
Adjacent to residential properties
Not to Scale

5A SKETCH SECTION THROUGH LANDSCAPE ZONE H EXISTING CONDITIONS - Eastern side of Edithvale North wetlands
Not to Scale



5B SKETCH SECTION THROUGH LANDSCAPE ZONE H PROPOSED REVEGETATION - Eastern side of Edithvale North wetlands
Not to Scale



6 INDICATIVE PLAN VIEW OF PROPOSED REVEGETATION TO TERRESTRIAL AREAS IN LA ZONES H, I AND J
Not to Scale

LA ZONE A
Edithvale Road

Existing conditions
- Edithvale Road crosses the wetland and is the most accessible point to Edithvale Wetlands. The road links the Nepean Highway with Wells Road and Mornington Peninsula Freeway and carries significant volumes of traffic.
- Avifauna habitat values are negligible in this zone due to the presence of Edithvale Road (Birds Australia, 2004).
- Stands of *Phragmites* fringe the road and form an excellent buffer between Edithvale Road and Edithvale North and South Wetlands.

Revegetation Prescription Aims for LA Zone A
- Retain the function of vegetation in this zone as a buffer between Edithvale Road and the wetlands.
- Reduce the impact of weeds invading the wetland from the road reserve
- Improve the visual presentation of the wetlands along Edithvale Road in recognition of this as the main visitor entry point to the wetlands.

LA ZONE B
Western boundary between Chelsea Public Golf Course and Edithvale South

Existing Conditions
- The main unsealed shared trail traverses north south through this zone directly adjacent to the two metre plus high cyclone mesh fencing to Chelsea Public Golf Course. Melbourne Water own Chelsea Public Golf course.
- Threatened or notable bird species seen in this zone include Flame Robins, liking the open and short grassy conditions (Birds Australia, 2004).
- Some scattered trees break up the linearity of the high flow channel and fenceline, and provide some shade for path users.

Revegetation Prescription Aims for LA Zone B
- Establish additional indigenous overstorey trees to improve the bird habitat values and the landscape values.

LA ZONE C
Western residential interface to Edithvale South

Existing Conditions
- Rear boundary fencelines are visually dominant, with mown grass only between the edge of path and fences.
- A more informal walking track has been established east of Centre Swamp drain. This area contains scattered overstorey trees, external to the wetland, which provide shade and may be used in preference to main trail by pedestrians due to poor shading and amenity values of the main path.
- Threatened or notable bird species seen in this zone include Flame Robins, liking the open and short grassy conditions (Birds Australia, 2004).

Revegetation Prescription Aims for LA Zone C
- Establish additional indigenous overstorey trees to improve the landscape values and additional screening between residential housing and the wetlands.

LA ZONE D
Western side of Edithvale South with existing overstorey trees

Existing conditions
- Predominantly scattered indigenous overstorey trees including Swamp Gum and Red Gum, and grazed pasture grass understorey. A mob of approximately 40 kangaroos are present in this area of the wetlands. This is the only large dryland area within the wetland boundary fenceline with stands of established trees.
- This area provides good habitat for field birds and raptors as it is recognised as providing the most extensive area of trees in Edithvale Wetlands. Threatened/notable species include Barn Owl and Fan-tailed Cuckoo (Birds Australia, 2004).

Revegetation Prescription Aims for LA Zone D
- Increase the presence of scattered shrubs as understorey to improve avifauna habitat values in this area.
- Recognise and protect this area as the largest stand of native/indigenous trees adjacent to Edithvale Wetlands.

LA ZONE E
South-western end of Edithvale South

Existing Conditions
- Open grassed area with no planting outside of the wetland fence.
- Bird habitat values not specifically noted.

Revegetation Prescription Aims for LA Zone E
- Increase and expand the Plains Grassland/Grassy Woodland vegetation community adjacent to Edithvale Wetlands.

LA ZONE F
Residential interface to south-eastern side of Edithvale South Wetland

Existing Conditions
- Unsealed informal maintenance and pedestrian access path outside wetland perimeter fence.
- The bird habitat values in this zone are low outside the wetland perimeter fence. Inside the wetland perimeter fence the values include the fringing Tall Marsh vegetation which is favoured by species such as the Clamorous Reed-Warblers and Golden-headed Cisticolas (Birds Australia, 2004).

Revegetation Prescription Aims for LA Zone F
- Retain the open character of this zone with no overstorey trees for wildfire management purposes.
- Decrease the impact of weeds from this zone into the wetland, particularly Kikuyu.

LA ZONE G
Open area adjoining the eastern boundary of Edithvale South Wetlands

Existing Conditions
- Open grassed area with scattered planting areas of overstorey trees (individual species not determined).
- Bird habitat values in this zone are negligible.

Revegetation Prescription Aims for LA Zone G
- Expand the habitat diversity adjacent to the wetland with scattered open woodland vegetation.
- Improve community interest and ownership of the wetland through appropriate integration of open space and environmental values.
- Explore opportunities to utilise this area for pre-treatment of stormwater inputs to the wetlands.

LA ZONE H
Eastern interface of Edithvale North with Branagan Drive from Edithvale Road north to Llewellyn Avenue

Existing conditions
- Width of the zone varies, but is generally between 30 to 40 metres.
- Revegetation areas have been established in scattered clumps between residential properties and the wetland.
- This area is noted as being dominated by introduced bird species including the Common Myna, Common Starling and Spotted Turtle-Dove. The residential land use is the primary influence on this along with the vegetation style and type (Birds Australia, 2004).

Revegetation Prescription Aims for LA Zone H
- Plant additional indigenous vegetation reflective of the Plains Grassland/Grassy Woodland EVC character in this zone.
- Improve the shrub and field layer species in the existing and new planting areas to improve habitat diversity.
- Retain selective view sheds over the wetlands from adjoining properties and council open space reserves.

LA ZONE I
North-eastern interface of Edithvale North extending from Llewellyn Avenue open space reserve, north west to Nurten Parade.

Existing conditions
- Reserve between wetland fence and residential properties widens to approximately 80 metres in width.
- Bird habitat values are similar to those described in LA Zone H.

Revegetation Prescription Aims for LA Zone I
- Plant additional indigenous vegetation reflective of the Plains Grassland/Grassy Woodland EVC character in this zone.
- Improve the shrub and field layer species in the existing and new planting areas to improve habitat diversity.
- Retain selective view sheds over the wetlands from adjoining properties and council open space reserves.

LA ZONE J
North-western interface of Edithvale North adjacent to Atherton Close

Existing conditions
- Reserve between wetland perimeter fence and residential properties is approximately 30 to 40 metres wide. The lack of existing vegetation between housing and the wetland increases their visual prominence, impact on wetland habitat values and visitor amenity values on the existing maintenance access track.
- The bird habitat values are similar to those described in LA Zone I, although there is generally a lack of indigenous overstorey vegetation at all through this zone.

Revegetation Prescription Aims for LA Zone J
- Soften the interface between the housing and the wetlands by planting additional scattered indigenous overstorey trees and selective mid-storey.
- As part of the new path alignment along the northern boundary, revegetation is to retain selective views of the wetlands.

LA ZONE K
Western interface with Centre Swamp Drain and adjoining open space

Existing conditions
- Narrow reserve of approximately 20 metres between fence and Centre Swamp Drain.
- Viewing platform with expansive views over the northern wetlands to the Dandenongs in the east.
- Bird habitat values are similar to those described in LA Zone J.

Revegetation Prescription Aims for LA Zone K
- Plant additional scattered indigenous overstorey trees to establish a link with the remnant vegetation in Rosedale Golf Course.
- As part of the proposed path connecting the viewing platform to the maintenance track around the north of the wetland, ensure revegetation works retain selected views over the wetland whilst providing a screening function.

LA ZONE L
Dog pond area on the western boundary

Existing conditions
- The dog pond is saline with large exposed sand areas that have no vegetation.
- The intent of the dog pond reducing the incidents of people walking dogs through the wetlands is a positive initiative.
- Threatened and notable species in this zone include Flame Robin and Black-fronted Dotterel. Despite the lack of fencing a few wetland species use the saline ponds including the Black-fronted Dotterel and Masked Lapwing and the small marsh next to the saline pond supports Superb Fair-wrens and Golden-headed Cisticolas (Birds Australia, 2004).

Revegetation Prescription Aims for LA Zone L
- Improve the landscape and community educational values of this zone with additional appropriate scattered overstorey tree planting in the terrestrial zone and additional planting.
- Retain the community and dog owner use of this zone, however, where possible establish saltmarsh vegetation to the perimeter.

LA ZONE M
Edithvale North Wetlands (modified ponds)

Existing conditions
- Constructed in the late 1980's.
- Northern ponds are deeper than Edithvale South (LA Zone N) and have intercepted saline ground water.
- This area of the wetland is characterised by deep ponds fringed by tall reeds, and are important for many species, most notably Blue-billed Duck and Musk Duck which favour the deeper water. This is particularly important in late summer when these ponds can hold numbers of Australasian Shovelers and Hardheads and occasionally Common Greenshank along the edges. Latham's Snipe will feed along the marshy fringes, except where there is Tall Marsh and can be flushed from the grassy banks. Plume Robbins frequent the area in winter where they prefer the open conditions such as bare wetland edges and shorter grass (Birds Australia, 2004).

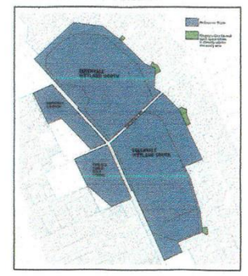
Revegetation Prescription Aims for LA Zone M
- Increase habitat diversity with species enrichment planting to the wetlands and some revegetation of terrestrial areas with Plains Grassland/Grassy Woodland vegetation.
- Monitor and control Spiny Rush which is present in low numbers.
- Monitor water quality in conjunction with vegetation to ensure diversity of vegetation is retained and eutrophic conditions do not occur.

LA ZONE N
Edithvale South Wetlands

Existing conditions
- Purchased by DVA in the mid-1970's.
- Relatively natural morphology, subject to a few minor modifications including some deepening and creation of small island.
- Peat layer remains in-tact in the wetland.
- These ephemeral wetlands are extremely important for migratory waders, especially when water levels are receding and damp mud is exposed. All wader species utilise the whole wetland area, though Latham's Snipe stray from the cover of marshy vegetation (Birds Australia, 2004).

Revegetation Prescription Aims for LA Zone N
- Maintain seasonal wetting and drying cycle.
- Monitor water quality in conjunction with vegetation to ensure diversity of vegetation is retained and eutrophic conditions do not occur.
- Recognise the diversity of frog populations in the wetland, in addition to the avifauna habitat values.
- Establish Swamp Scrub along some of the wetland margins where it will not impact on wider bird habitat values to improve the diversity of habitat values, and be representative of the former vegetation regime of Carrum Carrum Swamp.

LAND OWNERSHIP DIAGRAM



VEGETATION COMMUNITIES KEY

RAMSAR MANAGEMENT PLAN GOAL

To maintain and enhance the natural and cultural heritage of the wetlands and associated terrestrial areas through effective management and active community ownership.

RAMSAR MANAGEMENT PLAN OBJECTIVES
relevant to the Revegetation Prescriptions Project

- To maintain and enhance the diversity of wetland vegetation, where practical, to its pre-European state, except where other needs (eg. keeping fire risk at acceptable levels) dictate an alternative approach.
- To maintain and enhance the diversity and abundance of fauna in the wetland.
- To prevent wildfire and peat fires, and to use fire for vegetation and fauna habitat management, consistent with protection of property and visitors, and in a manner that does not start a peat fire.
- To ensure that landscaping is done in a manner that resembles the floristic and structure of pre-European vegetation of the area (using plant material of local provenance), including extensive open areas, and that landscaping protects and enhances the hydrogeological and ecological functioning of the wetlands.
- To ensure that community use of the wetlands is consistent with maintaining ecological values by catering for a suitable range of activities in areas where the wetlands and their fauna will not be disturbed.
- To provide opportunities for environmental education for schools, tertiary institutions, special interest groups and general public, consistent with the protection and interpretation of the natural and cultural heritage of the wetlands.
- To generate adequate information on the key environmental variables to ensure well documented and adaptive management.

REVEGETATION PRESCRIPTIONS PROJECT AIMS:

- reinforce the revegetation works that have been undertaken over the years with some changes to establish a relatively natural open woodland character in the terrestrial areas;
- establish some selected areas of the fringing Swamp Scrub on the wetland margins whilst retaining extensive areas of open wetland character;
- continue the Spiny Rush control program and control of other weeds in the wetlands and undertake species enrichment where required;
- improve the avifauna values with additional vegetation to screen adjoining activities from the wetland and provide a diversity of habitats for a range of birds;
- protect the significant vegetation communities;
- continue to encourage community involvement in revegetation works and in particular recognise the ongoing work and involvement of the Friends of Edithvale-Seaford Wetlands, and
- create an inviting natural setting which reflects the environmental significance of the wetlands and engenders a respect for these values from visitors and local residents.

DRAWING KEY

- Landscape zones for revegetation prescription purposes
- Views from formal viewing platforms
- Informal viewsheds around the site to be retained in future plantings
- Main pedestrian and bicycle access routes
- Maintenance vehicle access
- Indicative 1:100 year floodline
- Indicative locations of stormwater inputs
- Wetland perimeter fence
- Path with surfacing (including maintenance access and shared trails)
- Informal paths - no surfacing

THOMPSON BERRILL LANDSCAPE DESIGN P/L in association with Australian Ecosystems P/L

Melbourne Water

EDITHVALE WETLANDS
REVEGETATION PRESCRIPTIONS PROJECT

FINAL

DWG ESW-03A
JAN 2005

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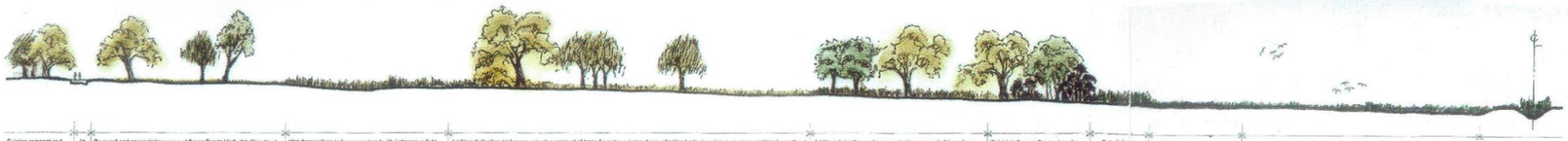
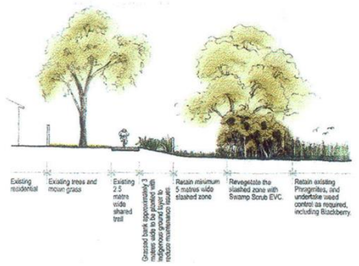
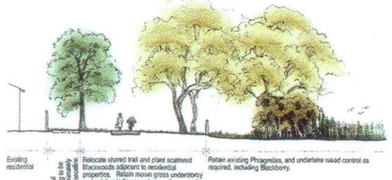
SCALE 1:4000 @ A0



1 SKETCH SECTION THROUGH LANDSCAPE ZONE SA AND SL
Open space on the north side of Seaford Wetland
Not to Scale



2 SKETCH SECTION THROUGH LANDSCAPE ZONE SC
Located immediately south of Seaford North Primary School
Scale 1:100



3 SKETCH SECTION THROUGH LANDSCAPE ZONE SD
Located south of Armstrongs Road
Scale 1:100

4 SKETCH SECTION THROUGH LANDSCAPE ZONE SD
Located south of Denbigh Rd
Scale 1:100

LA ZONE SA
North west area of the site adjacent to Patterson River Secondary College and Seaford North Primary School

Existing Conditions
- This zone is owned and managed by Frankston City Council
- The western area adjacent to housing and schools contains remnant indigenous trees including Coastal Manna Gum, Coast Banksia and Red Gum, which are remnants of the Damp Sands Herb-rich Woodland. The original distribution of this vegetation community is described as having an open woodland character.
- Extensive revegetation, with indigenous shrubs and trees has been undertaken.
- The most valuable bird habitat feature in this zone are the remnant Eucalypts including hollows that are used by the Eastern Rosellas and Rainbow Lorikeets. Unfortunately these trees are also used by introduced birds including the Common Mynas and Common Starlings. The revegetation areas provide habitat for understorey and canopy birds. The areas that form dense screens provide cover for small understorey birds including Eastern Yellow Robins, Superb Fairy-wrens and White-browed Scrubwrens (Birds Australia, 2004).

Revegetation Prescription Aims for LA Zone SA
- Reinstate Damp Sands Herb-rich Woodland reflective of its original distribution pattern and lightly wooded character.
- Improve bird habitat values by allowing open wet depressions to remain with low shrub and reeds for shelter, and selective removal of recently planted overstorey trees to minimise habitat for raptor bird species.

LA ZONE SB
Rural Land, with potential to be acquired by Council

Existing Conditions
- Freehold land currently grazed, with potential to be acquired by Frankston City Council.
- There is a combination of Pines and introduced vegetation and scattered remnant vegetation including Red Gums, Swamp Gums and Banksia along the eastern boundary.
- The dominant habitat type in this area is introduced pasture which is favoured by flocks of Flame Robins during the winter as they prefer the open and short grassy conditions, along with other species including Straw-necked and Australian White Ibis which prefer grazing in an open habitat (Birds Australia, 2004).

Revegetation Prescription Aims for LA Zone SB
- Create freshwater wetlands (ie. Herb-rich Plains Grassy Wetland) in the old creek course depressions through a combination of revegetation and increasing seasonal freshwater flows.
- Retain the majority of the zone as open slashed pasture with some scattered low shrubs and field layer species from Swamp Scrub EVC for shelter.
- Retain and improve the remnant Damp Sands Herb-rich Woodland vegetation along the eastern boundary with progressive removal of Pines.

LA ZONE SC
Western boundary north of Armstrong Road

Existing Conditions
- No views over wetland due to extensive area of Tall Marsh .
- Stormwater outfall at the northern end of zone contributes to permanent wetness of this area and favourable conditions for Tall Marsh.
- The trees provide habitat for common foliage dependent species including Spotted Pardalote and Brown Thornbill. During flowering, the mature trees support large numbers of common nectar-feeding birds including White-plumed and New Holland Honeyeaters and the Red and Little Wattlebirds (Birds Australia, 2004).

Revegetation Prescription Aims for LA Zone SC
- Increase vegetation between housing and wetland including reinstatement of Swamp Scrub margin. This will also improve wetland habitat and vegetation diversity reflective of the original Carrum Carrum Swamp.
- Address weed invasion into the Wetland in the northern extent of the zone.

LA ZONE SD
Western boundary from Mona Street to Armstrong Road

Existing Conditions
- Linear reserve in the north section of this zone with predominantly planted native and indigenous overstorey trees. The current position of the shared trail prevents vegetation being established between residential properties and the path. The visual dominance of side boundary fences reduces the recreational values and landscape character in this zone.
- Bird habitat values are similar to those described in LA Zone SC.

Revegetation Prescription Aims for LA Zone SD
- Increase planting of overstorey trees to provide additional screening to residential properties and provide shade to shared path.
- Improve the recreational and landscape character and value of this zone with additional trees for shade and create a natural bushland character.
- Increase diversity of indigenous species on fill mound over time.

LA ZONE SE
Western boundary from Seaford Primary School to Mona Street

Existing Conditions
- Open water areas close to the wetland perimeter fence. There is a viewing mound with a bench seat just south of Mona Street.
- Bird habitat values are similar to those described in LA Zone SC.

Revegetation Prescription Aims for LA Zone SE
- Increase planting of overstorey trees to provide additional screening to residential properties and provide shade to shared path.
- Improve the recreational and landscape character and value of this zone with additional trees for shade and create a natural bushland character.
- Improve the environmental and landscape amenity of the viewing mound including potential for a screened approach and interpretive information about the birds.
- Improve the environmental and landscape value of grassed overland flow swale on the western side of perimeter fence by planting sedge and rush species.

LA ZONE SF
Southern boundary to Seaford Primary School and proposed residential use

Existing Conditions
- Established trees including a mix of native and introduced trees including Cypress trees.
- Path is close to the wetland perimeter fence and affords good views northwards over wetland.
- Bird habitat values are similar to those described in LA Zone SC.

Revegetation Prescription Aims for LA Zone SF
- Retain established vegetation as a buffer between proposed residences and the wetlands.
- Screen the path from the wetland to potentially improve bird habitat values in an area of the wetland that currently has low presence of bird species.

LA ZONE SG
Opposite Erwin Drive

Existing Conditions
- Levee bank between the Road and wetland provides good viewing points over wetlands, particularly the *Juncus krausii*.
- No specific information on the bird habitat values in this zone. They are assumed to be similar to those described in LA Zone SC.

Revegetation Prescription Aims for LA Zone SG
- Provide vegetation screen/buffer between the southern end of the wetland and visual and physical movement along the path, whilst retaining some selective views over the wetland from the shared trail.

LA ZONE SH
Eastern boundary to Francis Street

Existing Conditions
- Good views over wetland from Francis Street frontage.
- Established stands of revegetation including stands of Coast Banksia *Banksia integrifolia* which is self seeding and regenerating in the adjoining wetland areas.
- The Coast Banksia are noted as supporting healthy numbers of Little Wattlebirds and New Holland Honeyeaters. The thick areas of revegetation provide excellent habitat for small understorey dwelling birds including Superb Fairy-wrens, White-browed Scrubwrens and Brown Thornbills. It would be expected that as these plantings mature Eastern Yellow Robins and Crested Shrike-tits would expand into this area (Birds Australia, 2004).

Revegetation Prescription Aims for LA Zone SH
- Improve vegetation management between existing path and wetland.
- Protect the low lying depressions outside the wetland perimeter fence.
- Additional revegetation with Damp Sands Herb-rich Woodland species to achieve an open woodland character.

LA ZONE SI
Eastern boundary to residential courts including Rossiter and Bennet Courts

Existing Conditions
- Housing adjacent, poor visibility and access.
- Stormwater outfall creates a freshwater meadow that has good habitat values at the end of Rossiter Court. The area adjoining this is slightly elevated and provides good views over the wetland.
- Bird habitat values similar to those described in LA Zone SH, although there are no dense plantings of Coast Banksia in this zone.

Revegetation Prescription Aims for LA Zone SI
- Improve the landscape character by selective trimming and removal of some trees, and strengthening the low shrub and field layer species to establish an open woodland character.
- Potential exciting viewing area over the freshwater meadow, along with interpretation of the localised change in vegetation in this area.
- Increase wetland habitat diversity and selective screening with planting of Swamp Scrub along the wetland margins.

LA ZONE SJ
Eastern boundary from Bennett Court North to Armstrong Road

Existing Conditions
- This zone has been largely revegetated over recent years with dense plantings of predominantly indigenous species.
- The wider reserve in this zone is not apparent to the shared trail user, as revegetation works have screened views into and out of this larger area of open space.
- Bird habitat values are similar to those described in SH.

Revegetation Prescription Aims for LA Zone SJ
- Achieve a scattered open woodland character of the Damp Sands Herb-rich Woodland
- Increase wetland habitat diversity and selective screening by planting Swamp Scrub EVC along the wetland margins

LA ZONE SK
Eastern boundary to Wells Road

Existing Conditions
- Remnant Damp Sands Herb-rich Woodland along the eastern boundary of this zone, which contains remnant vegetation including a large number of large remnant Swamp Gum, Red Gum and Coast Banksia. There are extensive shelter belt plantings of Pines amongst this remnant vegetation.
- The eastern extent of this zone contains the best quality woodland habitat for bush birds with all types of bush bird fauna represented. It is the only site where Red-browed Finches, Yellow-faced Honeyeaters and Striated Pardalotes occur. The variety of microhabitats allows for a range of different foraging requirements and Spotted Pardalotes, Eastern Yellow Robins and Dusky Woodswallows are all known to nest in this area which may be important locally as a site where bush birds can breed. The major threats to the bird habitat values are motorbike and BMX bike access and weed invasion (Birds Australia, 2004).

Revegetation Prescription Aims for LA Zone SK
- Restore the Damp Sands Herb-rich Woodland vegetation present along the eastern boundary with progressive removal of existing Pine trees and allowing natural regeneration of indigenous species, in preference to revegetation.
- Expand the area of Damp Sands Herb-rich Woodland to the wetland perimeter to establish a natural connection between the open woodland and the wetland.
- North of the levee bank only, reintroduce fringing Swamp Scrub between the wetland margin and the Damp Sands Herb-rich Woodland vegetation. South of the levee bank the wetland margins are to remain free of Swamp Scrub.

LA ZONE SL
Seaford Wetland, north of east-west access bank/levee bank

Existing Conditions
- The area seasonally inundates.
- There is no specific description of bird habitat values for this zone. It is anticipated if the area is restored to a similar condition to LA Zone SM, the bird habitat values will be similar.

Revegetation Prescription Aims for LA Zone SL
- Minor adjustments to hydrological regime to allow seasonal wetting of this area to an approximate depth of 300mm, and active revegetation to establish Brackish Wetland/Herbland which will expand the waterbird habitat.
- Undertake Spiny Rush control and ongoing monitoring.
- Establish Swamp Scrub along the east and west margins, leaving the northern extent open for uninhibited avitaune flight path.

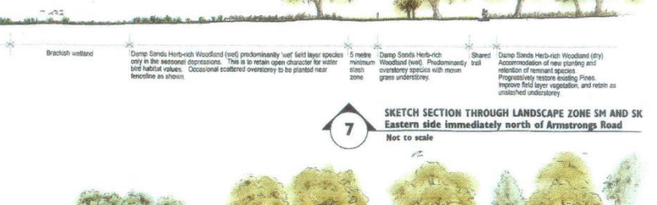
RAMSAR MANAGEMENT PLAN GOAL

To maintain and enhance the natural and cultural heritage of the wetlands and associated terrestrial areas through effective management and active community ownership.

RAMSAR MANAGEMENT PLAN OBJECTIVES
relevant to the Revegetation Prescriptions Project

- To maintain and enhance the diversity of wetland vegetation, where practical, to its pre-European state, except where other needs (eg. keeping fire risk at acceptable levels) dictate an alternative approach.
- To maintain and enhance the diversity and abundance of fauna in the wetland.
- To prevent wildfire and peat fires, and to use fire for vegetation and fauna habitat management, consistent with protection of property and visitors, and in a manner that does not start a peat fire.
- To ensure that landscaping is done in a manner that resembles the floristic and structure of pre-European vegetation of the area (using plant material of local provenance), including extensive open areas, and that landscaping protects and enhances the hydrogeological and ecological functioning of the wetlands.
- To ensure that community use of the wetlands is consistent with maintaining ecological values by catering for a suitable range of activities in areas where the wetlands and their fauna will not be disturbed.
- To provide opportunities for environmental education for schools, tertiary institutions, special interest groups and general public, consistent with the protection and interpretation of the natural and cultural heritage of the wetlands.
- To generate adequate information on the key environmental variables to ensure well documented and adaptive management.

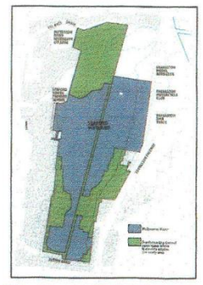
REVEGETATION PRESCRIPTIONS PROJECT AIMS:
- reinforce the revegetation works that have been undertaken over the years with some changes to establish a relatively natural open woodland character in the terrestrial areas; establish some selected areas of the fringing Swamp Scrub on the wetland margins whilst retaining extensive areas of open wetland character;
- continue the Spiny Rush control program and control of other weeds in the wetlands and undertake species enrichment where required;
- improve the avifauna values with additional vegetation to screen adjoining activities from the wetland and provide a diversity of habitats for a range of birds;
- protect the significant vegetation communities;
- continue to encourage community involvement in revegetation works and in particular recognise the ongoing work and involvement of the Friends of Edithvale-Seaford Wetlands; and
- create an inviting natural setting which reflects the environmental significance of the wetlands and engenders a respect for these values from visitors and local residents.



7 SKETCH SECTION THROUGH LANDSCAPE ZONE SM AND SK
Eastern side immediately north of Armstrongs Road
Not to scale

8 SKETCH SECTION THROUGH LANDSCAPE ZONE SL AND SK
Eastern side north of the central levee bank
Not to scale

LAND OWNERSHIP DIAGRAM



VEGETATION COMMUNITIES KEY
- EXISTING NATIVE/INDIGENOUS OVERSTOREY VEGETATION
- PROPOSED OVERSTOREY INDIGENOUS TREES
- OPEN WATER / MUDFLATS
- SALINE AQUATIC SUBMERGED MEADOW
- SWAMP SCRUB
- DAMP SANDS HERB-RICH WOODLAND (WET)
- DAMP SANDS HERB-RICH WOODLAND (DRY)
- BRACKISH WETLAND Sea Rush Wetland
- AQUATIC HERBLAND/PLAINS SEDGY WETLAND Plains Sedgy Wetland Aquatic Herbland/Sedgeland
- TALL MARSH Common Reed dominated Cumbungi dominated
- BRACKISH AQUATIC HERBFIELD Brackish Aquatic Herbland Brackish Wetland Herbland/Sedgeland
- SLASHED/MOWN AREAS
- PASTURE GRASS - NOT MOWN/SLASHED

DRAWING KEY
- Landscape zones for revegetation prescription purposes
- Views from formal viewing platforms
- Informal viewsheds around the site to be retained in future plantings
- Main pedestrian and bicycle access routes
- Maintenance vehicle access
- Indicative 1:100 year floodline
- Indicative locations of stormwater inputs
- Wetland perimetre fence
- Path with surfacing (including maintenance access and shared

THOMPSON BERRILL LANDSCAPE DESIGN P/L in association with Australian Ecosystems P/L

Melbourne Water

FRANKSTON CITY

SEAFORD WETLANDS
REVEGETATION PRESCRIPTIONS PROJECT

FINAL

DWG ESW-03B
JAN 2005

0 50 100 150 250 m
SCALE 1:4000 @ A0

Appendix 14 Edithvale-Seaford Ramsar Wetlands Desktop Cultural Heritage Assessments for the Edithvale Section (Heritage Insight 2016a) and Seaford Section (Heritage Insight 2016b).

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